2013 Annual Revision Cycle

National Electrical Code® Committee Report on Comments

NOTE: Notice of Intent to Make an NEC® Motion (NITMAM) deadline is May 3, 2013

A compilation of the documented action on comments received by the code-making panels for the 2013 Annual Revision Cycle

NOTE: The proposals contained in the NEC Report on Proposals (ROP) and the comments addressed in this Report on Comments (ROC) will be presented for action at the NFPA June 2013 Annual Association Technical Meeting to be held June 10–13 in Chicago, IL, only when proper Amending Motions have been submitted to the NFPA by the deadline of May 3, 2013. For more information on the new rules and for up-to-date information on schedules and deadlines for processing NFPA Documents, check the NFPA website (www.nfpa.org) or contact NFPA Standards Administration.

NFPA®
National Fire Protection Association®
1 BATTERYMARCH PARK, QUINCY, MA 02169-7471

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Information on NFPA Codes and Standards Development

I. Applicable Regulations. The primary rules governing the processing of NFPA documents (codes, standards, recommended practices, and guides) are the NFPA *Regulations Governing Committee Projects (Regs)*. Other applicable rules include NFPA *Bylaws*, NFPA *Technical Meeting Convention Rules*, NFPA *Guide for the Conduct of Participants in the NFPA Standards Development Process*, and the NFPA *Regulations Governing Petitions to the Board of Directors from Decisions of the Standards Council*. Most of these rules and regulations are contained in the *NFPA Directory*. For copies of the *Directory*, contact Codes and Standards Administration at NFPA Headquarters; all these documents are also available on the NFPA website at "www.nfpa.org."

The following is general information on the NFPA process. All participants, however, should refer to the actual rules and regulations for a full understanding of this process and for the criteria that govern participation.

II. Technical Committee Report. The Technical Committee Report is defined as "the Report of the Technical Committee and Technical Correlating Committee (if any) on a document. A Technical Committee Report consists of the Report on Proposals (ROP), as modified by the Report on Comments (ROC), published by the Association."

III. Step 1: Report on Proposals (ROP). The ROP is defined as "a report to the Association on the actions taken by Technical Committees and/or Technical Correlating Committees, accompanied by a ballot statement and one or more proposals on text for a new document or to amend an existing document." Any objection to an action in the ROP must be raised through the filing of an appropriate Comment for consideration in the ROC or the objection will be considered resolved.

IV. Step 2: Report on Comments (ROC). The ROC is defined as "a report to the Association on the actions taken by Technical Committees and/or Technical Correlating Committees accompanied by a ballot statement and one or more comments resulting from public review of the Report on Proposals (ROP)." The ROP and the ROC together constitute the Technical Committee Report. Any outstanding objection following the ROC must be raised through an appropriate Amending Motion at the Association Technical Meeting or the objection will be considered resolved.

V. Step 3a: Action at Association Technical Meeting. Following the publication of the ROC, there is a period during which those wishing to make proper Amending Motions on the Technical Committee Reports must signal their intention by submitting a Notice of Intent to Make a Motion. Documents that receive notice of proper Amending Motions (Certified Amending Motions) will be presented for action at the annual June Association Technical Meeting. At the meeting, the NFPA membership can consider and act on these Certified Amending Motions as well as Follow-up Amending Motions, that is, motions that become necessary as a result of a previous successful Amending Motion. (See 4.6.2 through 4.6.9 of *Regs* for a summary of the available Amending Motions and who may make them.) Any outstanding objection following action at an Association Technical Meeting (and any further Technical Committee consideration following successful Amending Motions, see *Regs* at 4.7) must be raised through an appeal to the Standards Council or it will be considered to be resolved.

VI. Step 3b: Documents Forwarded Directly to the Council. Where no Notice of Intent to Make a Motion (NITMAM) is received and certified in accordance with the Technical Meeting Convention Rules, the document is forwarded directly to the Standards Council for action on issuance. Objections are deemed to be resolved for these documents.

VII. Step 4a: Council Appeals. Anyone can appeal to the Standards Council concerning procedural or substantive matters related to the development, content, or issuance of any document of the Association or on matters within the purview of the authority of the Council, as established by the *Bylaws* and as determined by the Board of Directors. Such appeals must be in written form and filed with the Secretary of the Standards Council (see 1.6 of *Regs*). Time constraints for filing an appeal must be in accordance with 1.6.2 of the *Regs*. Objections are deemed to be resolved if not pursued at this level.

VIII. Step 4b: Document Issuance. The Standards Council is the issuer of all documents (see Article 8 of *Bylaws*). The Council acts on the issuance of a document presented for action at an Association Technical Meeting within 75 days from the date of the recommendation from the Association Technical Meeting, unless this period is extended by the Council (see 4.8 of *Regs*). For documents forwarded directly to the Standards Council, the Council acts on the issuance of the document at its next scheduled meeting, or at such other meeting as the Council may determine (see 4.5.6 and 4.8 of *Regs*).

IX. Petitions to the Board of Directors. The Standards Council has been delegated the responsibility for the administration of the codes and standards development process and the issuance of documents. However, where extraordinary circumstances requiring the intervention of the Board of Directors exist, the Board of Directors may take any action necessary to fulfill its obligations to preserve the integrity of the codes and standards development process and to protect the interests of the Association. The rules for petitioning the Board of Directors can be found in the *Regulations Governing Petitions to the Board of Directors from Decisions of the Standards Council* and in 1.7 of the *Regs*.

X. For More Information. The program for the Association Technical Meeting (as well as the NFPA website as information becomes available) should be consulted for the date on which each report scheduled for consideration at the meeting will be presented. For copies of the ROP and ROC as well as more information on NFPA rules and for up-to-date information on schedules and deadlines for processing NFPA documents, check the NFPA website (www.nfpa.org) or contact NFPA Codes & Standards Administration at (617) 984-7246.

Chapter 5. Special Occupancies

Chapter 6. Special Equipment

Chapter 7. Special Conditions

Chapter 8. Communications Systems

Chapter 9. Tables

TYPES OF ACTION

P Partial Revision **N** New Document **R** Reconfirmation **W** Withdrawal

The following classifications apply to Committee members and represent their principal interest in the activity of the Committee.

1. M Manufacturer: A representative of a maker or marketer of a product, assembly, or system, or portion thereof, that is affected by the standard.
2. U User: A representative of an entity that is subject to the provisions of the standard or that voluntarily uses the standard.
3. IM Installer/Maintainer: A representative of an entity that is in the business of installing or maintaining a product, assembly, or system affected by the standard.
4. L Labor: A labor representative or employee concerned with safety in the workplace.
5. RT Applied Research/Testing Laboratory: A representative of an independent testing laboratory or independent applied research organization that promulgates and/or enforces standards.
6. E Enforcing Authority: A representative of an agency or an organization that promulgates and/or enforces standards.
7. I Insurance: A representative of an insurance company, broker, agent, bureau, or inspection agency.
8. C Consumer: A person who is or represents the ultimate purchaser of a product, system, or service affected by the standard, but who is not included in (2).
9. SE Special Expert: A person not representing (1) through (8) and who has special expertise in the scope of the standard or portion thereof.

NOTE 1: "Standard" connotes code, standard, recommended practice, or guide.

NOTE 2: A representative includes an employee.

NOTE 3: While these classifications will be used by the Standards Council to achieve a balance for Technical Committees, the Standards Council may determine that new classifications of member or unique interests need representation in order to foster the best possible Committee deliberations on any project. In this connection, the Standards Council may make such appointments as it deems appropriate in the public interest, such as the classification of "Utilities" in the National Electrical Code Committee.

NOTE 4: Representatives of subsidiaries of any group are generally considered to have the same classification as the parent organization.

FORM FOR FILING NEC® NOTICE OF INTENT TO MAKE A MOTION (NITMAM) AT AN ASSOCIATION TECHNICAL MEETING 2013 REVISION CYCLE FINAL DATE FOR RECEIPT OF NEC® NITMAM: 5:00 pm EDST, May 3, 2013 (NEC only)

If you have questions about filling out or filing the NITMAM, please contact the Codes and Standards Administration at 617-984-7249

For further information on the Codes- and Standards-Making Process see the NFPA website (www.nfpa.org)

FOR OFFICE USE ONLY

Log #:__________________

Date Rec'd:______________

Date 8/10/2005 **Name** John B. Smith **Tel. No.** 617-555-1212

Company or Affiliation John B. Smith Consulting **Email Address** jsmith@aol.com

Street Address 9 Seattle Street **City** Seattle **State** WA **Zip** 02255

1. **(a) NFPA Document (include Number and Title)** National Electrical Code/NFPA 70, 2011 ed
   (b) Proposal or Comment Number 2-27
   (c) Section/Paragraph 210.8(B)(8)

2. **Motion to be made. Please check one (See also 4.6 of the Regulations Governing Committee Projects):**

(a) Proposal

X (1) Accept. _____ (2) Accept an Identifiable Part.*
_____ (3) Accept as modified by the TC. _____ (4) Accept an Identifiable Part as modified by TC.*

(b) Comment

______ (1) Accept. ____(2) Accept an Identifiable Part. * ____(3) Accept as modified by the TC.
______ (4) Accept an Identifiable Part as modified by TC.* ____(5) Reject _____(6) Reject an Identifiable Part.*

(c) Return Technical Committee Report for Further Study

_____ (1) Return entire Report. _____ (2) Return a portion of a Report in the form of a proposal and related comment(s).
______(3) Return a portion of a Report in the form of identifiable part(s) of a proposal and related comments(s). (Identify the specific portion of the proposal and the related comments below)*

*** Clearly identify the Identifiable Part(s) indicated above (use separate sheet if required).**

____

____

____

3. I am entitled to make this motion in accordance with 4.6.8 of the Regulations Governing Committee Projects, as follows [check (a), (b), or (c)]:

(a)_X_ This motion may be made by the original submitter or their designated representative, and I am the [if you check (a) indicate one of the following]:

X I am the original submitter of the proposal or comment, or

___I am the submitter's designated representative (attach written authorization signed by the original submitter)

(b)____This motion may be made by a Technical Committee Member and I am a Member of the responsible Technical Committee.

(c)____This motion may be made by anyone.

(Form continued on next page)

4. Comments or Clarification (optional): This NITMAM will be reviewed by a Motions Committee. In addition to determining whether your Amending Motion is proper, the Committee may take other actions as described in 2.3 of the Technical Meeting Convention Rules as follows:

> **Restating and Grouping of Motions. Upon request or on its own initiative, and in consultation with the mover(s), the Motions Committee may: (a) restate an Amending Motion to facilitate the making of a proper motion or to clarify the intent of the mover; and (b) group Amending Motions which are dependent on one another into a single Amending Motion. Dependent motions are motions that the mover(s) wish to be considered by the assembly and voted on as single up or down package. In addition to the foregoing, the Motions Committee may take such other actions or make such other recommendations as will facilitate the fair and efficient consideration of motions within the available time.**

The NFPA Staff may contact you to clarify your motion or to consult on the permitted actions in 2.3. If you have any comments, suggestions or requests of the Motions Committee as it reviews your NITMAM and considers actions permitted in 2.3, please provide them below. (Use additional sheet if necessary):

Name (please print):_____John B. Smith__________

John B Smith

Signature (required):____

(Note: This NITMAM will be reviewed, and if proper, your Amending Motion will be certified in accordance with the Technical Meeting Convention Rules and posted on the NFPA website by May 17, 2013. Documents that have Certified Amending Motions will be considered at the June 2013 Annual Meeting Technical Committee Report Session. In order to have your Certified Amending Motion considered at that meeting you must appear, sign in, and make the motion as prescribed in the Convention Rules).

PLEASE USE A SEPARATE NITMAM FORM FOR EACH AMENDING MOTION YOU WISH TO MAKE

Mail to: Secretary, Standards Council, National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471
NFPA Fax: (617) 770-3500 • **Email**: NITMAM@nfpa.org

FORM FOR FILING NEC® NOTICE OF INTENT TO MAKE A MOTION (NITMAM) AT AN ASSOCIATION TECHNICAL MEETING
2013 ANNUAL REVISION CYCLE
FINAL DATE FOR RECEIPT OF NEC® NITMAM: 5:00 pm EDST, May 3, 2013 (NEC only)

If you have questions about filling out or filing the NEC® NITMAM, please contact Codes and Standards Administration at 617-984-7249 **For further information on the Codes- and Standards-Making Process, see the NFPA website (www.nfpa.org)**	**FOR OFFICE USE ONLY** Log #:__________________ Date Rec'd:______________

Date_______________**Name**____**Tel. No.**____

Company or Affiliation ____**Email Address**_________________________________

Street Address________________________________**City**_______________________**State**_____**Zip**____________________________

1. **(a) NFPA Document (include Number and Title)**____
   (b) Proposal or Comment Number___________________
   (c) Section/Paragraph ___________________________________

2. **Motion to be made. Please check one: (See also 4.6 of the Regulations Governing Committee Projects)**

(a) Proposal

_______(1) Accept. ______ (2) Accept an Identifiable Part.*

______ (3) Accept as modified by the TC. _____ (4) Accept an Identifiable Part as modified by TC.*

(b) Comment

______ (1) Accept. ____(2) Accept an Identifiable Part.* ____(3) Accept as modified by the TC.

______ (4) Accept an Identifiable Part as modified by TC.* ____(5) Reject _____(6) Reject an Identifiable Part.*

(c) Return Technical Committee Report for Further Study

_____ (1) Return entire Report. _____ (2) Return a portion of a Report in the form of a proposal and related comment(s).

______(3) Return a portion of a Report in the form of identifiable part(s) of a proposal and related comment(s). (Identify the specific portion of the proposal and the related comments below)*

*** Clearly identify the Identifiable Part(s) indicated above (use separate sheet if required).**

____

____

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3. I am entitled to make this motion in accordance with 4.6.8 of the Regulations Governing Committee Projects, as follows: [(check (a), (b), or (c)].

(a)____ This motion may be made by the original submitter or their designated representative, and I am the [(if you check (a) indicate one of the following)]:

___I am the original submitter of the proposal or comment, or

___I am the submitter's designated representative (attach written authorization signed by the original submitter)

(b)____This motion may be made by a Technical Committee Member and I am a Member of the responsible Technical Committee.

(c)____This motion may be made by anyone.

(Form continued on next page)

4. Comments or Clarification (optional): This NITMAM will be reviewed by a Motions Committee. In addition to determining whether your Amending Motion is proper, the Committee may take other actions as described in 2.3 of the Technical Meeting Convention Rules as follows:

> **Restating and Grouping of Motions. Upon request or on its own initiative, and in consultation with the mover(s), the Motions Committee may: (a) restate an Amending Motion to facilitate the making of a proper motion or to clarify the intent of the mover; and (b) group Amending Motions which are dependent on one another into a single Amending Motion. Dependent motions are motions that the mover(s) wish to be considered by the assembly and voted on as single up or down package. In addition to the foregoing, the Motions Committee may take such other actions or make such other recommendations as will facilitate the fair and efficient consideration of motions within the available time.**

The NFPA Staff may contact you to clarify your motion or to consult on the permitted actions in 2.3. If you have any comments, suggestions, or requests of the Motions Committee as it reviews your NITMAM and considers actions permitted in 2.3, please provide them below. (Use additional sheet if necessary):

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Name (please print):____

Signature (required):____

(Note: This NITMAM will be reviewed, and if proper, your Amending Motion will be certified in accordance with the Technical Meeting Convention Rules and posted on the NFPA website by May 3, 2013. Documents that have Certified Amending Motions will be considered at the 2013Annual Technical Meeting. In order to have your Certified Amending Motion considered at that meeting, you must appear, sign in, and make the motion as prescribed in the Convention Rules).

PLEASE USE A SEPARATE NITMAM FORM FOR EACH NEC® AMENDING MOTION YOU WISH TO MAKE.

Mail to: Secretary, Standards Council, National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471
NFPA Fax: (617) 770-3500 • **Email**: NITMAM@nfpa.org

Sequence of Events Leading to Issuance of an NFPA Committee Document

Step 1 Call for Proposals

▼ Proposed new document or new edition of an existing document is entered into one of two yearly revision cycles, and a Call for Proposals is published.

Step 2 Report on Proposals (ROP)

▼ Committee meets to act on Proposals, to develop its own Proposals, and to prepare its Report.

▼ Committee votes by written ballot on Proposals. If two-thirds approve, Report goes forward. Lacking two-thirds approval, Report returns to Committee.

▼ Report on Proposals (ROP) is published for public review and comment.

Step 3 Report on Comments (ROC)

▼ Committee meets to act on Public Comments to develop its own Comments, and to prepare its report.

▼ Committee votes by written ballot on Comments. If two-thirds approve, Report goes forward. Lacking two-thirds approval, Report returns to Committee.

▼ Report on Comments (ROC) is published for public review.

Step 4 Association Technical Meeting

▼ *"Notices of intent to make a motion"* are filed, are reviewed, and valid motions are certified for presentation at the Association Technical Meeting. ("Consent Documents" that have no certified motions bypass the Association Technical Meeting and proceed to the Standards Council for issuance.)

▼ NFPA membership meets each June at the Association Technical Meeting and acts on Technical Committee Reports (ROP and ROC) for documents with "certified amending motions."

▼ Committee(s) vote on any amendments to Report approved at NFPA Annual Membership Meeting.

Step 5 Standards Council Issuance

▼ Notification of intent to file an appeal to the Standards Council on Association action must be filed within 20 days of the NFPA Annual Membership Meeting.

▼ Standards Council decides, based on all evidence, whether or not to issue document or to take other action, including hearing any appeals.

The Association Technical Meeting

The process of public input and review does not end with the publication of the ROP and ROC. Following the completion of the Proposal and Comment periods, there is yet a further opportunity for debate and discussion through the Association Technical Meeting that takes place at the NFPA Annual Meeting.

The Association Technical Meeting provides an opportunity for the final Technical Committee Report (i.e., the ROP and ROC) on each proposed new or revised code or standard to be presented to the NFPA membership for the debate and consideration of motions to amend the Report. The specific rules for the types of motions that can be made and who can make them are set forth in NFPA's rules, which should always be consulted by those wishing to bring an issue before the membership at an Association Technical Meeting. The following presents some of the main features of how a Report is handled.

The Filing of a Notice of Intent to Make a Motion. Before making an allowable motion at an Association Technical Meeting, the intended maker of the motion must file, in advance of the session, and within the published deadline, a Notice of Intent to Make a Motion. A Motions Committee appointed by the Standards Council then reviews all notices and certifies all amending motions that are proper. The Motions Committee can also, in consultation with the makers of the motions, clarify the intent of the motions and, in certain circumstances, combine motions that are dependent on each other together so that they can be made in one single motion. A Motions Committee report is then made available in advance of the meeting listing all certified motions. Only these Certified Amending Motions, together with certain allowable Follow-Up Motions (that is, motions that have become necessary as a result of previous successful amending motions) will be allowed at the Association Technical Meeting.

Consent Documents. Often there are codes and standards up for consideration by the membership that will be noncontroversial and no proper Notices of Intent to Make a Motion will be filed. These "Consent Documents" will bypass the Association Technical Meeting and head straight to the Standards Council for issuance. The remaining documents are then forwarded to the Association Technical Meeting for consideration of the NFPA membership.

What Amending Motions Are Allowed. The Technical Committee Reports contain many Proposals and Comments that the Technical Committee has rejected or revised in whole or in part. Actions of the Technical Committee published in the ROP may also eventually be rejected or revised by the Technical Committee during the development of its ROC. The motions allowed by NFPA rules provide the opportunity to propose amendments to the text of a proposed code or standard based on these published Proposals, Comments, and Committee actions. Thus, the list of allowable motions include motions to accept Proposals and Comments in whole or in part as submitted or as modified by a Technical Committee action. Motions are also available to reject an accepted Comment in whole or part. In addition, Motions can be made to return an entire Technical Committee Report or a portion of the Report to the Technical Committee for further study.

The NFPA Annual Meeting, also known as the NFPA Conference & Expo, takes place in June of each year. A second Fall membership meeting was discontinued in 2004, so the NFPA Technical Committee Report Session now runs once each year at the Annual Meeting in June.

Who Can Make Amending Motions. NFPA rules also define those authorized to make amending motions. In many cases, the maker of the motion is limited by NFPA rules to the original submitter of the Proposal or Comment or his or her duly authorized representative. In other cases, such as a Motion to Reject an accepted Comment, or to Return a Technical Committee Report or a portion of a Technical Committee Report for Further Study, anyone can make these motions. For a complete explanation, the NFPA Regs should be consulted.

Action on Motions at the Association Technical Meeting. In order to actually make a Certified Amending Motion at the Association Technical Meeting, the maker of the motion must sign in at least an hour before the session begins. In this way a final list of motions can be set in advance of the session. At the session, each proposed document up for consideration is presented by a motion to adopt the Technical Committee Report on the document. Following each such motion, the presiding officer in charge of the session opens the floor to motions on the document from the final list of Certified Amending Motions followed by any permissible Follow-Up Motions. Debate and voting on each motion proceeds in accordance with NFPA rules. NFPA membership is not required in order to make or speak to a motion, but voting is limited to NFPA members who have joined at least 180 days prior to the Association Technical Meeting and have registered for the meeting. At the close of debate on each motion, voting takes place, and the motion requires a majority vote to carry. In order to amend a Technical Committee Report, successful amending motions must be confirmed by the responsible Technical Committee, which conducts a written ballot on all successful amending motions following the meeting and prior to the document being forwarded to the Standards Council for issuance.

Standards Council Issuance

One of the primary responsibilities of the NFPA Standards Council, as the overseer of the NFPA codes and standards development process, is to act as the official issuer of all NFPA codes and standards. When it convenes to issue NFPA documents, it also hears any appeals related to the document. Appeals are an important part of assuring that all NFPA rules have been followed and that due process and fairness have been upheld throughout the codes and standards development process. The Council considers appeals both in writing and through the conduct of hearings at which all interested parties can participate. It decides appeals based on the entire record of the process as well as all submissions on the appeal. After deciding all appeals related to a document before it, the Council, if appropriate, proceeds to issue the document as an official NFPA code or standard. Subject only to limited review by the NFPA Board of Directors, the decision of the Standards Council is final, and the new NFPA code or standard becomes effective twenty days after Standards Council issuance.

Report of the Committee on

National Electrical Code®

Technical Correlating Committee

Michael J. Johnston, *Chair*
National Electrical Contractors Association, MD [IM]

Mark W. Earley, *Secretary (Staff-Nonvoting)*
National Fire Protection Association, MA

Kimberly L. Shea, *Recording Secretary (NV)*
National Fire Protection Association, MA

James E. Brunssen, Telcordia, NJ [UT]
Rep. Alliance for Telecommunications Industry Solutions
Merton W. Bunker, Jr., US Department of State, VA [U]
William R. Drake, Actuant Electrical, CA [M]
William T. Fiske, Intertek Testing Services, NY [RT]
Palmer L. Hickman, National Joint Apprentice & Training Committee, MD [L]
Rep. International Brotherhood of Electrical Workers
David L. Hittinger, Independent Electrical Contractors of Greater Cincinnati, OH [IM]
Rep. Independent Electrical Contractors, Inc.
Daniel J. Kissane, Legrand/Pass & Seymour, NY [M]
Rep. National Electrical Manufacturers Association
John R. Kovacik, UL LLC, IL [RT]
Neil F. LaBrake, Jr., National Grid, NY [UT]
Rep. Electric Light & Power Group/EEI
Danny Liggett, The DuPont Company, Inc., TX [U]
Rep. American Chemistry Council
Richard P. Owen, Oakdale, MN [E]
Rep. International Association of Electrical Inspectors

Alternates

Thomas L. Adams, Engineering Consultant, IL [UT]
(Alt. to Neil F. LaBrake, Jr.)
Rep. Electric Light & Power Group/EEI
Lawrence S. Ayer, Biz Com Electric, Inc., OH [IM]
(Alt. to David L. Hittinger)
Rep. Independent Electrical Contractors, Inc.
James T. Dollard, Jr., IBEW Local Union 98, PA [L]
(Alt. to Palmer L. Hickman)
Rep. International Brotherhood of Electrical Workers
Stanley J. Folz, Morse Electric Company, NV [IM]
(Alt. to Michael J. Johnston)
Rep. National Electrical Contractors Association
Ernest J. Gallo, Telcordia Technologies, Inc., NJ [UT]
(Alt. to James E. Brunssen)
Rep. Alliance for Telecommunications Industry Solutions
Alan Manche, Schneider Electric, KY [M]
(Alt. to William R. Drake)
Robert A. McCullough, Tuckerton, NJ [E]
(Alt. to Richard P. Owen)
Rep. International Association of Electrical Inspectors
Michael E. McNeil, FMC Bio Polymer, ME [U]
(Alt. to Danny Liggett)
Rep. American Chemistry Council
Mark C. Ode, UL LLC, AZ [RT]
(Alt. to John R. Kovacik)
James F. Pierce, Intertek, OR [RT]
(Alt. to William T. Fiske)
Vincent J. Saporita, Cooper Bussmann, MO [M]
(Alt. to Daniel J. Kissane)
Rep. National Electrical Manufacturers Association

Nonvoting

Richard G. Biermann, Biermann Electric Company, Inc., IA [IM]
(Member Emeritus)
Timothy J. Pope, Canadian Standards Association, Canada [SE]
Rep. CSA/Canadian Electrical Code Committee
D. Harold Ware, Libra Electric Company, OK [IM]

Staff Liaison: **Mark W. Earley**

CODE-MAKING PANEL NO. 1

Articles 90, 100, 110, Chapter 9, Table 10,
Annex A, Annex H, and Annex I

Gil Moniz, *Chair*
National Electrical Manufacturers Association, MA [M]
Rep. National Electrical Manufacturers Association

Michael A. Anthony, University of Michigan, MI [U]
Rep. Association of Higher Education Facilities Officers
Louis A. Barrios, Shell Global Solutions, TX [U]
Rep. American Chemistry Council
Kenneth P. Boyce, UL LLC, IL [RT]
H. Landis Floyd, The DuPont Company, Inc., DE [U]
Rep. Institute of Electrical & Electronics Engineers, Inc.
Palmer L. Hickman, National Joint Apprentice & Training Committee, MD [L]
Rep. International Brotherhood of Electrical Workers
David L. Hittinger, Independent Electrical Contractors of Greater Cincinnati, OH [IM]
Rep. Independent Electrical Contractors, Inc.
Neil F. LaBrake, Jr., National Grid, NY [UT]
Rep. Electric Light & Power Group/EEI
Randall R. McCarver, Telcordia Technologies, Inc., NJ [U]
Rep. Alliance for Telecommunications Industry Solutions
James F. Pierce, Intertek, OR [RT]
Harry J. Sassaman, Forest Electric Corporation, NJ [IM]
Rep. National Electrical Contractors Association
Susan Newman Scearce, City of Humboldt, TN [E]
Rep. International Association of Electrical Inspectors

Alternates

Thomas L. Adams, Engineering Consultant, IL [UT]
(Alt. to Neil F. LaBrake, Jr.)
Rep. Electric Light & Power Group/EEI
Mark Christian, IBEW Local 175, TN [L]
(Alt. to Palmer L. Hickman)
Rep. International Brotherhood of Electrical Workers
Benjamin F. Dunford, Ben Dunford Electric Company Inc., TN [IM]
(Alt. to David L. Hittinger)
Rep. Independent Electrical Contractors, Inc.
William T. Fiske, Intertek Testing Services, NY [RT]
(Alt. to James F. Pierce)
Ernest J. Gallo, Telcordia Technologies, Inc., NJ [U]
(Alt. to Randall R. McCarver)
Rep. Alliance for Telecommunications Industry Solutions
Donald R. Iverson, National Electrical Manufacturers Association, MI [M]
(Alt. to Gil Moniz)
Michael J. Johnston, National Electrical Contractors Association, MD [IM]
(Alt. to Harry J. Sassaman)
Joseph Marquardt, ExxonMobil Production Company, AK [U]
(Alt. to Louis A. Barrios)
Rep. American Chemistry Council
Dirk R. F. Muller, UL LLCF, Germany [RT]
(Alt. to Kenneth P. Boyce)
James R. Sanguinetti, University of Nevada, Las Vegas, NV [U]
(Alt. to Michael A. Anthony)
Rep. Association of Higher Education Facilities Officers
Mohinder P. Sood, City of Alexandria, VA [E]
(Alt. to Susan Newman Scearce)
Rep. International Association of Electrical Inspectors

Nonvoting

Ark Tsisserev, Stantec, Canada [SE]
Rep. CSA/Canadian Electrical Code Committee

CODE-MAKING PANEL NO. 2

Articles 210, 215, 220, Annex D,
Examples D1 through D6

Mark R. Hilbert, *Chair*
MR Hilbert Electrical Inspections & Training, NH [E]
Rep. International Association of Electrical Inspectors

Charles L. Boynton, The DuPont Company, Inc., TX [U]
Rep. American Chemistry Council
Frank Coluccio, New York City Department of Buildings, NY [E]
Ronald E. Duren, PacifiCorp, WA [UT]
Rep. Electric Light & Power Group/EEI
Thomas L. Harman, University of Houston-Clear Lake, TX [SE]
Donald M. King, IBEW Local Union 313, DE [L]
Rep. International Brotherhood of Electrical Workers
Frank Kodzis, Intertek Testing Services, MA [RT]
Robert L. LaRocca, UL LLC, NY [RT]
James E. Mitchem, TIC, The Industrial Company/TIC Holdings, CO [U]
Rep. Institute of Electrical & Electronics Engineers, Inc.
Steven Orlowski, National Association of Home Builders, DC [U]
Rep. National Association of Home Builders
James T. Pauley, Square D Company/Schneider Electric, KY [M]
Rep. National Electrical Manufacturers Association
Robert G. Wilkinson, IEC Texas Gulf Coast, TX [IM]
Rep. Independent Electrical Contractors, Inc.
Thomas H. Wood, Cecil B. Wood, Inc., IL [IM]
Rep. National Electrical Contractors Association

Alternates

Jacob G. Benninger, Cornell University, NY [L]
(Alt. to Donald M. King)
Rep. International Brotherhood of Electrical Workers
Lawrence Brown, National Association of Home Builders, DC [U]
(Alt. to Steven Orlowski)
David A. Dini, UL LLC, IL [RT]
(Alt. to Robert L. LaRocca)
Daniel J. Kissane, Legrand/Pass & Seymour, NY [M]
(Alt. to James T. Pauley)
Rep. National Electrical Manufacturers Association
William Ross McCorcle, American Electric Power, OK [UT]
(Alt. to Ronald E. Duren)
Rep. Electric Light & Power Group/EEI
William J. McGovern, City of Plano, TX [E]
(Alt. to Mark R. Hilbert)
Rep. International Association of Electrical Inspectors
Fernando E. Pacheco, Methanex Chile SA, TX [U]
(Alt. to Charles L. Boynton)
Rep. American Chemistry Council
Stephen J. Thorwegen, Jr., FSG Electric, TX [IM]
(Alt. to Robert G. Wilkinson)
Rep. Independent Electrical Contractors, Inc.
Charles M. Trout, Maron Electric Company, FL [IM]
(Alt. to Thomas H. Wood)
Rep. National Electrical Contractors Association

Nonvoting

William Burr, Canadian Standards Association, Canada [RT]
Douglas A. Lee, US Consumer Product Safety Commission, MD [C]
Andrew M. Trotta, US Consumer Product Safety Commission, MD [C]
(Alt. to Douglas A. Lee)

CODE-MAKING PANEL 3

Articles 300, 590, 720, 725, 727, 760,
Chapter 9, Tables 11(A) and (B), Tables 12(A) and (B)

Paul J. Casparro, *Chair*
Scranton Electricians JATC, PA [L]
Rep. International Brotherhood of Electrical Workers

Steven D. Burlison, Progress Energy, FL [UT]
Rep. Electric Light & Power Group/EEI
Shane M. Clary, Bay Alarm Company, CA [M]
Rep. Automatic Fire Alarm Association, Inc.
Adam D. Corbin, Corbin Electrical Services, Inc., NJ [IM]
Rep. Independent Electrical Contractors, Inc.
Les Easter, Atkore International, IL [M]
Rep. National Electrical Manufacturers Association
Stanley D. Kahn, Tri-City Electric Company, Inc., CA [IM]
Rep. National Electrical Contractors Association
Ray R. Keden, ERICO, Inc., CA [M]
Rep. Building Industry Consulting Services International
Steven J. Owen, Steven J. Owen, Inc., AL [IM]
Rep. Associated Builders & Contractors
David A. Pace, Olin Corporation, AL [U]
Rep. American Chemistry Council
Mark A. Sepulveda, USA Alarm Systems, Inc., CA [IM]
Rep. Electronic Security Association
(VL to 720, 725, 727, 760)
John E. Sleights, Travelers Insurance Company, CT [I]
Susan L. Stene, UL LLC, CA [RT]
Robert J. Walsh, City of Hayward, CA [E]
Rep. International Association of Electrical Inspectors
Wendell R. Whistler, Intertek Testing Services, OR [RT]

Alternates

Richard S. Anderson, RTKL Associates Inc., VA [M]
(Alt. to Ray R. Keden)
Rep. Building Industry Consulting Services International
Sanford E. Egesdal, Egesdal Associates PLC, MN [M]
(Alt. to Shane M. Clary)
Rep. Automatic Fire Alarm Association, Inc.
Michael J. Farrell III, Lucas County Building Regulation, MI [L]
(Alt. to Paul J. Casparro)
Rep. International Brotherhood of Electrical Workers
Danny Liggett, The DuPont Company, Inc., TX [U]
(Alt. to David A. Pace)
Rep. American Chemistry Council
Mark C. Ode, UL LLC, AZ [RT]
(Alt. to Susan L. Stene)
Roger S. Passmore, IES Industrial, Inc., SC [IM]
(Alt. to Steven J. Owen)
Rep. Associated Builders & Contractors
Louis P. Petrucci, Jr., Bonner Electric Inc., RI [IM]
(Alt. to Adam D. Corbin)
Rep. Independent Electrical Contractors, Inc.
George A. Straniero, AFC Cable Systems, Inc., NJ [M]
(Alt. to Les Easter)
Rep. National Electrical Manufacturers Association
Joseph J. Wages, Jr., Springdale, AR [E]
(Alt. to Robert J. Walsh)
Rep. International Association of Electrical Inspectors

Nonvoting

Edward C. Lawry, Oregon, WI [E]
(Member Emeritus)

CODE-MAKING PANEL NO 4

Articles 225, 230, 690, 692, 705

Ronald J. Toomer, *Chair*
Toomer Electrical Company Inc., LA [IM]
Rep. National Electrical Contractors Association

Malcolm Allison, Mersen USA Newburyport-MA, LLC, NH [M]
Rep. National Electrical Manufacturers Association
Ward I. Bower, Solar Energy Industries Association, NM [U]
Rep. Solar Energy Industries Association
(VL to 690, 692, 705)
Thomas E. Buchal, Intertek Testing Services, NY [RT]
James G. Cialdea, Three-C Electrical Company Inc., MA [IM]
Rep. InterNational Electrical Testing Association
Ronald Todd Fries, HellermannTyton, WI [M]
Mark D. Gibbs, Babcock & Wilcox Y-12, LLC, TN [U]
Rep. Institute of Electrical & Electronics Engineers, Inc.
Roger D. McDaniel, Georgia Power Company, GA [UT]
Rep. Electric Light & Power Group/EEI
James J. Rogers, Towns of Oak Bluffs, Tisbury, West Tisbury, MA [E]
Rep. International Association of Electrical Inspectors
John A. Sigmund, PPG Industries, Inc., LA [U]
Rep. American Chemistry Council
Todd W. Stafford, National Joint Apprentice & Training Committee, TN [L]
Rep. International Brotherhood of Electrical Workers
Robert H. Wills, Intergrid, LLC, NH [U]
Rep. American Wind Energy Association
(VL to 690, 692, 694, 705)
Timothy P. Zgonena, UL LLC, IL [RT]
Vincent C. Zinnante, Westpoint Electric Inc., TX [IM]
Rep. Independent Electrical Contractors, Inc.

Alternates

Paul D. Barnhart, UL LLC, NC [RT]
(Alt. to Timothy P. Zgonena)
Alex Z. Bradley, The DuPont Company, Inc., DE [U]
(Alt. to John A. Sigmund)
Rep. American Chemistry Council
William F. Brooks, Brooks Engineering, CA [U]
(Alt. to Ward I. Bower)
Rep. Solar Energy Industries Association
(VL to 690, 692, 705)
Larry D. Cogburn, Cogburn Bros., Inc., FL [IM]
(Alt. to Ronald J. Toomer)
Rep. National Electrical Contractors Association
Brian L. Crise, NIETC, OR [L]
(Alt. to Todd W. Stafford)
Rep. International Brotherhood of Electrical Workers
Barry N. Hornberger, PECO Energy Company, PA [UT]
(Alt. to Roger D. McDaniel)
Rep. Electric Light & Power Group/EEI
Tim LaLonde, Haskin Electric, Inc., WA [IM]
(Alt. to Vincent C. Zinnante)
Rep. Independent Electrical Contractors, Inc.
Howard Liu, Intertek Testing Services, NY [RT]
(Alt. to Thomas E. Buchal)
Robert W. Preus, Advanced Renewable Technology, LLC, OR [U]
(Alt. to Robert H. Wills)
Rep. American Wind Energy Association
(VL to 690, 692, 694, 705)
Patrick G. Salas, General Electric Company, CT [M]
(Alt. to Malcolm Allison)
Rep. National Electrical Manufacturers Association
Glenn A. Soles, Clark County Department of Development Services, NV [E]
(Alt. to James J. Rogers)
Rep. International Association of Electrical Inspectors

Nonvoting

Stephen W. Douglas, QPS Evaluation Services Inc., Canada [SE]
Rep. CSA/Canadian Electrical Code Committee

CODE-MAKING PANEL 5

Articles 200, 250, 280, 285

Nathan Philips, *Chair*
Integrated Electronic Systems, OR [IM]
Rep. National Electrical Contractors Association

Trevor N. Bowmer, Telcordia Technologies, NJ [U]
Rep. Alliance for Telecommunications Industry Solutions
David Brender, Copper Development Association, Inc., NY [M]
Rep. Copper Development Association Inc.
Martin J. Brett, Jr., Wheatland Tube Company, DE [M]
Rep. American Iron and Steel Institute
Paul Dobrowsky, Innovative Technology Services, NY [U]
Rep. American Chemistry Council
G. Scott Harding, F. B. Harding, Inc., MD [IM]
Rep. Independent Electrical Contractors, Inc.
Joseph Harding, Power Tool Institute, OH [M]
William J. Helfrich, US Department of Labor, PA [E]
Paul J. LeVasseur, Bay City JEATC, MI [L]
Rep. International Brotherhood of Electrical Workers
Charles F. Mello, UL LLC, WA [RT]
Daleep C. Mohla, DCM Electrical Consulting Services, Inc., TX [U]
Rep. Institute of Electrical & Electronics Engineers, Inc.
Christine T. Porter, Intertek Testing Services, WA [RT]
Gregory J. Steinman, Thomas & Betts Corporation, TN [M]
Rep. National Electrical Manufacturers Association
Richard Temblador, Southwire Company, GA [M]
Rep. The Aluminum Association, Inc.
C. Douglas White, CenterPoint Energy, Inc., TX [UT]
Rep. Electric Light & Power Group/EEI
David A. Williams, Delta Charter Township, MI [E]
Rep. International Association of Electrical Inspectors

Alternates

Gary A. Beckstrand, Utah Electrical JATC, UT [L]
(Alt. to Paul J. LeVasseur)
Rep. International Brotherhood of Electrical Workers
Joseph P. DeGregoria, UL LLC, NY [RT]
(Alt. to Charles F. Mello)
Jacob M. Howlett, Wilson Construction Company, OR [IM]
(Alt. to Nathan Philips)
Rep. National Electrical Contractors Association
Ronald Lai, Burndy LLC, NH [M]
(Alt. to Gregory J. Steinman)
Rep. National Electrical Manufacturers Association
Richard E. Loyd, R & N Associates, AZ [M]
(Alt. to Martin J. Brett, Jr.)
Rep. American Iron and Steel Institute
Randall R. McCarver, Telcordia Technologies, Inc., NJ [U]
(Alt. to Trevor N. Bowmer)
Rep. Alliance for Telecommunications Industry Solutions
Michael E. McNeil, FMC Bio Polymer, ME [U]
(Alt. to Paul Dobrowsky)
Rep. American Chemistry Council
Mike O'Meara, Arizona Public Service Company, AZ [UT]
(Alt. to C. Douglas White)
Rep. Electric Light & Power Group/EEI
William A. Pancake, III, Universal Engineering Sciences, FL [E]
(Alt. to David A. Williams)
Rep. International Association of Electrical Inspectors
Paul R. Picard, AFC Cable Systems, Inc., MA [M]
(Alt. to Richard Temblador)
Rep. The Aluminum Association, Inc.
Michael Querry, Trinity River Authority, TX [IM]
(Alt. to G. Scott Harding)
Rep. Independent Electrical Contractors, Inc.
Elliot Rappaport, Coconut Creek, FL [U]
(Alt. to Daleep C. Mohla)
Rep. Institute of Electrical & Electronics Engineers, Inc.
Phil Simmons, Simmons Electrical Services, WA [M]
(Alt. to David Brender)
Rep. Copper Development Association Inc.
Thomas R. Siwek, Robert Bosch Tool Corporation, IL [M]
(Alt. to Joseph Harding)
Rep. Power Tool Institute, Inc
Fred Song, Intertek Testing Services, China [RT]
(Alt. to Christine T. Porter)

Nonvoting

Robert A. Nelson, Canadian Standards Association, Canada [RT]

CODE-MAKING PANEL 6

Articles 310, 400, 402, Chapter 9 Tables 5 through 9, and Annex B

Scott Cline, *Chair*
McMurtrey Electric, Inc., CA [IM]
Rep. National Electrical Contractors Association

Samuel B. Friedman, General Cable Corporation, RI [M]
Rep. National Electrical Manufacturers Association
Robert L. Huddleston, Jr., Eastman Chemical Company, TN [U]
Rep. American Chemistry Council
G. W. Kent, Kent Electric & Plumbing Systems, TX [IM]
Rep. Independent Electrical Contractors, Inc.
William F. Laidler, IBEW Local 223 JATC, MA [L]
Rep. International Brotherhood of Electrical Workers
Paul R. Picard, AFC Cable Systems, Inc., MA [M]
Rep. The Aluminum Association, Inc.
Carl Timothy Wall, Alabama Power Company, AL [UT]
Rep. Electric Light & Power Group/EEI
Mario Xerri, UL LLC, NY [RT]
Joseph S. Zimnoch, The Okonite Company, NJ [M]
Rep. Copper Development Association Inc.

Alternates

Peter E. Bowers, Satellite Electric Company, Inc., MD [IM]
(Alt. to G. W. Kent)
Rep. Independent Electrical Contractors, Inc.
John J. Cangemi, UL LLC, NY [RT]
(Alt. to Mario Xerri)
Todd Crisman, K-Electric Company/NJATC, NE [L]
(Alt. to William F. Laidler)
Rep. International Brotherhood of Electrical Workers
Richard A. Holub, The DuPont Company, Inc., DE [U]
(Alt. to Robert L. Huddleston, Jr.)
Rep. American Chemistry Council
Christel K. Hunter, General Cable/Alcan Cable, NV [M]
(Alt. to Samuel B. Friedman)
Rep. National Electrical Manufacturers Association
Lowell Lisker, AFC Cable Systems, Inc., MA [M]
(Alt. to Paul R. Picard)
Rep. The Aluminum Association, Inc.
Charles David Mercier, Southwire Company, GA [M]
(Alt. to Joseph S. Zimnoch)
Rep. Copper Development Association Inc.
Michael W. Smith, Schaeffer Electric Company, Inc., MO [IM]
(Alt. to Scott Cline)
Rep. National Electrical Contractors Association
John Stacey, City of St. Louis, MO [E]
(Voting Alt. to IAEI Rep.)
Rep. International Association of Electrical Inspectors

CODE-MAKING PANEL 7

Articles 320, 322, 324, 326, 328, 330, 332, 334, 336, 338, 340, 382, 394, 396, 398, 399

Michael W. Smith, *Chair*
Schaeffer Electric Company, Inc., MO [IM]
Rep. National Electrical Contractors Association

Thomas H. Cybula, UL LLC, NY [RT]
Chris J. Fahrenthold, Facility Solutions Group, TX [IM]
Rep. Independent Electrical Contractors, Inc.
Herman J. Hall, Austin, TX [M]
Rep. The Vinyl Institute
Christel K. Hunter, General Cable/Alcan Cable, NV [M]
Rep. The Aluminum Association, Inc.
Samuel R. La Dart, City of Memphis, TN [L]
Rep. International Brotherhood of Electrical Workers
Charles David Mercier, Southwire Company, GA [M]
Rep. National Electrical Manufacturers Association
Ronald G. Nickson, National Multi Housing Council, DC [U]
Dennis A. Nielsen, Lawrence Berkeley National Laboratory, CA [U]
Rep. Institute of Electrical & Electronics Engineers, Inc.
Charles J. Palmieri, Town of Norwell, MA [E]
Rep. International Association of Electrical Inspectors
John W. Ray, Duke Energy Corporation, NC [UT]
Rep. Electric Light & Power Group/EEI
Gregory L. Runyon, Eli Lilly and Company, IN [U]
Rep. American Chemistry Council
David E. Schumacher, Associated Builders and Contractors, IA [IM]
Rep. Associated Builders & Contractors
George A. Straniero, AFC Cable Systems, Inc., NJ [M]
Rep. Copper Development Association Inc.

Alternates

J. Richard Barker, Alcan Cable, a General Cable Company, CA [M]
(Alt. to Christel K. Hunter)
Rep. The Aluminum Association, Inc.
William B. Crist, Sr., Houston Stafford Electric Company, TX [IM]
(Alt. to Chris J. Fahrenthold)
Rep. Independent Electrical Contractors, Inc.
Donald G. Dunn, Aramco Services Company, TX [U]
(Alt. to Dennis A. Nielsen)
Rep. Institute of Electrical & Electronics Engineers, Inc.
Rachel E. Krepps, Baltimore Gas & Electric Company, MD [UT]
(Alt. to John W. Ray)
Rep. Electric Light & Power Group/EEI
Keith Owensby, Chattanooga Electrical JATC, TN [L]
(Alt. to Samuel R. La Dart)
Rep. International Brotherhood of Electrical Workers
Kevin T. Porter, Encore Wire Corporation, TX [M]
(Alt. to George A. Straniero)
Rep. Copper Development Association Inc.
Irozenell Pruitt, E. I. DuPont de Nemours & Company, TX [U]
(Alt. to Gregory L. Runyon)
Rep. American Chemistry Council
Susan L. Stene, UL LLC, CA [RT]
(Alt. to Thomas H. Cybula)
Allen R. Turner, James City County, Virginia, VA [E]
(Alt. to Charles J. Palmieri)
Rep. International Association of Electrical Inspectors
Wesley L. Wheeler, Cogburn Bros., Inc., FL [IM]
(Alt. to Michael W. Smith)
Rep. National Electrical Contractors Association

CODE-MAKING PANEL 8

Articles 342, 344, 348, 350, 352, 353, 354, 355, 356, 358, 360, 362, 366, 368, 370, 372, 374, 376, 378, 380, 384, 386, 388, 390, 392, Chapter 9, Tables 1 through 4, Example D13 and Annex C

Larry D. Cogburn, *Chair*
Cogburn Bros., Inc., FL [IM]
Rep. National Electrical Contractors Association

Richard J. Berman, UL LLC, IL [RT]
David M. Campbell, AFC Cable Systems, Inc., MA [M]
Rep. The Aluminum Association, Inc.
Kenneth W. Hengst, EAS Contracting, LP, TX [IM]
Rep. Independent Electrical Contractors, Inc.
James M. Imlah, City of Hillsboro, OR [E]
Rep. International Association of Electrical Inspectors
David H. Kendall, Thomas & Betts Corporation, TN [M]
Rep. The Vinyl Institute
Richard E. Loyd, R & N Associates, AZ [M]
Rep. American Iron and Steel Institute
Michael C. Martin, Lyondellbasell Industries, TX [U]
Rep. American Chemistry Council
Paul W. Myers, PCS Nitrogen, OH [U]
Rep. Institute of Electrical & Electronics Engineers, Inc.
Gary W. Pemble, Montana Electrical JATC, MT [L]
Rep. International Brotherhood of Electrical Workers
Rodney J. West, Square D Company/Schneider Electric, OH [M]
Rep. National Electrical Manufacturers Association
Leslie R. Zielke, South Carolina Electric & Gas Company, SC [UT]
Rep. Electric Light & Power Group/EEI

Alternates

Timothy M. Andrea, Southwire Company, GA [M]
(Alt. to David M. Campbell)
Rep. The Aluminum Association, Inc.
George R. Dauberger, Thomas & Betts Corporation, TN [M]
(Alt. to David H. Kendall)
Rep. The Vinyl Institute
David A. Gerstetter, UL LLC, IL [RT]
(Alt. to Richard J. Berman)
Pete Jackson, City of Bakersfield Development Services, CA [E]
(Alt. to James M. Imlah)
Rep. International Association of Electrical Inspectors
Gregory L. Maurer, Wheatland Tube Company, PA [M]
(Alt. to Richard E. Loyd)
Rep. American Iron and Steel Institute
Stephen P. Poholski, Newkirk Electric Associates, Inc., MI [IM]
(Alt. to Larry D. Cogburn)
Rep. National Electrical Contractors Association
Dan Rodriguez, IBEW Local Union 332, CA [L]
(Alt. to Gary W. Pemble)
Rep. International Brotherhood of Electrical Workers
Frederic F. Small, Hubbell Incorporated, CT [M]
(Alt. to Rodney J. West)
Rep. National Electrical Manufacturers Association
Michael K. Weitzel, Central Washington Electrical Education, WA [IM]
(Alt. to Kenneth W. Hengst)
Rep. Independent Electrical Contractors, Inc.

CODE-MAKING PANEL 9

Articles 312, 314, 404, 408, 450, 490

David G. Humphrey, *Chair*
County of Henrico, Virginia, VA [E]
Rep. International Association of Electrical Inspectors

Rodney D. Belisle, NECA-IBEW Electrical Training Trust, OR [L]
Rep. International Brotherhood of Electrical Workers
Kevin J. Breen, Breen Electrical Contractors Inc., NY [IM]
Rep. Independent Electrical Contractors, Inc.
Billy Breitkreutz, Fluor Corporation, TX [U]
Rep. Associated Builders & Contractors
Wayne Brinkmeyer, Britain Electric Company, TX [IM]
Rep. National Electrical Contractors Association
Paul D. Coghill, Intertek Testing Services, OH [RT]
Frederic P. Hartwell, Hartwell Electrical Services, Inc., MA [SE]
Robert D. Osborne, UL LLC, NC [RT]
Bradford D. Rupp, Allied Moulded Products, Inc., OH [M]
Rep. National Electrical Manufacturers Association
Sukanta Sengupta, FMC Corporation, NJ [U]
Rep. Institute of Electrical & Electronics Engineers, Inc.
Ralph H. Young, Eastman Chemical Company, TN [U]
Rep. American Chemistry Council

Alternates

Gregory A. Bowman, NABCO Electric, TN [IM]
(Alt. to Wayne Brinkmeyer)
Rep. National Electrical Contractors Association
Kenneth S. Crawford, DuPont, WV [U]
(Alt. to Ralph H. Young)
Rep. American Chemistry Council
Jerry M. Ferraro, Northeast Utilities, CT [UT]
(Voting Alt to ELPG/EEI rep.)
Rep. Electric Light & Power Group/EEI
L. Keith Lofland, International Association of Electrical Inspectors (IAEI), TX [E]
(Alt. to David G. Humphrey)
Kenneth L. McKinney, Jr., UL LLC, NC [RT]
(Alt. to Robert D. Osborne)
Ronnie H. Ridgeway, Siemens Industry, Inc., TX [M]
(Alt. to Bradford D. Rupp)
Rep. National Electrical Manufacturers Association
Edward Rodriguez, IEC Texas Gulf Coast, TX [IM]
(Alt. to Kevin J. Breen)
Rep. Independent Electrical Contractors, Inc.
Rhett A. Roe, IBEW Local Union 26 JATC, MD [L]
(Alt. to Rodney D. Belisle)
Rep. International Brotherhood of Electrical Workers

CODE-MAKING PANEL 10

Article 240

Julian R. Burns, *Chair*
Quality Power Solutions, Inc., NC [IM]
Rep. Independent Electrical Contractors, Inc.

Scott A. Blizard, American Electrical Testing Company, Inc., MA [IM]
Rep. InterNational Electrical Testing Association
Dennis M. Darling, Stantec, Canada [U]
Rep. Institute of Electrical & Electronics Engineers, Inc.
James T. Dollard, Jr., IBEW Local Union 98, PA [L]
Rep. International Brotherhood of Electrical Workers
Carl Fredericks, The Dow Chemical Company, TX [U]
Rep. American Chemistry Council
Jeffrey H. Hidaka, UL LLC, IL [RT]
Robert J. Kauer, Building Inspection Underwriters, Inc., PA [E]
Rep. International Association of Electrical Inspectors
Alan Manche, Schneider Electric, KY [M]
Rep. National Electrical Manufacturers Association
Robert W. Mount, Jr., Hussmann Corporation, MO [M]
Rep. Air-Conditioning, Heating, & Refrigeration Institute
George J. Ockuly, Technical Marketing Consultants, MO [M]
Richard Sobel, Quantum Electric Corporation, NY [IM]
Rep. National Electrical Contractors Association
John F. Vartanian, National Grid, MA [UT]
Rep. Electric Light & Power Group/EEI

Alternates

Christopher M. Jensen, North Logan City, UT [E]
(Alt. to Robert J. Kauer)
Rep. International Association of Electrical Inspectors
Frank G. Ladonne, UL LLC, IL [RT]
(Alt. to Jeffrey H. Hidaka)
Kevin J. Lippert, Eaton Corporation, PA [M]
(Alt. to Alan Manche)
Rep. National Electrical Manufacturers Association
Richard E. Lofton, II, IBEW Local Union 280, OR [L]
(Alt. to James T. Dollard, Jr.)
Rep. International Brotherhood of Electrical Workers
Bruce M. Rockwell, American Electrical Testing Company, Inc., NJ [IM]
(Alt. to Scott A. Blizard)
Rep. InterNational Electrical Testing Association
Vincent J. Saporita, Cooper Bussmann, MO [M]
(Alt. to George J. Ockuly)
Roy K. Sparks, III, Elanco Animal Health, IN [U]
(Alt. to Carl Fredericks)
Rep. American Chemistry Council
Steve A. Struble, Freeman's Electric Service, Inc., SD [IM]
(Alt. to Julian R. Burns) Rep. Independent Electrical Contractors, Inc.
Steven E. Townsend, General Motors Corporation, MI [U]
(Alt. to Dennis M. Darling)
Rep. Institute of Electrical & Electronics Engineers, Inc.

CODE-MAKING PANEL 11

Articles 409, 430, 440, 460, 470, Annex D, and Example D8

John M. Thompson, *Chair*
UL LLC, NC [RT]

Luis M. Bas, Intertek Testing Services, FL [RT]
Terry D. Cole, Hamer Electric, Inc., WA [IM]
Rep. Independent Electrical Contractors, Inc.
James M. Fahey, IBEW Local Union 103/MBTA, MA [L]
Rep. International Brotherhood of Electrical Workers
Robert G. Fahey, City of Janesville, WI [E]
Rep. International Association of Electrical Inspectors
Stanley J. Folz, Morse Electric Company, NV [IM]
Rep. National Electrical Contractors Association
Paul E. Guidry, Fluor Enterprises, Inc., TX [U]
Rep. Associated Builders & Contractors
James C. Missildine, Jr., Southern Company Services, Inc., AL [UT]
Rep. Electric Light & Power Group/EEI
Arthur S. Neubauer, Arseal Technologies, GA [U]
Rep. American Petroleum Institute
Charles L. Powell, Eastman Chemical Company, TN [U]
Rep. American Chemistry Council
Vincent J. Saporita, Cooper Bussmann, MO [M]
Arthur J. Smith, III, Waldemar S. Nelson & Company, Inc., LA [U]
Rep. Institute of Electrical & Electronics Engineers, Inc.
Ron Widup, Shermco Industries, TX [IM]
Rep. InterNational Electrical Testing Association
James R. Wright, Siemens Industry, Inc., IL [M]
Rep. National Electrical Manufacturers Association

Alternates

Gregory J. Clement, Fluor Enterprises, Inc., TX [U]
(Alt. to Paul E. Guidry)
Rep. Associated Builders & Contractors
Terry W. Cromer, NC Association of Electrical Contractors, NC [IM]
(Alt. to Terry D. Cole)
Rep. Independent Electrical Contractors, Inc.
Jeffrey A. DesJarlais, UL LLC, IL [RT]
(Alt. to John M. Thompson)
Eric Gesualdi, Shell Oil Company, TX [U]
(Alt. to Arthur S. Neubauer)
Rep. American Petroleum Institute
Rodney B. Jones, Clackamas County, Oregon, OR [E]
(Alt. to Robert G. Fahey)
Rep. International Association of Electrical Inspectors
Ed Larsen, Schneider Electric USA, IA [M]
(Alt. to James R. Wright)
Rep. National Electrical Manufacturers Association
Jebediah J. Novak, Cedar Rapids Electrical JATC, IA [L]
(Alt. to James M. Fahey)
Rep. International Brotherhood of Electrical Workers
George J. Ockuly, Technical Marketing Consultants, MO [M]
(Alt. to Vincent J. Saporita)
Bobby A. Walton, Intertek, TX [RT]
(Alt. to Luis M. Bas)

CODE-MAKING PANEL 12

Articles 610, 620, 625, 626, 630, 640, 645, 647, 650, 660, 665, 668, 669, 670, 685 and Annex D, Examples D9 and D10

Timothy M. Croushore, *Chair*
FirstEnergy Technologies, PA [UT]
Rep. Electric Light & Power Group/EEI

Thomas R. Brown, Intertek Testing Services, NY [RT]
Philip Clark, City of Detroit, MI [E]
Rep. International Association of Electrical Inspectors
Karl M. Cunningham, Alcoa, Inc., PA [M]
Rep. The Aluminum Association, Inc.
(VL to 610, 625, 630, 645, 660, 665, 668, 669, 685)
Thomas L. Hedges, Hedges Electric & Construction, Inc., CA [IM]
Rep. National Electrical Contractors Association
Jeffrey L. Holmes, IBEW Local Union 1 JATC, MO [L]
Rep. International Brotherhood of Electrical Workers
Angelo G. Horiates, Navy Crane Center, VA [U]
(VL to 610)
Robert E. Johnson, ITE Safety, MA [U]
Rep. Information Technology Industry Council
(VL to 640, 645, 647, 685)
Andy Juhasz, Kone, Inc., IL [M]
Rep. National Elevator Industry Inc.
(VL to 610, 620, 630)
Stanley Kaufman, CableSafe, Inc./OFS, GA [M]
Rep. Society of the Plastics Industry, Inc.
(VL to 640, 645)
John R. Kovacik, UL LLC, IL [RT]
Todd Lottmann, Cooper Bussmann, MO [M]
Rep. National Electrical Manufacturers Association
Jeffrey S. Menig, General Motors Company, MI [U]
Rep. Society of Automotive Engineers-Hybrid Committee
Duke W. Schamel, Electrical Service Solutions, Inc., CA [IM]
Rep. Independent Electrical Contractors, Inc.
Arthur E. Schlueter, Jr., A. E. Schlueter Pipe Organ Company, GA [M]
Rep. American Institute of Organ Builders
(VL to 640, 650)
Robert C. Turner, Inductotherm Corporation, MD [M]
(VL to 610, 630, 665, 668, 669)
Ryan Gregory Ward, IdleAire, Inc., TN [U]
Rep. Transportation Electrification Committee
(VL to 625, 626)
Kenneth White, Olin Corporation, NY [U]
Rep. American Chemistry Council

Alternates

Timothy M. Andrea, Southwire Company, GA [M]
(Alt. to Karl M. Cunningham)
Rep. The Aluminum Association, Inc.
(VL to 610, 625, 630, 645, 660, 665, 668, 669, 685)
Joseph M. Bablo, UL LLC, IL [RT]
(Alt. to John R. Kovacik)
Jeffrey W. Blain, Schindler Elevator Corporation, NY [M]
(Alt. to Andy Juhasz)
Rep. National Elevator Industry Inc.
(VL to 610, 620, 630)
William A. Brunner, Main Electric Construction Inc., ND [IM]
(Alt. to Thomas L. Hedges)
Rep. National Electrical Contractors Association
William B. Crist, Jr., IES Residential Inc., TX [IM]
(Alt. to Duke W. Schamel)
Rep. Independent Electrical Contractors, Inc.
Jody B. Greenwood, Navy Crane Center, VA [U]
(Alt. to Angelo G. Horiates)
(VL to 610)
Gery J. Kissel, General Motors Corporation, MI [U]
(Alt. to Jeffrey S. Menig)
Rep. Society of Automotive Engineers-Hybrid Committee
Todd R. Konieczny, Intertek Testing Services, MA [RT]
(Alt. to Thomas R. Brown)
Joseph F. Prisco, IBM Corporation, MN [U]
(Alt. to Robert E. Johnson)
Rep. Information Technology Industry Council
(VL to 640, 645, 647, 685)
Jose A. Salazar, Southern California Edison Company, CA [UT]
(Alt. to Timothy M. Croushore)
Rep. Electric Light & Power Group/EEI
Emad Tabatabaei, Inductotherm Corporation, NJ [M]
(Alt. to Robert C. Turner)
(VL to 610, 630, 665, 668, 669)
Frank Tse, Leviton Manufacturing Company, Inc., NY [M]
(Alt. to Todd Lottmann)
Rep. National Electrical Manufacturers Association
Dale Wion, Iowa Electrical Apprenticeship, IA [L]
(Alt. to Jeffrey L. Holmes)
Rep. International Brotherhood of Electrical Workers
Phillip J. Yehl, City of Peoria, IL [E]
(Alt. to Philip Clark)
Rep. International Association of Electrical Inspectors

Nonvoting

Andre R. Cartal, Yardley, PA [E]
(Member Emeritus)

CODE-MAKING PANEL 13

**Articles 445, 455, 480, 695, 700,
701, 702, 708, Annex F and Annex G**

Donald P. Bliss, *Chair*
NI2 Center for Infrastructure Expertise, NH [U]

Martin D. Adams, Adams Electric, Inc., CO [IM]
Rep. National Electrical Contractors Association
Kenneth L. Box, Cummins Power Generation, GA [M]
James L. Brown, Detroit Edison, DTE Energy, MI [UT]
Rep. Electric Light & Power Group/EEI
Daniel J. Caron, Bard, Rao + Athanas Consulting Engineers, LLC, MA [SE]
Walter F. Constantine, Draka Cableteq USA, MA [M]
Rep. Copper Development Association Inc.
Richard D. Currin, Jr., North Carolina State University, NC [U]
Rep. American Society of Agricultural & Biological Engineers
Neil A. Czarnecki, Reliance Controls Corporation, WI [M]
Rep. National Electrical Manufacturers Association
Herbert H. Daugherty, Electric Generating Systems Association, FL [M]
James E. Degnan, Sparling, WA [U]
Rep. American Society for Healthcare Engineering
Ronald A. Keenan, M. C. Dean, Inc., VA [IM]
Rep. Independent Electrical Contractors, Inc.
Linda J. Little, IBEW Local 1 Electricians JATC, MO [L]
Rep. International Brotherhood of Electrical Workers
Daniel R. Neeser, Cooper Bussmann, MO [M]
Mark C. Ode, UL LLC, AZ [RT]
Peter M. Olney, Vermont Department of Public Safety, VT [E]
Rep. International Association of Electrical Inspectors
Shawn Paulsen,CSA Group,Canada [RT]
Arnoldo L. Rodriguez, LyondellBasell Industries, TX [U]
Rep. American Chemistry Council
Michael L. Savage, Sr., Middle Department Inspection Agency, Inc., MD [E]
Mario C. Spina, Verizon Wireless, OH [U]
Rep. Institute of Electrical & Electronics Engineers, Inc.
David Tobias, Jr., Intertek Testing Services, OH [RT]
James R. White, Shermco Industries, Inc., TX [IM]
Rep. InterNational Electrical Testing Association

Alternates

Lawrence S. Ayer, Biz Com Electric, Inc., OH [IM]
(Alt. to Ronald A. Keenan)
Rep. Independent Electrical Contractors, Inc.
Barry S. Bauman, Alliant Energy, WI [U]
(Alt. to Richard D. Currin, Jr.)
Rep. American Society of Agricultural & Biological Engineers
Krista McDonald Biason, HGA Architects and Engineers, MN [U]
(Alt. to James E. Degnan)
Rep. American Society for Healthcare Engineering
James S. Conrad, RSCC Wire & Cable, CT [M]
(Alt. to Walter F. Constantine)
Rep. Copper Development Association Inc.
Timothy Crnko, Cooper Bussmann, MO [M]
(Alt. to Daniel R. Neeser)
Alfonso J. Dazio, Consolidated Edison Company of New York, NY [UT]
(Alt. to James L. Brown)
Rep. Electric Light & Power Group/EEI
James T. Dollard, Jr., IBEW Local Union 98, PA [L]
(Alt. to Linda J. Little)
Rep. International Brotherhood of Electrical Workers
Lawrence W. Forshner, Bard, Rao + Athanas Consulting Engineers LLC, MA [SE]
(Alt. to Daniel J. Caron)
Steven F. Froemming, City of Franklin, WI [E]
(Alt. to Peter M. Olney)
Rep. International Association of Electrical Inspectors
Chad Kennedy, Schneider Electric, SC [M]
(Alt. to Neil A. Czarnecki)
Rep. National Electrical Manufacturers Association
John R. Kovacik, UL LLC, IL [RT]
(Alt. to Mark C. Ode)
Herbert V. Whittall, Electrical Generating Systems Association, FL [M]
(Alt. to Herbert H. Daugherty)

CODE-MAKING PANEL 14

**Articles 500, 501, 502, 503, 504, 505,
506, 510, 511, 513, 514, 515, and 516**

Robert A. Jones, *Chair*
Independent Electrical Contractors, Inc., TX [IM]
Rep. Independent Electrical Contractors, Inc.

Harold G. Alexander, American Electric Power Company, OH [UT]
Rep. Electric Light & Power Group/EEI
Edward M. Briesch, UL LLC, IL [RT]
William T. Fiske, Intertek Testing Services, NY [RT]
Mark Goodman, Hydrogen Energy California LLC, CA [U]
Joseph H. Kuczka, Killark Electric Manufacturing Company, MO [M]
Rep. National Electrical Manufacturers Association
William G. Lawrence, Jr., FM Global, MA [I]
L. Evans Massey, Baldor Electric Company, SC [M]
Rep. Instrumentation, Systems, & Automation Society
William E. McBride, Northern Electric Company, AK [U]
Rep. Institute of Electrical & Electronics Engineers, Inc.
Jeremy Neagle, US Bureau of Alcohol, Tobacco, Firearms & Explosives, MD [U]
John L. Simmons, Florida East Coast JATC, FL [L]
Rep. International Brotherhood of Electrical Workers
David B. Wechsler, Lake Jackson, TX [U]
Rep. American Chemistry Council
Mark C. Wirfs, R & W Engineering, Inc., OR [U]
Rep. Grain Elevator and Processing Society

Alternates

Donald W. Ankele, UL LLC, IL [RT]
(Alt. to Edward M. Briesch)
Steven J. Blais, EGS Electrical Group, IL [M]
(Alt. to Joseph H. Kuczka)
Rep. National Electrical Manufacturers Association
Mark W. Bonk, Cargill Incorporated, MN [U]
(Alt. to Mark C. Wirfs)
Rep. Grain Elevator and Processing Society
Dave Burns, Shell P&T: Innovation /R&D, TX [U]
(Alt. to Mark Goodman)
Rep. American Petroleum Institute
Larry W. Burns, Burns Electric, Inc., TX [IM]
(Alt. to Robert A. Jones)
Rep. Independent Electrical Contractors, Inc.
Thomas E. Dunne, Long Island Joint Apprenticeship & Training Committee, NY [L]
(Alt. to John L. Simmons)
Rep. International Brotherhood of Electrical Workers
Richard A. Holub, The DuPont Company, Inc., DE [U]
(Alt. to David B. Wechsler)
Rep. American Chemistry Council
Jack E. Jamison, Jr., Miller Engineering, Inc., WV [E]
(Voting Alt. to IAEI Rep.)
Rep. International Association of Electrical Inspectors
Arkady Levi, Exelon Power, MD [UT]
(Alt. to Harold G. Alexander)
Rep. Electric Light & Power Group/EEI
Ryan Parks, Intertek, TX [RT]
(Alt. to William T. Fiske)
Eddie Ramirez, FM Global, MA [I]
(Alt. to William G. Lawrence, Jr.)
Ted H. Schnaare, Rosemount Incorporated, MN [M]
(Alt. to L. Evans Massey)
Rep. Instrumentation, Systems, & Automation Society

Nonvoting

Timothy J. Pope, Canadian Standards Association, Canada [RT]
Eduardo N. Solano, Estudio Ingeniero Solano S.A., Argentina [SE]
Fred K. Walker, US Department of the Air Force, FL [U]
Rep. TC on Airport Facilities

CODE-MAKING PANEL 15

Articles 517, 518, 520, 522, 525, 530, 540

Lawrence E. Todd, *Chair*
Intertek Testing Services, KY [RT]

James R. Duncan, Sparling Electrical Engineering & Technology Consulting, WA [U]
Rep. Institute of Electrical & Electronics Engineers, Inc.
Douglas S. Erickson, Northstar Management Company, MO [U]
Rep. American Society for Healthcare Engineering
Kenneth J. Gilbert, Florida Power & Light Company, FL [UT]
Rep. Electric Light & Power Group/EEI
Mitchell K. Hefter, Philips Controls, TX [IM]
Rep. Illuminating Engineering Society of North America
(VL to 518, 520, 525, 530, 540)
Kim Jones, Funtastic Shows, OR [U]
Rep. Outdoor Amusement Business Association, Inc.
(VL to 525)
Edwin S. Kramer, Radio City Music Hall, NY [L]
Rep. International Alliance of Theatrical Stage Employees
(VL to 518, 520, 525, 530, 540)
Gary J. Krupa, US Department of Veterans Affairs, NE [U]
Stephen M. Lipster, The Electrical Trades Center, OH [L]
Rep. International Brotherhood of Electrical Workers
Hugh O. Nash, Jr., Nash-Consult, TN [SE]
Rep. TC on Electrical Systems
Kevin T. Porter, Encore Wire Corporation, TX [M]
Rep. The Aluminum Association, Inc.
Brian E. Rock, Hubbell Incorporated, CT [M]
Rep. National Electrical Manufacturers Association
Marcus R. Sampson, Minnesota Department of Labor & Industry, MN [E]
Rep. International Association of Electrical Inspectors
James C. Seabury III, Enterprise Electric, LLC, TN [IM]
Rep. Independent Electrical Contractors, Inc.
Bruce D. Shelly, Shelly Electric Company, Inc., PA [IM]
Rep. National Electrical Contractors Association
Michael D. Skinner, CBS Studio Center, CA [U]
Rep. Alliance of Motion Picture and Television Producers
(VL to 518, 520, 525, 530, 540)
Donald J. Talka, UL LLC, NY [RT]
Kenneth E. Vannice, Leviton Manufacturing Company Inc., OR [M]
Rep. US Institute for Theatre Technology
(VL to 518, 520, 525, 530, 540)
Michael Velvikis, High Voltage Maintenance Corporation, WI [IM]
Rep. InterNational Electrical Testing Association

Alternates

Gary A. Beckstrand, Utah Electrical JATC, UT [L]
(Alt. to Stephen M. Lipster)
Rep. International Brotherhood of Electrical Workers
Chad E. Beebe, ASHE - AHA, WA [U]
(Alt. to Douglas S. Erickson)
James L. Brown, Detroit Edison, DTE Energy, MI [UT]
(Alt. to Kenneth J. Gilbert)
Rep. Electric Light & Power Group/EEI
Carmon A. Colvin, Bright Future Electric, LLC, AL [IM]
(Alt. to James C. Seabury III)
Rep. Independent Electrical Contractors, Inc.
Matthew B. Dozier, IDesign Services, TN [U]
(Alt. to James R. Duncan)
Rep. Institute of Electrical & Electronics Engineers, Inc.
Joe L. DuPriest, Orange County Public Schools, FL [E]
(Alt. to Marcus R. Sampson)
Rep. International Association of Electrical Inspectors
Samuel B. Friedman, General Cable Corporation, RI [M]
(Alt. to Brian E. Rock)
Rep. National Electrical Manufacturers Association
Don W. Jhonson, Interior Electric, Inc., FL [IM]
(Alt. to Bruce D. Shelly)
Rep. National Electrical Contractors Association
Jay Y. Kogoma, Intertek Testing Services, CA [RT]
(Alt. to Lawrence E. Todd)
Joseph P. Murnane, Jr., UL LLC, NY [RT]
(Alt. to Donald J. Talka)
Steven R. Terry, Electronic Theatre Controls Inc., NY [M]
(Alt. to Kenneth E. Vannice)
Rep. US Institute for Theatre Technology
(VL to 518, 520, 525, 530, 540)

CODE-MAKING PANEL 16

Articles770, 800, 810, 820, 830, 840

Thomas E. Moore, *Chair*
City of Beachwood, OH [E]
Rep. International Association of Electrical Inspectors

Donna Ballast, dbi, TX [M]
Rep. Telecommunications Industry Association
George Bish, Secure Watch Security, NC [IM]
Rep. Satellite Broadcasting & Communications Association
J. Robert Boyer, UTC/Edwards Company, NJ [M]
Rep. National Electrical Manufacturers Association
James E. Brunssen, Telcordia, NJ [U]
Rep. Alliance for Telecommunications Industry Solutions
Fred C. Dawson, E. I. Du Pont Canada Company, Canada [U]
Rep. American Chemistry Council
Roland E. Deike, Jr., CenterPoint Energy, Inc., TX [UT]
Rep. Electric Light & Power Group/EEI
Gerald Lee Dorna, Belden Wire & Cable Co., IN [M]
Rep. Insulated Cable Engineers Association Inc
Randolph J. Ivans, UL LLC, NY [RT]
Robert W. Jensen, dbi-Telecommunication Infrastructure Design, TX [M]
Rep. Building Industry Consulting Services International
Steven C. Johnson, Johnson Telecom, LLC, CA [UT]
Rep. National Cable & Telecommunications Association
William J. McCoy, Telco Sales, Inc., TX [U]
Rep. Institute of Electrical & Electronics Engineers, Inc.
Michael F. Murphy, Intertek Testing Services, MA [RT]
Harold C. Ohde, IBEW-NECA Technical Institute, IL [L]
Rep. International Brotherhood of Electrical Workers
Thomas J. Parrish, Telgian Corporation, MI [M]
Rep. Automatic Fire Alarm Association, Inc.
W. Douglas Pirkle, Pirkle Electric Company, Inc., GA [IM]
Rep. National Electrical Contractors Association
Luigi G. Prezioso, M. C. Dean, Inc., VA [IM]
Rep. Independent Electrical Contractors, Inc.

Alternates

Trevor N. Bowmer, Telcordia Technologies, NJ [U]
(Alt. to James E. Brunssen)
Rep. Alliance for Telecommunications Industry Solutions
Larry Chan, City of New Orleans, LA [E]
(Voting Alt. to IAEI Rep.)
Rep. International Association of Electrical Inspectors
Terry C. Coleman, National Joint Apprentice & Training Committee, TN [L]
(Alt. to Harold C. Ohde)
Rep. International Brotherhood of Electrical Workers
Timothy D. Cooke, Times Fiber Communications, Inc., VA [UT]
(Alt. to Steven C. Johnson)
Rep. National Cable & Telecommunications Association
John A. Kacperski, Tele Design Services, CA [M]
(Alt. to Robert W. Jensen)
Rep. Building Industry Consulting Services International
Stanley Kaufman, CableSafe, Inc./OFS, GA [M]
(Alt. to Gerald Lee Dorna)
Rep. Insulated Cable Engineers Association Inc
David M. Lettkeman, Dish Network Service, LLC, CO [IM]
(Alt. to George Bish)
Rep. Satellite Broadcasting & Communications Association
Jack McNamara, Bosch Security Systems, NY [M]
(Alt. to J. Robert Boyer)
Rep. National Electrical Manufacturers Association
David B. Schrembeck, DBS Communications, Inc., OH [IM]
(Alt. to Luigi G. Prezioso)
Rep. Independent Electrical Contractors, Inc.
Anthony Tassone, UL LLC, NY [RT]
(Alt. to Randolph J. Ivans)

CODE-MAKING PANEL 17

Articles 422, 424, 426, 427, 680, 682

Donald R. Cook, *Chair*
Shelby County Department of Development Services, AL [E]
Rep. International Association of Electrical Inspectors

Thomas V. Blewitt, UL LLC, NY [RT]
Randal Hunter, Cooper Bussmann, NV [M]
Rep. National Electrical Manufacturers Association
Don W. Jhonson, Interior Electric, Inc., FL [IM]
Rep. National Electrical Contractors Association
Wayne E. Morris, Association of Home Appliance Manufacturers, DC [M]
(VL to 422, 424)
Jurgen Pannock, Whirlpool Corporation, TN [M]
Rep. Air-Conditioning, Heating, & Refrigeration Institute
(VL to 422, 424)
Marcos Ramirez, Hatfield-Reynolds Electric Company, AZ [IM]
Rep. Independent Electrical Contractors, Inc.
Chester L. Sandberg, Shell Exploration & Production Inc., CA [U]
Rep. Institute of Electrical & Electronics Engineers, Inc.
Ronald F. Schapp, Intertek Testing Services, OH [RT]
Kenneth M. Shell, Tyco Thermal Controls, CA [M]
Rep. Copper Development Association Inc.
(VL to 426, 427)
Ronald Sweigart, E.I. duPont de Nemours & Company, Inc., DE [U]
(VL to 422, 424, 426, 427, 682)
Lee L. West, Newport Controls, LLC, CA [M]
Rep. Association of Pool & Spa Professionals
(VL to 680)
Randy J. Yasenchak, IBEW Local Union 607, PA [L]
Rep. International Brotherhood of Electrical Workers

Alternates

Dennis L. Baker, Springs & Sons Electrical Contractors Inc., AZ [IM]
(Alt. to Marcos Ramirez)
Rep. Independent Electrical Contractors, Inc.
Ira "Lee" Douglas, Murfreesboro, TN [E]
(Alt. to Donald R. Cook)
Rep. International Association of Electrical Inspectors
E. P. Hamilton, III, E. P. Hamilton & Associates, Inc., TX [M]
(Alt. to Lee L. West)
Rep. Association of Pool & Spa Professionals
(VL to 680)
Brian Myers, IBEW Local Union 98, PA [L]
(Alt. to Randy J. Yasenchak)
Rep. International Brotherhood of Electrical Workers
Stephen C. Richbourg, Gulf Power Company, FL [UT]
(Voting Alt.to ELPG/EEI Rep.)
Rep. Electric Light & Power Group/EEI
Gary L. Siggins, UL LLC, CA [RT]
(Alt. to Thomas V. Blewitt)
Kam Fai Siu, Intertek Testing Services, China [RT]
(Alt. to Ronald F. Schapp)
Marcelo E. Valdes, GE Energy Industrial Solutions, CT [M]
(Alt. to Randal Hunter)
Rep. National Electrical Manufacturers Association
Matt B. Williams, Association of Home Appliance Manufacturers, DC [M]
(Alt. to Wayne E. Morris)
(VL to 422, 424)

Nonvoting

Douglas A. Lee, US Consumer Product Safety Commission, MD [C]
(Alt. to Andrew M. Trotta)
Andrew M. Trotta, US Consumer Product Safety Commission, MD [C]

CODE-MAKING PANEL 18

Articles 406, 410, 411, 600, 605

Bobby J. Gray, *Chair*
Hoydar/Buck, Inc., WA [IM]
Rep. National Electrical Contractors Association

Ron D. Alley, Northern New Mexico IEC, NM [IM]
Rep. Independent Electrical Contractors, Inc.
Frederick L. Carpenter, Acuity Brands Lighting, GA [M]
Rep. National Electrical Manufacturers Association
Kurt J. Clemente, Clark Nexsen Architecture & Engineering, VA [U]
Rep. Institute of Electrical & Electronics Engineers, Inc.
Paul Costello, NECA and IBEW Local 90 JATC, CT [L]
Rep. International Brotherhood of Electrical Workers
Hakim Hasan, Intertek Testing Services, GA [RT]
Lee C. Hewitt, UL LLC, IL [RT]
Melvyn J. Kochan, Young Electric Sign Company, NV [M]
Rep. International Sign Association
(VL to 600)
Amos D. Lowrance, Jr., City of Chattanooga, Tennessee, TN [E]
Rep. International Association of Electrical Inspectors
Michael S. O'Boyle, Philips Lightolier, MA [M]
Rep. American Lighting Association
(VL to 410, 411)
Sondra K. Todd, Westar Energy, Inc., KS [UT]
Rep. Electric Light & Power Group/EEI
Randall K. Wright, RKW Consulting, PA [SE]

Alternates

Donald Berlin, Intermatic Inc., IL [M]
(Alt. to Michael S. O'Boyle)
Rep. American Lighting Association
(VL to 410, 411)
Steve Campolo, Leviton Manufacturing Company, Inc., NY [M]
(Alt. to Frederick L. Carpenter)
Rep. National Electrical Manufacturers Association
Robert T. Carlock, R. T. Carlock Company, TN [IM]
(Alt. to Ron D. Alley)
Rep. Independent Electrical Contractors, Inc.
William S. Dundas, International Sign Association, VA [M]
(Alt. to Melvyn J. Kochan)
Rep. International Sign Association
(VL to 600)
Richard Hollander, City of Tucson, AZ [E]
(Alt. to Amos D. Lowrance, Jr.)
Rep. International Association of Electrical Inspectors
Charles S. Kurten, UL LLC, NY [RT]
(Alt. to Lee C. Hewitt)
Jesse Sprinkle, IBEW Local 461, IL [L]
(Alt. to Paul Costello)
Rep. International Brotherhood of Electrical Workers
Charles M. Trout, Maron Electric Company, FL [IM]
(Alt. to Bobby J. Gray)
Rep. National Electrical Contractors Association

CODE-MAKING PANEL 19

Articles 545, 547, 550, 551, 552, 553, 555,
604, 675, and Annex D, Examples D11 and D12

Leslie Sabin-Mercado, *Chair*
San Diego Gas & Electric Company, CA [UT]
Rep. Electric Light & Power Group/EEI

Barry S. Bauman, Alliant Energy, WI [U]
Rep. American Society of Agricultural & Biological Engineers
Ron B. Chilton, North Carolina Department of Insurance, NC [E]
Rep. International Association of Electrical Inspectors
Timothy Edwards, General Cable/Alcan Cable, GA [M]
Rep. The Aluminum Association, Inc.
Wade Elliott, Utility Services Group, Inc., WA [U]
Rep. National Association of RV Parks & Campgrounds
(VL to 550, 551, 552)
Bruce A. Hopkins, Recreation Vehicle Industry Association, VA [M]
(VL to 550, 551, 552)
David W. Johnson, CenTex IEC, TX [IM]
Rep. Independent Electrical Contractors, Inc.
Thomas R. Lichtenstein, UL LLC, IL [RT]
Timothy P. McNeive, Thomas & Betts Corporation, TN [M]
Rep. National Electrical Manufacturers Association
Ronald Michaelis, South Bend & Vicinity Electrical JATC, IN [L]
Rep. International Brotherhood of Electrical Workers
Doug Mulvaney, Kampgrounds of America, Inc., MT [U]
(VL to 550, 551, 552, 555)
Thomas F. Thierheimer, Britain Electric Company, TX [IM]
Rep. National Electrical Contractors Association
Michael L. Zieman, RADCO, CA [RT]
(VL to 545, 550, 551, 552)
Donald W. Zipse, Zipse Electrical Forensics, LLC, PA [U]
Rep. Institute of Electrical & Electronics Engineers, Inc.

Alternates

Glenn H. Ankenbrand, Delmarva Power, MD [UT]
(Alt. to Leslie Sabin-Mercado)
Rep. Electric Light & Power Group/EEI
Aisha Bajwa, Alcan Cable, a General Cable Company, CA [M]
(Alt. to Timothy Edwards)
Rep. The Aluminum Association, Inc.
William Bruce Bowman, Fox Systems, Inc., GA [IM]
(Alt. to David W. Johnson)
Rep. Independent Electrical Contractors, Inc.
Garry D. Cole, Shelby/Mansfield KOA, OH [U]
(Alt. to Wade Elliott)
Rep. National Association of RV Parks & Campgrounds
(VL to 550, 551, 552)
Chris Fairlee, Kampgrounds of America, Inc., MT [U]
(Alt. to Doug Mulvaney)
(VL to 550, 551, 552, 555)
Robert J. Fick, Alliant Energy, WI [U]
(Alt. to Barry S. Bauman)
Rep. American Society of Agricultural & Biological Engineers
John P. Goodsell, Hubbell Incorporated, CT [M]
(Alt. to Timothy P. McNeive)
Rep. National Electrical Manufacturers Association
Dean C. Hunter, Minnesota Department of Labor & Industry, MN [E]
(Alt. to Ron B. Chilton)
Rep. International Association of Electrical Inspectors
Kent Perkins, Recreation Vehicle Industry Association, VA [M]
(Alt. to Bruce A. Hopkins)
(VL to 550, 551, 552)
Raymond F. Tucker, Consulting Professional Engineer/RADCO, CA [RT]
(Alt. to Michael L. Zieman)
(VL to 545, 550, 551, 552)
Ronald D. Weaver, Jr., North Alabama Electrical JATC, AL [L]
(Alt. to Ronald Michaelis)
Rep. International Brotherhood of Electrical Workers
Eugene W. Wirth, UL LLC, WA [RT]
(Alt. to Thomas R. Lichtenstein)

NFPA Electrical Engineering Division Technical Staff:
William M. Burke, Division Manager
Mark W. Earley, Chief Electrical Engineer
Mark Cloutier, Senior Electrical Engineer
Christopher Coache, Senior Electrical Engineer
Michael Fontaine, Senior Electrical Engineer
Lee Richardson, Senior Electrical Engineer
Richard Roux, Senior Electrical Engineer
Jean Blanc, Associate Electrical Engineer

Committee Scope: This Committee shall have primary responsibility for documents on minimizing the risk of electricity as a source of electric shock and as a potential ignition source of fires and explosions. It shall also be responsible for text to minimize the propagation of fire and explosions due to electrical installations.

These lists represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the front of this book.

This Report on Comments was prepared by the **National Electrical Code Committee**, and documents its action on the comments received on its Report on NFPA 70, **National Electrical Code**, 2014 edition, as published in the Report on Proposals for the 2014 Annual Revision Cycle.

This Report on Comments has been submitted to letter ballot of the **National Electrical Code Committee**. The results of the balloting, after circulation of any negative votes, can be found in the report.

This Report on Comments has also been submitted to the **Technical Correlating Committee on the National Electrical Code®** (TCC) in two Parts. Part 1 is a letter ballot on the TCC Actions, if any; and Part II is a letter ballot Authorizing the Release of The Report. The TCC, which consists of 12 voting members, votes as follows:

Part 1: 12 voted affirmatively

Part 2: 12 voted affirmatively

19-1 Log #379 NEC-P19 **Final Action: Reject**
(Entire Document)

Submitter: David E. Shapiro, Safety First Electric
Comment on Proposal No: 19-2
Recommendation: Revise text to read as follows:
The terms, "adequate" and "adequately" and "inadequately" and "inadequate" should be <u>removed and, if needed, replaced with terms that can be consistently enforced and understood.</u>
Substantiation: I believe that the action on this proposal should be changed to "Accepted," or "Accepted in principle."
Where these terms can be understood to have clear meanings that permit of consistent enforcement it is most likely because the meanings are specified in writing, as in manufacturers' instructions. Section 110.3 addresses this—explicitly with regard to listed or labeled equipment in Section 110.3(B), Where equipment is not listed or labeled, the AHJ does need need to rely on the the presence of these adjectives to fulfill the responsibilities in Section 110.3(A).
Where these terms do not have clear interpretations based on material such as manufacturers' instructions or product standards, Section 110.12 can be applied. The Informational Note, being advisory only, does not restrict the application of Section 110.12's general duty aspect to items listed in ANSI-NECA 1-2006, such as secure, level and plumb mounting.
Panel Meeting Action: Reject
Panel Statement: The submitter has not indicated what term should be used as replacements, he only states that the terms "adequate", "adequately", "inadequately" and "inadequate" should be replaced. The specific identification and use of alternative language needs to be separately substantiated in each case. Also, these terms tend to qualitative and they allow for a qualified person to make judgment calls in the field and, therefore, are acceptable.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

ARTICLE 90 — INTRODUCTION

1-1 Log #1239 NEC-P01 **Final Action: Accept**
(90.1(C))

TCC Action: The Correlating Committee directs the title of 90.1(A) remain "Practical Safeguarding" and the term "Purpose" be removed.
Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 1-3
Recommendation: I support the panel action and request the panel maintain their position.
Panels Action: Delete 90.1(C) in its entirety and revise 90.1(A) as follows: (A) Practical Safeguarding Purpose. The purpose of this Code is the practical safeguarding of persons and property from hazards arising from the use of electricity. This Code is not intended as a design specification or an instruction manual for untrained persons.
Substantiation: The introduction of the code should be positive yet not contain regulations.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-2 Log #1335 NEC-P01 **Final Action: Reject**
(90.2(A)(5))

Submitter: Paul Dobrowsky, Holley, NY
Comment on Proposal No: 1-5
Recommendation: Accept the proposal in principle and add a definition of Premises as follows:
Premises. Property consisting of land, with or without buildings or structures.
Substantiation: During discussions it appeared that different opinions exist regarding whether land without a building or structure would be considered a premises. Section 90.2(A)(1) uses the word "premises" including "buildings, structures, etc. If the term conductor is removed from the definition of "device" and a change for the 2011 NEC removed the word "material" from the definition of "equipment" it is now unclear if conductors are considered equipment. If a property does not have buildings or structures, but does have wiring and "equipment" does the NEC apply? Adding this definition will provide clarity that the NEC applies to property as stated in 90.1(A) that has no buildings or structures but has "wiring". A panel statement indicating if this position it true would be helpful.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 1-17. The proper location for definitions is in Article 100.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-3 Log #289 NEC-P01 **Final Action: Reject**
(90.2(B)(1), Informational Note 2 (New))

Submitter: Robert C. DeLucia, Electrical Inspector
Comment on Proposal No: 1-8
Recommendation: Add an Informational Note as follows:
Informational Note No. 2: <u>*See Article 625 for the installation of equipment and devices related to electric vehicle charging.*</u>
Substantiation: This Public Comment alerts the user as to the requirements necessary for the electric (automotive) vehicle and brings correlation between 90.2(B)(1) and Article 625.
Panel Meeting Action: Reject
Panel Statement: The proposed comment does not improve clarity and is inappropriate for 90.2(B) as electric vehicle supply equipment is covered in 90.2(A).
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-4 Log #1240 NEC-P01 **Final Action: Accept**
(90.2(B)(5))

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 1-11
Recommendation: I support the action taken by the panel and wish the panel to maintain their position.
Substantiation: Utilization equipment and premises wiring comes under the control of the NEC. The utility distribution system is covered by the NESC, Article 90.2(B)(5)(c) of the NEC should reiterate that the NEC does not cover supply wiring by other written agreements under the conditions of this article.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-5 Log #1349 NEC-P01 **Final Action: Reject**
(90.2(B)(5))

Submitter: Louis Barrios, Shell Global Solutions
Comment on Proposal No: 1-9
Recommendation: The committee action should have been Accept in Principle and modify the text so that it is identical to NFPA 70E- 2012.
Substantiation: During the 2012 revision cycle of NFPA 70E, the committee changed the order of 90.2(B)(5) and modified the language in 90.2(B)(5)(b). The content of 90.2(B)(5) in NFPA 70E and the NEC should match.
Panel Meeting Action: Reject
Panel Statement: It is not a requirement that the language of NFPA 70 and 70E, *Standard for Electrical Safety in the Workplace*, match exactly, since the Standards Council approved a change in the scope of the Technical Committee on Electrical Safety in the Workplace in October 2008.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-6 Log #1496 NEC-P01 **Final Action: Reject**
(90.2(B)(6) (New))

Submitter: Lee M. Kraemer, First Solar
Comment on Proposal No: 1-13
Recommendation: Reconsider the rejection of proposal 2933.
Original proposal
(6) Installations of <u>utility scale</u> PV systems under the exclusive control of a~~n~~ ~~electric~~ public<u> or private</u> utility ~~or independent power producer~~, located outdoors or in a building space used exclusively for such installations. Installations must be on property owned or leased by the ~~electric~~ <u>public or private</u> utility ~~or independent power producer,~~ for the purpose of communications, metering, generation, control, transformation, transmission or distribution of electric energy.
Add informational note describing utility scale PV installations as:
<u>Are of the "free field" or "ground mounted" variety. The PV modules are installed in large open spaces and not on roofs of residential, commercial or industrial structures whose primary purpose are for activities other than strictly supporting the PV modules.</u>
<u>The Point of Interconnection or Point of Common Coupling between the PV system and the Utility is at voltage level at or greater than 12 kV.</u>
<u>The Point of Interconnection or Point of Common Coupling between the PV system and the Utility is through dedicated electrical switchgear, substation, switchyard or similar methods whose sole purpose is to safely and effectively interconnect the two systems. Any electrical loads connected to said electrical equipment are only used for power of auxiliary equipment vital to the generation of the PV power.</u>
<u>The access to the power plants is only by Qualified Personnel.</u>
<u>The access to the power plants by the general public is restricted by a continuous locked fencing system consisting of a minimum height of six feet above ground.</u>

Substantiation: Additional Clarification of Proposal 2933 NEC-P01
We are requesting the clear exclusion of utility scale PV (defined below) from the NEC in order to prevent the erroneous interpretation, on the part of AHJs to apply NEC requirements to utility scale PV installations rather than the appropriate NESC code requirements. Inclusion of section 690 (PV Systems) in the NEC could lead an AHJ to the conclusion that all PV systems are within the scope of the NEC when in fact only PV systems that fall under the scope defined in 90.2 are within the jurisdiction of the NEC.
The only other renewable energy source covered by NEC is "Small Wind Power" which is defined as "Wind (turbine) electric systems that consist of one or more wind electric generators with individual generators having up to and including 100 kW". Therefore, precedence has been set to define a size limitation after-which the NEC does not have jurisdiction over power generation systems.

Specific Response to NEC CMB Statements:

• Regardless of technology, equipment under the exclusive control of an electric utility that is presently addressed by 90.2(B)(5) is already excluded from the scope of the NEC.
— First Solar Response – Agree

• Independent Power Producer (IPP) systems are utility interactive systems not under the exclusive control of a utility.
First Solar Response – Rather than "IPP" the term "Private Utility" should have been used in the proposal. Wording has been revised in the suggested new wording above.
– Section 2 of the 2012 NESC defines utilities as "An organization responsible for the engineering and supervision (design, construction, operation, and maintenance) of a public or private supply, communicating, area lighting, street lighting, signal or railroad utility system." And defines a private utility as "an entity that performs or provides one or more utility services to its own facilities…and/or (b) generates or transmits power that is delivered to another utility."
– NESC also defines a Generating Station as – "A plant wherein electrical energy is produced by conversion from some other form of energy, (e.g., chemical, nuclear, solar, mechanical, or hydraulic) by means of suitable apparatus. This includes all generating station auxiliaries and other associated equipment required for the operation of the plant. Not included are stations producing power exclusively for use with communications systems."
• The submitter's contention that "there are no differences in the design, construction or operation of utility and nonutility systems" has not been substantiated.
— First Solar Response – A clear definition of "Utility Scale PV Power Plant" has been provided
– Are of the "free field" or "ground mounted" variety. The PV modules are installed in large open spaces and not on roofs of residential, commercial or industrial structures whose primary purpose are for activities other than strictly supporting the PV modules.
– The Point of Interconnection or Point of Common Coupling between the PV system and the Utility is at voltage level at or greater than 12 kV.
– The Point of Interconnection or Point of Common Coupling between the PV system and the Utility is through dedicated electrical switchgear, substation, switchyard or similar methods whose sole purpose is to safely and effectively interconnect the two systems. Any electrical loads connected to said electrical equipment are only used for power of auxiliary equipment vital to the generation of the PV power.
– The access to the power plants is only by Qualified Personnel.
– The access to the power plants by the general public is restricted by a continuous locked fencing system consisting of a minimum height of six feet above ground.
• Electric utilities are subjected to specific regulations and utilize other specific installation code requirements that have not been addressed by the proposal, and systems owned and operated by a utility are serviced and maintained by qualified personnel
— First Solar Response - Agreed, utilities are subject to NESC which is the appropriate Code for electricity generation.
– Section 011(8). (Scope) of the 2012 NESC states that the code covers "similar systems to those listed above that that are under the exclusive control of qualified persons, and authorized by a regulating or controlling body, including those associated with an industrial complex or utility interactive system."
– Section 2 of the 2012 NESC defines utilities as "An organization responsible for the engineering and supervision (design, construction, operation, and maintenance) of a public or private supply, communicating, area lighting, street lighting, signal or railroad utility system." And defines a private utility as "an entity that performs or provides one or more utility services to its own facilities…and/or (b) generates or transmits power that is delivered to another utility."
• While the substantiation states that all utility grade sites limit access, there is nothing in this proposal to say that these are limited to "utility grade sites", what such a site is, or that access is limited.
— First Solar Response – A clear definition of "Utility Scale PV Power Plant" has been provided above.
Panel Meeting Action: Reject
Panel Statement: Installations, including photovoltaic installations, that do not fall under one of the items in 90.2(B) are under the scope of the NEC regardless of the scale, mounting means, voltage, etc.
The Informational Note to 90.2(B)(4) and (5) gives examples of entities that are considered "utilities" and therefore not under the jurisdiction of the NEC. However, a key point in that note and this discussion is that those entities are subject to regulatory oversight. By removing "utility scale" systems of any type from these requirements without assurances that some type of regulatory oversight is in place also removes the inherent system safety that the regulatory oversight provides. The Submitter's substantiation indicates that the NESC may include this type of installation but it also notes that the NESC Scope states these are "authorized by a regulating or controlling body." No such body is assured or even indicated in the proposed text.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-7 Log #5 NEC-P01 **Final Action: Reject**
(90.2(C))

Submitter: David L. Hittinger, Independent Electrical Contractors of Greater Cincinnati
Comment on Proposal No: 1-15
Recommendation: Revise text to read as follows:
(C) Special Permission. ~~The authority having jurisdiction for enforcing this *Code* may grant exception for the installation of conductors and equipment that are not under the exclusive control of the electric utilities and are used to connect the electric utility supply system to the service conductors of the premises served, provided such installations are outside a building or structure, or terminate inside nearest the point of entrance of the service conductors.~~ <u>By special permission, the authority having jurisdiction may waive specific requirements in this *Code* or permit alternative methods where it is assured that equivalent objectives can be achieved by establishing and maintaining effective safety.</u>
Substantiation: See Proposal 1-15 in the submitter's substantiation that refers to applying 90.4. Revising 90.2(C) to mirror the second paragraph of 90.4 clarifies the intent of what "special permission" is in the Scope of the NEC. The current text is confusing as it reiterates what is not covered in 90.2(B). Revising the Scope to the exact wording found in 90.4 simplifies the Scope and the intent.
Panel Meeting Action: Reject
Panel Statement: This comment removes existing provisions without adequate technical substantiation. The comment removes the recognition and general limitations on lengths of supply conductors that enter a building by special permission of the AHJ.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-8 Log #994 NEC-P01 **Final Action: Reject**
(90.8(B))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 1-19
Recommendation: Revise text to read as follows:
90.8 Wiring Planning.
(B) Number of Circuits in Enclosures. ~~It is elsewhere provided in this *Code* that the number of wires and circuits confined in a single enclosure be varyingly restricted.~~ <u>The number of wires and circuits in a single enclosure is restricted in various ways in other Articles of this *Code*.</u> Limiting the number of circuits in a single enclosure minimizes the effects from a short circuit or ground fault.
Substantiation: 90.8(B) revise first sentence for lucidity:
Panel Meeting Action: Reject
Panel Statement: The existing language is clear. The recommended text does not add clarity or usability.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-9 Log #1111 NEC-P01 **Final Action: Reject**
(90.9)

Submitter: Phil Simmons, Simmons Electrical Services
Comment on Proposal No: 1-20
Recommendation: Revise the existing text of the 2011 NEC as follows:
9**0.9 Units of Measurement**.
(A) Measurement System of Preference. <u>Except as provided in (E), (F) and (G)</u>~~For the purpose of this *Code*~~, metric units of measurement <u>shall be</u> ~~are~~ in accordance with the modernized metric system known as the International System of Units (SI).
(B) Preference Dual System of Units. SI units shall appear first, and inch-pound units shall immediately follow in parentheses. ~~Conversion from inch-pound units to SI units shall be based on hard conversion except as provided in 90.9(C).~~
(C) <u>**Hard Conversion.** Conversion from inch-pound units to SI units shall be based on hard conversion except as provided in (D), (E), (F), and (G).</u>
(D) ~~**Permitted Uses of Soft Conversion.**~~ <u>Where a negative impact on safety</u>

would result, soft conversion shall be used.

~~The cases given in 90.9(C)(1) through (C)(4) shall not be required to use hard conversion and shall be permitted to use soft conversion.~~

(E)(1) Trade Sizes. Where the actual measured size of a product is not the same as the nominal size, trade size designators shall be used rather than dimensions. Trade practices shall be followed in all cases.

(F)~~(2)~~ Extracted Material. Where material is extracted from another standard, the context of the original material shall not be compromised or violated. Any editing of the extracted text shall be confined to making the style consistent with that of the *NEC*.

(G)~~(3)~~ Industry Practice. Where industry practice is to express units in inch-pound units, the inclusion of SI units shall not be required.

~~**(4) Safety. Where a negative impact on safety would result, soft conversion shall be used.**~~

The section will then read as follows:

90.9 Units of Measurement.

(A) Measurement System of Preference. Except as provided in (E), (F) and (G), metric units of measurement shall be in accordance with the modernized metric system known as the International System of Units (SI).

(B) Preference. SI units shall appear first, and inch-pound units shall immediately follow in parentheses.

(C) Hard Conversion. Conversion from inch-pound units to SI units shall be based on hard conversion except as provided in (D), (E), (F), and (G).

(D) Soft Conversion. If a negative impact on safety would result, soft conversion shall be used.

(E) Trade Sizes. Where the actual measured size of a product is not the same as the nominal size, trade size designators shall be used rather than dimensions. Trade practices shall be followed in all cases.

(F) Extracted Material. Where material is extracted from another standard, the context of the original material shall not be compromised or violated. Any editing of the extracted text shall be confined to making the style consistent with that of the NEC.

(G) Industry Practice. Where industry practice is to express units in inch-pound units, the inclusion of SI units shall not be required.

Substantiation: This proposal and comment do not introduce any new material but make improvement in the format and arrangement of the requirements or provisions. Problems with the existing arrangements that are corrected in this proposed re-write include:

1. The requirement that conversion from inch-pound units to SI units shall be based on hard conversion except as provided in 90.9(C) is presently misplaced as a second sentence in (B). This is a major requirement that deserves to be in its own sub-section.

2. The existing subsection (C) is a permissive section stating that the examples shown in (C)(1) through (C)(4) are permitted use of soft conversion which is a more precise conversion than hard conversion. Problems that appear with this concept are as follows:

(a) (C)(1) refers to Trade Sizes and the rule allows Trade Sizes to be used without complying with either the Hard or Soft conversion. These common trade sizes including corresponding Metric Designators are shown in Table 300.1(C). The Informational Note states “Note: The metric designators and trade sizes are for identification purposes only and are not actual dimensions.” So, it is inappropriate for the dialog about Trade Sizes to be under the First Division label “Permitted Uses of Soft Conversion.” The proposal and Comment correct this mis-location.

(b) (C)(2) refers to Extracted Material or material that is extracted from usually another NFPA standard. The rule in (C)(2) requires “the context of the original material shall not be compromised or violated.” The rule does not indicate whether hard or soft conversion is to be used. The rule is presently mis-placed. This is corrected in the Proposal and Comment.

(c) The present (C)(3) refers to Industry Practice. It provides that if “industry practice is to express units in inch-pound units, the inclusion of SI units shall not be required.” This statement has nothing to do with Permitted Use of Soft Conversion and is presently misplaced. This is corrected in the Proposal and Comment.

(d) The present (C)(4) refers to “Safety.” Note that the title of (C) states (C)(1) through (C)(4) are permitted use of soft conversion. However, (C)(4) is a mandatory requirement to use Soft Conversion to avoid a negative impact on safety. This is corrected in the Proposal and Comment.

Panel Meeting Action: Reject

Panel Statement: The second sentence of 90.9(B) is not misplaced. Trade sizes, extracted material and industry practice are permitted uses of soft conversion tabulated in 3.2.7.3 of the NEC Style Manual. The relocation of 90.9(C)(4) is not needed.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

ARTICLE 100 — DEFINITIONS

17-1 Log #920 NEC-P17 **Final Action: Reject**
(100, 422, 518.3(B), 525.23, 600.10(C)(2), and 680)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 17-18a
Recommendation: Revise text to read as follows:

600.10 Portable or Mobile Signs.

(C) Wet or Damp Location.

(2) Ground-Fault Circuit Interrupter. The manufacturer of portable or mobile signs shall provide a listed appliance ground-fault circuit-interrupter protection for personnel. The ground-fault circuit interrupter shall be an integral part of the attachment plug or shall be located in the power-supply cord within 300 mm (12 in.) of the attachment plug. **[ROP 18–108]**

680.33 Luminaires.

(B) Over the Low Voltage Contact Limit But Not over 150 Volts. A lighting assembly without a transformer or power supply and with the luminaire lamp(s) operating at not over 150 volts shall be permitted to be cord-and-plug-connected where the assembly is listed as an assembly for the purpose. The installation shall comply with 680.23(A)(5), and the assembly shall have the following construction features:

(1) No exposed metal parts
(2) An impact-resistant polymeric lens and luminaire body
(3) A ground-fault circuit interrupter with open neutral conductor protection as an integral part of the assembly
(4) The luminaire lamp permanently connected to the listed appliance ground-fault circuit interrupter with open-neutral protection
(5) Compliance with the requirements of 680.23(A)

680.44 Protection. Except as otherwise provided in this section, the outlet(s) that supplies a self-contained spa or hot tub, a packaged spa or hot tub equipment assembly, or a field-assembled spa or hot tub shall be protected by a ground-fault circuit interrupter.

(A) Listed Units. If so marked, a listed self-contained unit or listed packaged equipment assembly that includes integral listed appliance ground-fault circuit-interrupter protection for all electrical parts within the unit or assembly (pumps, air blowers, heaters, lights, controls, sanitizer generators, wiring, and so forth) shall be permitted without additional GFCI protection.

680.62 Therapeutic Tubs (Hydrotherapeutic Tanks).

(A) Protection. Except as otherwise provided in this section, the outlet(s) that supplies a self-contained therapeutic tub or hydrotherapeutic tank, a packaged therapeutic tub or hydrotherapeutic tank, or a field-assembled therapeutic tub or hydrotherapeutic tank shall be protected by a ground-fault circuit interrupter.

(1) Listed Units. If so marked, a listed self-contained unit or listed packaged equipment assembly that includes integral listed appliance ground-fault circuit-interrupter protection for all electrical parts within the unit or assembly (pumps, air blowers, heaters, lights, controls, sanitizer generators, wiring, and so forth) shall be permitted without additional GFCI protection.

Substantiation: I am concerned that existing “portable GFCIs” may not have the 3 properties listed in the definition. I believe these additional properties deserve a more distinctive name.

Portable/cord GFCI appear in other articles and could well need the same level of protection as specified in 422. Suggest that the definition be moved to 100. and referenced in 518.3(B), 525.23, 600.10(C)(2), 680.33(B), 680.44(A), & 680.62(A)(1).

Panel Meeting Action: Reject

Panel Statement: The commenter cites panel proposal 17-18a and seeks to amend 680.33, 680.44, and 680.62. These articles were not part of the original proposal and they make no reference to “portable GFCI’s”, as implied in the commenter’s substantiation. The comment, therefore, represents a new proposal. In addition, the comment proposes a new term, “listed appliance ground-fault circuit-interrupter protection for personnel”, that is not used in the product safety standard (ANSI/UL 943) or on listed devices. Also, the proposed product does not exist. Finally, the substantiation expresses concern that “existing portable GFCIs” may not have the 3 properties listed in the definition.” These properties are applicable to existing listed portable ground-fault circuit-interrupters, per the product safety standard. The suggested language is inconsistent with the existing language in the article.

Number Eligible to Vote: 9

Ballot Results: Affirmative: 9

18-1 Log #920a NEC-P18 **Final Action: Accept in Part**
(100, 422, 518.3(B), 525.23, 600.10(C)(2), and 680)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 17-18a
Recommendation: Revise text to read as follows:

600.10 Portable or Mobile Signs.

(C) Wet or Damp Location.

(2) Ground-Fault Circuit Interrupter. The manufacturer of portable or mobile signs shall provide a listed appliance ground-fault circuit-interrupter protection for personnel. The ground-fault circuit interrupter shall be an integral part of the attachment plug or shall be located in the power-supply cord within 300 mm (12 in.) of the attachment plug. **[ROP 18–108]**

680.33 Luminaires.

(B) Over the Low Voltage Contact Limit But Not over 150 Volts. A lighting assembly without a transformer or power supply and with the luminaire lamp(s) operating at not over 150 volts shall be permitted to be cord-and-plug-connected where the assembly is listed as an assembly for the purpose. The installation shall comply with 680.23(A)(5), and the assembly shall have the following construction features:

(1) No exposed metal parts
(2) An impact-resistant polymeric lens and luminaire body
(3) A ground-fault circuit interrupter with open neutral conductor protection as

an integral part of the assembly
(4) The luminaire lamp permanently connected to the listed appliance ground-fault circuit interrupter with open-neutral protection
(5) Compliance with the requirements of 680.23(A)
680.44 Protection. Except as otherwise provided in this section, the outlet(s) that supplies a self-contained spa or hot tub, a packaged spa or hot tub equipment assembly, or a field-assembled spa or hot tub shall be protected by a ground-fault circuit interrupter.
(A) Listed Units. If so marked, a listed self-contained unit or listed packaged equipment assembly that includes integral listed appliance ground-fault circuit-interrupter protection for all electrical parts within the unit or assembly (pumps, air blowers, heaters, lights, controls, sanitizer generators, wiring, and so forth) shall be permitted without additional GFCI protection.
680.62 Therapeutic Tubs (Hydrotherapeutic Tanks).
(A) Protection. Except as otherwise provided in this section, the outlet(s) that supplies a self-contained therapeutic tub or hydrotherapeutic tank, a packaged therapeutic tub or hydrotherapeutic tank, or a field-assembled therapeutic tub or hydrotherapeutic tank shall be protected by a ground-fault circuit interrupter.
(1) Listed Units. If so marked, a listed self-contained unit or listed packaged equipment assembly that includes integral listed appliance ground-fault circuit-interrupter protection for all electrical parts within the unit or assembly (pumps, air blowers, heaters, lights, controls, sanitizer generators, wiring, and so forth) shall be permitted without additional GFCI protection.
Substantiation: I am concerned that existing "portable GFCIs" may not have the 3 properties listed in the definition. I believe these additional properties deserve a more distinctive name.
Portable/cord GFCI appear in other articles and could well need the same level of protection as specified in 422. Suggest that the definition be moved to 100 and referenced in 518.3(B), 525.23, 600.10(C)(2), 680.33(B), 680.44(A), & 680.62(A)(1).
Panel Meeting Action: Accept in Part
Accept only the words "a listed" in 600.10(C)(2).
Panel Statement: A Listed GFCI in the plug cap or within 12 inches of the plug would by definition (UL-943) be a portable GFCI and contain open neutral features. There is no defined appliance GFCI in the UL-943 standard. This meets the intent of the submitter.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

1-10 Log #18 NEC-P01 **Final Action: Accept**
(100 Scope and Part II)

TCC Action: The Correlating Committee advises that Article Scope Statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the panel action. The Correlating Committee directs that the last sentence of the Part 1 Article Scope and the first paragraph of Part II be revised to read as follows to better correlate:
Part II contains definitions applicable only to articles and parts of articles specifically covering installations and equipment operating at over 600 volts, nominal.
II. Over 600 Volts, Nominal
The definitions in Part I are intended to apply wherever the terms are used throughout this Code, the definitions in Part II are applicable only to articles and parts of articles specifically covering installations and equipment operating at over 600 volts, nominal.
Submitter: Technical Correlating Committee on National Electrical Code®,
Comment on Proposal No: 1-72
Recommendation: The Correlating Committee advises that Article Scope statements are the responsibility of the Correlating Committee and the Correlating Committee Rejects the panel action.
The Correlating Committee directs that the panel clarify the panel action on this proposal since the recommended text in this proposal, in the first paragraph of the proposed text, does not have a proposed destination and the second paragraph appears to be inserted into Part II of Article 100. However, it deals with under 600 volts as well as over 600 volts.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the direction of the TCC and continues to accept Proposal 1-72 and clarifies its action as follows:
The first recommendation in Proposal 1-72 revises the second sentence of the second paragraph of the Scope of Article 100 in the 2011 NEC by adding "articles and" to precede "parts of articles".
The second recommendation in Proposal 1-72 is intended to revise the opening statement of Part II of Article 100 in the 2011 NEC, which will read as follows:
II. Over 600 Volts, Nominal
The definitions in Part I are intended to apply wherever the terms are used throughout this Code, the definitions in Part II are applicable only to articles and parts of the articles specifically covering installations and equipment operating at over 600 volts, nominal.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-11 Log #393 NEC-P01 **Final Action: Accept**
(100, Part I Scope)

Submitter: Thomas L. Adams, Macomb, IL
Comment on Proposal No: 1-70
Recommendation: Continue to reject the Proposal.
Substantiation: A review and comparison of the present text of Part I of Article 100 with OSHA 1926 shows the OSHA document breaks at 600 Volts. Changing the Scope of Article 100, Part I will create a conflict between the two documents causing voltages from 600 Volts to 1000 Volts to be in violation of OSHA requirements. In addition, a Note within the OSHA document states that "If the electrical installation is made in accordance with the National Electrical Code ANSI/NFPA 70-1984, exclusive of Formal Interpretations and Tentative Interim Amendments, it will be deemed to be in compliance with 1926.403 through 1926.408, except for 1926.404(b)(1) and 1926.405(a)(2)(ii)(E), (F), (G), and (J)." This would further conflict with the proposed text without significant amendment.
Panel Meeting Action: Accept
Panel Statement: A joint task group appointed by the Correlating Committee consisting of representatives from HVTG, CMP 1 and CMP 8 reviewed proposals rejected by CMP 1 and CMP 8 related to replacing 600V to 1000V. The joint task group concluded that neither the joint task group nor the High Voltage Task Group has the necessary background research to further justify technical substantiation for the rejected proposals. Such substantiation would likely need to come from entities such as the manufacturers or the NFPA Research Foundation. The joint task group recommended that CMP 1 and CMP 8 not change the original actions taken during the 2014 proposal stage. In addition, the panel does not necessarily agree with all of all the substantiation for the comment.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-12 Log #1241 NEC-P01 **Final Action: Accept**
(100, Part II)

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 1-70
Recommendation: Continue to reject this proposal which would change 600 volts to 1000 volts.
Substantiation: Replacing 600 volts with 1000 volts will have a major impact on installers, component manufacturers, and industry standards. Increased spacing must be considered when going from 600 volts to 1000 volts. Personal safety must also be considered.
Because the proposer has not provided enough information to the public to justify and understand all the ramifications of the proposal, the committee should continue to reject the submitter's proposal.
Panel Meeting Action: Accept
Panel Statement: A joint task group appointed by the Correlating Committee consisting of representatives from HVTG, CMP 1 and CMP 8 reviewed proposals rejected by CMP 1 and CMP 8 related to replacing 600V to 1000V. The joint task group concluded that neither the joint task group nor the High Voltage Task Group has the necessary background research to further justify technical substantiation for the rejected proposals. Such substantiation would likely need to come from entities such as the manufacturers or the NFPA Research Foundation. The joint task group recommended that CMP 1 and CMP 8 not change the original actions taken during the 2014 proposal stage. In addition, the panel does not necessarily agree with all of all the substantiation for the comment.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-13 Log #4 NEC-P01 **Final Action: Accept in Principle**
(100.Accessible, Readily)

Submitter: Palmer Hickman, Upper Marlboro, MD
Comment on Proposal No: 1-24
Recommendation: Revise text to read as follows:
Accessible, Readily (Readily Accessible). Capable of being reached quickly for operation, renewal, or inspections without requiring those to whom ready access is requisite to use tools, to climb over or remove obstacles, or to resort to portable ladders, and so forth.
Substantiation: This is an editorial revision of Proposal 1-24. The need to use a tool to reach something for operation, renewal, or inspection may make it accessible, but not necessarily readily accessible as substantiated in Proposal 1-24. The need to use a tool, even one as simple as a screw driver, would add another level of action that would impede or delay access.
Panel Meeting Action: Accept in Principle
Revise text to read as follows:
Accessible, Readily (Readily Accessible). Capable of being reached quickly for operation, renewal, or inspections without requiring those to whom ready access is requisite to actions such as; to use tools, to climb over or remove obstacles, or to resort to portable ladders, and so forth.
Panel Statement: Editorial. Revise the text as follows: add the words "to actions such as" after the word "requisite" and before the words "to use tools"

Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:

BARRIOS, L.: The term "readily accessible" is used in multiple articles in the NEC under the jurisdiction of multiple code making panels. CMP-1 rejected proposal 1-24, which proposed to add the phrase "use tools", stating that "a significant change in the definition... may create unintended consequences throughout the Code". Because the panel rejected this proposal, the other code making panels did not get the opportunity to comment on how this change may impact their intended use of the term. During the ROC stage, CMP1 reversed its decision and accepted the addition of "use tools". At this stage, the other code making panels do not get the opportunity to comment on how this change will impact the usage of the term. Therefore, the proper action on this comment should be to Reject.

LABRAKE, JR., N.: Adding "tools" as an obstruction would also include "keys" which is not the intent of this requirement. Also, the Panel's addition of "to use tools" in the definition in Article 100 can cause correlation issues in other sections of the Code such as 230.72(C).

Comment on Affirmative:

BOYCE, K.: The change associated with Comment 1-13 is significant and the need to eliminate the use of any form of tool has not been fully substantiated as it relates to being 'capable of being reached quickly.' This modification may have significant impact throughout the NEC as it relates to the use of the term "readily accessible", and the other Code Panels will not have the benefit of fully analyzing and understanding the implications of this impact. The change will be expected to require considerable product redesign without a clearly defined benefit based on today's practices. It may also require placement of switches and the like in locations where they are subject to nuisance actuation that may lead to other, new problems due to this modified placement.

11-1 Log #802 NEC-P11 **Final Action: Reject**
(100.Adjustable Speed Drive, Adjustable Speed Drive System)

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 11-75
Recommendation: I support assigning the definitions for "Adjustable Speed Drive" and "Adjustable Speed Systems" to Article 100. I do not support the reworked definitions. Return the definitions to the original language used in Section 430.2 of the 2011 NEC to read as follows:
Adjustable Speed Drive. A combination of the power converter, motor, and motor-mounted auxiliary devices such as encoders, tachometers, thermal switches and detectors. air blowers, heaters, and vibration sensors.

Adjustable Speed Drive System. An interconnected combination of equipment that provides a means of adjusting the speed of a mechanical load coupled to a motor. A drive system typically consists of an adjustable speed drive and auxiliary electrical apparatus.
Substantiation: The reworked definitions are incomplete and do not add clarity. Furthermore, these definitions were revised without substantiation. The proposed definition for an "Adjustable Speed Drive System" is very broad and might even include mechanical systems that should not be included in the NEC. The proposed broad definition is so broad that it would include Ward-Leonard systems, or a water wheel driving an alternator. As proposed, it is not particularly useful.

There was no field evidence provided that indicated the existing definitions were not adequate nor that the existing definitions resulted in any field problems.

The current definition for "Adjustable Speed Drive System" that is used in the 2011 NEC, Section 430.2, is the same definition found in IEEE P1 566, Standard for Performance of Adjustable Speed AC Drives Rated 375 kW and Larger.
Changing these definitions could create confusion and application errors in the field due to the broad definition. The difference in this definition and the IEEE P1566 definition is an example of the confusion that will be created.
Panel Meeting Action: Reject
Panel Statement: The definitions in Proposal 11-75 as accepted and revised by CMP 11 provide a more concise and accurate description. It is the panel's intent that the definitions remain in Article 100 but remain under the purview of CMP 11.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-1 Log #916 NEC-P15 **Final Action: Reject**
(100.Alternate Power Source, 517.2, and 551.31)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 15-3
Recommendation: Revise text to read as follows:
100 I
Alternate Power Source. One or more generator sets, or battery systems where permitted, intended to provide power during the interruption of the normal electrical services or the public utility electrical service intended to provide power during interruption of service normally provided by the generating facilities on the premises.
517.2~~**Alternate Power Source.** One or more generator sets, or battery systems where permitted, intended to provide power during the interruption of the normal electrical services or the public utility electrical service intended to provide power during interruption of service normally provided by the generating facilities on the premises.~~
551.31 Multiple Supply Sources.(A) Multiple Supply Sources. Where a multiple supply system consisting of ~~an alternate~~ a secondary power source and a power-supply cord is installed, the feeder from the ~~alternate~~ secondary power source shall be protected by an overcurrent protective device. Installation shall be in accordance with 551.30(A), 551.30(B), and 551.40.
(C) ~~Alternate~~ Secondary Power Sources Exceeding 30 Amperes. If ~~an alternate~~ a secondary power source...".
Substantiation: The term *Alternate Power Source* is used in: section 517, section 551, 695.4(B)(3)(b), 700.4(B), 700.7(B), 701.4, 701.7(B), 702.2 <info fig>, 702.7(B), 708.2 <info fig>, 708.21, 708.22(A,B&C), and 750.20.
In all cases except 551.31 it appears to have the meaning found presently in 517.2. The TCC objected to moving the definition to 100 I because of conflicting usages. I believe that changing the term to *Secondary Power Sources* in 551.31 would allow the 517.2 definition to apply to all other usages and would then belong in 100 I as originally proposed. Another adjective rather than *Secondary* may be better. As it stands in the 2011 code we are using the same phrase for two meanings that can lead to confusion.
NEC Style Manual: 2.2.2.1 Article 100. In general, Article 100 shall contain definitions of terms that appear in two or more other articles of the *NEC*.
Panel Meeting Action: Reject
Panel Statement: In accordance with the direction of the correlating committee on Proposal 15-3 this definition should reside only in 517.2. Removing the definition from 517.2 and moving it to Article 100 with the changes indicated in the comment will lead to confusion of code users. The meaning of the term as used in the other cited NEC sections is different than that used in health care installations. The panel notes that this is extracted material from NFPA 99 and should be referenced as such. [99: 3.3.5].
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

9-1 Log #471 NEC-P09 **Final Action: Accept**
(100.Askarel)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 9-3
Recommendation: Revise text to read as follows:
Askarel. A generic term for a group of nonflammable synthetic chlorinated hydrocarbons used as electrical insulating media. ~~Askarels of various compositional types are used. Under arcing conditions, the gases produced, while consisting predominantly of noncombustible hydrogen chloride, can include varying amounts of combustible gases, depending on the askarel type.~~
Informational Note: Askarels of various compositional types are used. Under arcing conditions, the gases produced, while consisting predominantly of noncombustible hydrogen chloride, can include varying amounts of combustible gases, depending on the askarel type.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term and the NEC manual of style does not permit the definition to contain the defined term. Definitions are not requirements. Moreover, the definition also contains a list that is simply informational. The proposed changes eliminate the defined term. If the CMP believes that this information is a requirement it should place it somewhere else, perhaps within Article 450.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

5-1 Log #1144 NEC-P05 **Final Action: Reject**
(100.Bonding Jumper; Bonding Jumper, Main; Grounding Conductor, Equipment and Informational Note No 1 and 3; Bonding Jumper, System; and Separately Derived System)

Submitter: Paul Dobrowsky, American Chemistry Council
Comment on Proposal No: 5-3
Recommendation: The proposal should have been accepted.
Substantiation: The term Equipment Grounding Conductor needs to be replaced. Those opposed have no technical reason for their opposition or any other valid reason. It is not worth the effort and everyone understands what is meant are common responses.

It is very simple: Grounding electrode conductors are the connection to the earth and accomplish grounding. In the present NEC, Equipment Grounding Conductors and bonding jumpers provide a "path back" to the source. Both are always performing a bonding function. If the Grounding Electrode connection is removed or broken, the bonding function remains intact.

Section 250.4 does not permit the earth (ground) to be used as an effective ground fault current path but the term equipment grounding conductor inherently incorrectly contains the word "ground".

Visualize equipment supplied by a portable generator. The generator frame is not required to be connected to the earth. The "green" wire in the flexible cord is not performing a grounding function but is performing a bonding function.

Visualize building one supplied by a service, having the grounded conductor connected to the grounding electrode system by a grounding electrode conductor. A feeder supplies a second building and a grounding electrode conductor is required for grounding any equipment in the second building. An equipment grounding conductor is required to be installed from building 1 to building 2. Not for grounding, but for bonding, providing an effective fault current path.

Making this change has the added benefit of being more harmonized with other international standards and usage of terminology.

Experienced NEC users have to ignore other concepts in other definitions and requirements to use the existing term. This does not help the future NEC user or provide clarity in the existing NEC. Changing the term is the right thing to do and should be supported.

Panel Meeting Action: Reject

Panel Statement: The term "Equipment Grounding Conductor" is a significant and necessary term in the NEC. The substantiation does not provide documentation of any safety problem created for the electrical industry, or other users of the NEC, by the use of the term "equipment grounding conductor". It would be an unnecessary burden on the electrical industry to make such a significant change with no expected improvement in safety.

The Panel has long recognized that the equipment grounding conductor performs both a grounding and a bonding function. See the definition of Equipment Grounding Conductor in Article 100 along with Informational Note 1 that follows. The definition of "Equipment Grounding Conductor" was revised in proposal 5-14a to recognize that the conductor also provides the fault current path for ground faults. It should be noted that it has long been recognized that the Equipment Grounding Conductor provides the path for ground fault current but the definition needed to be changed to be accurate. The connection to earth is made by the grounding electrode. The grounding electrode conductor extends the earth connection to service equipment or separately derived systems. The equipment grounding conductor both extends the earth connection and bonds equipment together.

It would be inaccurate and confusing to change Equipment Grounding Conductor to Equipment Bonding Conductor since there is no definition of Equipment Bonding Conductor in Article 100. The definition of Bonding Conductor or Jumper indicates the conductor connects equipment together. There is no indication in this definition of extending the earth connection. This distinction is important to new as well as seasoned users of the NEC.

In addition, a change of this magnitude cannot be made to only a portion of the Articles where the terms are used. No proposal was made for not less than 47 of the Articles where the term Equipment Grounding Conductor is used.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 13 Negative: 3

Explanation of Negative:

DOBROWSKY, P.: The term "equipment grounding conductor" needs to be replaced with "equipment bonding conductor" throughout the NEC. Yes, the term equipment grounding conductor in Article 100 would need to be changed to the term equipment bonding conductor.

Some have argued that it is just a problem of education. Having the word "grounding" in a term describing conductor that is used primarily for a bonding function is not a problem to be solved by education.

The use of the term "equipment grounding conductor" is confusing both for those new to the electrical industry and even for some experienced users. The problem is compounded when dealing with other international standards.

No technical reason has been provided for not making the change. This conductor always provides a bonding function but does not always provide a grounding function such as in the case of a portable generator installed as a separately derived system.

MOHLA, D.: The comment should have been accepted.

Those opposed to the proposed change have not considered the pertinent substantiation in the proposal 5-3. In that substantiation, it was pointed out that "bonding" and "grounding" have distinct and different meanings. The Panel recognizes that the present term, "equipment grounding conductor", performs a bonding function. However, the revised definition of equipment grounding conductor in Proposal 5-14a indicates that the conductor is for the purpose of carrying ground-fault current even though ground-fault current does not travel principally to ground but, rather, to the source. Thus the use of the terms "equipment grounding conductor" and "ground fault current" erroneously imply that this fault current is intended to flow to ground. How wrong can we be!! Section 250.4(A) (5) specifically prohibits considering the ground as a viable path for current flow.

Additionally, there is a misconception that bonding equipment conductor to the grounded conductor will limit the voltage at the fault location and make the equipment safe. In fact, when fault current travels through the bonding conductor to the source where the virtual connection to ground occurs, the voltage at the fault location (for a grounded system), with respect to ground, is more than half of the supply voltage (voltage division due to the voltage drops in the supply conductor impedance and the bonding conductor impedance).

An appropriate term for the present equipment grounding conductor is necessary but that term should reflect the function of the conductor. Why do we use the term "bonding jumper" or "supply side bonding jumper" when these conductors are part of the same path from the faulted equipment to the source of the current? To be consistent, should not these jumpers be called "grounding" jumpers?

The Panel correctly questions that no safety connection has been documented. Documentation of this type will never be available since it would be rare for a connection of equipment to ground instead of to the source be identified as the proximate cause of an injury. Further, it would be rare to have data on the number of installations that are improperly installed - a condition that is difficult, but not impossible, for an inspector to identify. We simply do not know the extent of injuries that are waiting to happen due to improper bonding to ground instead of to the source.

The Panel indicated that it would be a "burden" on the electrical industry. The burden is a documentation issue that need not be corrected all at once. As documents from UL, NEMA, IAEI, and others are revised, the appropriate terms can then be updated. The immediate effect would be in the training of electricians. As pointed out in a previous proposal substantiation, questions raised at inspectors' forums and at Code classes are a good indication that there are many in the industry that do not fully understand the separate purposes of bonding and of grounding. The Code Panel members understand the distinction as do the large majority of qualified practitioners. This proposed change will not affect those that understand the principles of bonding and grounding but make it easier to understand for those who need to learn the proper installation methods for a safer installation.

Changes in terminology were intentionally submitted only for Chapters 1 through 4. Because the remaining chapters are very specific for special, rather than general, installations, coordination with the new terminology should be made by the appropriate Code Panels who have the expertise necessary to determine if "bonding" or "grounding" should be the operative term.

WILLIAMS, D.: The panel is gaining support for changing the term to bonding verses grounding. The concept of changing the term equipment grounding conductor to equipment bonding conductor is the right thing to do for the electrical industry. The terms in Article 250 should be reflected in their definition. We only ground (for the most part) at the service and everything after the service is bonding back to the service to complete the effective ground-fault current path. When people are explaining what an equipment grounding conductor does, you can't explain it properly without describing it as a bonding conductor. The definition should also include that the equipment bonding conductor provides the effective ground-fault current path for the feeder or branch circuit. I am voting for making the change to equipment bonding conductor knowing there are additional changes needed in this definition. I do agree with the panel that at the ROC stage is not the proper time to make all the changes necessary.

Comment on Affirmative:

PORTER, C.: I do not think replacing the term Equipment Grounding Conductor with the term Equipment Bonding Conductor works because the new term would not reflect the function of limiting the voltage on equipment and materials that the existing term has. I do believe the revised definition of the EGC does help to address some of the concern the submitter has. The discussion about this grounding and bonding conductor deserves to continue in hopes of providing a better term and a better understanding of the term.

5-2 Log #1278 NEC-P05 **Final Action: Reject**

(100.Bonding Jumper; Bonding Jumper, Main; Grounding Conductor, Equipment and Informational Note No 1 and 3; Bonding Jumper, System; and Separately Derived System)

Submitter: Elliot Rappaport, Electro Technology Consultants

Comment on Proposal No: 5-3

Recommendation: Accept proposal.

Substantiation: The Panel is correct in referencing 250.4(A) and (B). 250.4(A)(1) correctly defines system grounding. 250.4(A)(3), (4), and (5) are reasonable definitions for bonding although (3) and (4) are so similar that they might be combined (not part of this proposal). 250.4(A)(2) erroneously implies that a connection to earth will "limit the voltage to ground". Thus, it may be inferred by some, incorrectly, that connection to ground, per se, will make the system "safer".

The term "equipment grounding conductor" has a definite purpose that is not uniquely expressed in the term, i.e. "bond the equipment to a terminal at the source of voltage". As a result, there is a misconception that "grounding", without bonding to the source, will make a system safe. On the contrary, connecting equipment to ground without providing the bonding connection back to the source can make equipment less safe by increasing the time to clear the fault.

Since the "earth shall not be considered as an effective ground-fault path", and the ground fault current must return to the source to allow an overcurrent device to operate, the earth cannot and should not be depended upon to complete the path to the source in order to trip the overcurrent device quickly.

Renaming this conductor as an "Equipment Bonding Conductor (EBC)" will clarify that the primary purpose of this conductor is to bond to the source in order to provide a known path for ground fault current that will facilitate rapid fault clearing.

It is recognized that the term "EGC" has been in use for a long time and that changing it to EBC will cause some concerns including changing written literature that uses the EGC term. After the initial period of understanding, users will correctly understand the purpose of this conductor and this will enhance the safety of personnel.

The fundamental purpose of this and companion proposals is to clearly state that "systems" are "grounded" and "equipment" is "bonded". The fact that the bonding conductor may be grounded also is secondary to the primary function of bonding.

Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 5-1.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 13 Negative: 3
Explanation of Negative:
DOBROWSKY, P.: See my negative ballot comment on 5-1.
MOHLA, D.: See my explanation of negative vote on Comment 5-1.
WILLIAMS, D.: See my negative vote substantiation written for Comment 5-1
Comment on Affirmative:
PORTER, C.: See my statement in comment 5-1.

8-1 Log #268 NEC-P08 **Final Action: Accept**
(100.Cable Routing Assembly)

Submitter: Code-Making Panel 16,
Comment on Proposal No: 8-5
Recommendation: Continue to Reject Proposal 8-5.
Substantiation: Proposal 8-5 was referred to CMP 16 for comment by the TCC. A Task Group to review Proposal 8-5 for comment was appointed by CMP16 Chairman Tom Moore. It was the recommendation of the CMP 16 task group that CMP 16 support the CMP 8 panel meeting action to Reject Proposal 8-5. The submitter of Proposal 8-5 wanted to add new definition of Cable Routing Assembly to Article 100.
Proposal 16-3a included the same recommendation by the same submitter as Proposal 8-5. CMP 16 Rejected Proposal 16-3a with a panel statement indicating that cable routing assemblies are not intended for use with power wiring. Placing the definition in Article 100 may lead to confusion concerning the applications of cable routing assemblies. In this case, it is clearer to have the definition closely associated with the applicable articles.
The Task Group members were:
Harry Ohde, Chair, representing: IBEW
George Bish, representing Satellite Broadcasting & Communications Association
Randy Ivans representing Underwriters Laboratories Inc.
Steve Johnson representing National Cable & Communications Association
This comment was developed by a CMP-16 Task Group and balloted through the entire panel with the following ballot results:
16 Eligible to vote
14 Affirmative
2 Ballots Not Returned (D. Ballast and W.F. Murphy)
No Comments on Vote were received
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

16-1 Log #321 NEC-P16 **Final Action: Accept**
(100.Cable Routing Assembly)

TCC Action: See the Correlating Committee action on Comment 16-5 which relocates the definition of "Cable Routing Assembly" to Article 100.
Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 16-3a
Recommendation: Continue to reject proposals 16-3a and 16-4.
Substantiation: The Communications Cable and Connectivity Association supports the panel's action to reject these proposals. Including the definition of cable routing assemblies in Article 100 could give the impression that cable routing assemblies are suitable for electric light and power wiring. They are not listed for use with electric light and power wiring.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

3-1 Log #937 NEC-P03 **Final Action: Accept in Principle in Part**
(100.Cable Routing Assembly, 725.2, 760.2, 770.2, and 800.2)

TCC Action: See the Correlating Committee action on Comment 16-5 which relocates the definition of "Cable Routing Assembly" to Article 100.
Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 3-118
Recommendation: Revise text to read as follows:
100 Definitions.
<u>**Cable Routing Assembly.** A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support, route and protect high densities of wires and cables, typically communications wires and cables, optical fiber and data (Class 2 and Class 3) cables associated with information technology and communications equipment.</u>
725.2 Definitions.
~~**Cable Routing Assembly.** A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support and route conductors and cables. **[ROP 3–118]**~~
760.2 Definitions.
~~**Cable Routing Assembly.** A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support and route conductors and cables. **[ROP 3–171]**~~
770.2 Definitions.
~~**Cable Routing Assembly.** A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support, route and protect high densities of wires and cables, typically communications wires and cables, optical fiber and data (Class 2 and Class 3) cables associated with information technology and communications equipment.~~
800.2 Definitions.
~~**Cable Routing Assembly** A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support, route and protect high densities of wires and cables, typically communications wires and cables, optical fiber and data (Class 2 and Class 3) cables associated with information technology and communications equipment. **[ROP 16–23]**~~
Substantiation: The term *Cable Routing Assembly* is used in articles 725, 760, 770, 800, 820, and 830.
A term used in multiple articles should be defined in article 100. This is the place readers expect to find such definitions.
The term *Cable Routing Assembl*y is currently defined in 725.2, 760.2, 770.2, and 800.2. There are two different definitions for the same term. This leads to confusion. Defining a term in multiple places can easily lead to different definitions.
800.2 [820.2 830.2] Definitions. See Part I of Article 100. For the purposes of this article, the following additional definitions apply. **[ROP 16–82]**
725, 760, & 770 automatically inherits definitions from 100.
800, 820, & 830 have added a reference to definitions from 100.
[Staff Note: This comment has also been submitted to Panel 3 and Panel 16 for action.]
Panel Meeting Action: Accept in Principle in Part
Panel Statement: See the panel action and statement on Comment 3-2, which addresses the same issue.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13
Comment on Affirmative:
KAHN, S.: Technically, I agree with the panel action. Upon reflection, however, I note that Chapter 8 is a "stand alone" chapter and only specific references to Chapters 1-7 are applicable in that Chapter. Acceptance of the proposal as modified by the Comment applies a definition appearing in Chapter 7 and be referenced in Chapter 8.
STENE, S.: See my affirmative comment on Comment 3-2.

8-2 Log #310 NEC-P08 **Final Action: Accept**
(100.Cable Routing Assembly)

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 8-5
Recommendation: Continue to reject proposal 8-5.
Substantiation: The Communications Cable and Connectivity Association supports the panel's action to reject this proposal. Including the definition of cable routing assemblies in Article 100 could give the impression that cable routing assemblies are suitable for electric light and power wiring. They are not listed for use with electric light and power wiring.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

3-2 Log #937a NEC-P03 **Final Action: Accept in Principle in Part**
(100.Cable Routing Assembly, 725.2, 760.2, 770.2, and 800.2)

TCC Action: See the Correlating Committee action on Comment 16-5 which relocates the definition of "Cable Routing Assembly" to Article 100.
Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 3-118
Recommendation: Revise text to read as follows:
100 Definitions.
<u>**Cable Routing Assembly.** A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support, route and protect high densities of wires and cables, typically communications wires and cables, optical fiber and data (Class 2 and Class 3) cables associated with information technology and communications equipment.</u>
725.2 Definitions.
~~**Cable Routing Assembly.** A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support and route conductors and cables. **[ROP 3–118]**~~
760.2 Definitions.
~~**Cable Routing Assembly.** A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support~~

~~and route conductors and cables. **[ROP 3–171]**~~

770.2 Definitions.

~~**Cable Routing Assembly.** A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support, route and protect high densities of wires and cables, typically communications wires and cables, optical fiber and data (Class 2 and Class 3) cables associated with information technology and communications equipment.~~

800.2 Definitions.

~~**Cable Routing Assembly** A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support, route and protect high densities of wires and cables, typically communications wires and cables, optical fiber and data (Class 2 and Class 3) cables associated with information technology and communications equipment. **[ROP 16–23]**~~

Substantiation: The term *Cable Routing Assembly* is used in articles 725, 760, 770, 800, 820, and 830.

A term used in multiple articles should be defined in article 100. This is the place readers expect to find such definitions.

The term *Cable Routing Assembl*y is currently defined in 725.2, 760.2, 770.2, and 800.2. There are two different definitions for the same term. This leads to confusion. Defining a term in multiple places can easily lead to different definitions.

800.2 [820.2 830.2] Definitions. See Part I of Article 100. For the purposes of this article, the following additional definitions apply. **[ROP 16–82]**

725, 760, & 770 automatically inherits definitions from 100.

800, 820, & 830 have added a reference to definitions from 100.

[Staff Note: This comment has also been submitted to Panel 1 and Panel 16 for action.]

Panel Meeting Action: Accept in Principle in Part

Panel Statement: Refer to the action on Comments 3-41 and 3-88.

The panel agrees with the deletion of the definitions from 725.2, and 760.2 and now refers to the definition in 800.2 through the action on Comment 3-41.

The panel rejects placement of the definition in Article 100 based on direction from the correlating committee shown in Proposal 3-118.

The panel does not take action regarding 770.2 and 800.2 because they are not within the panel's scope.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

Comment on Affirmative:

KAHN, S.: See my Explanation of Affirmative with Comment on Comment no. 3-1.

STENE, S.: The Correlating Committee should direct Panel 16 to locate this definition in Article 100 since it appears in more than one article and there is no technical or compelling reason to have the definition located in Article 800.

16-2 Log #937b NEC-P16 **Final Action: Reject**

(100.Cable Routing Assembly, 725.2, 760.2, 770.2, and 800.2)

TCC Action: See the Correlating Committee action on Comment 16-5 which relocates the definition of "Cable Routing Assembly" to Article 100.

Submitter: James F. Williams, Fairmont, WV

Comment on Proposal No: 16-23

Recommendation: Revise text to read as follows:

100 Definitions.

<u>**Cable Routing Assembly.** A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support, route and protect high densities of wires and cables, typically communications wires and cables, optical fiber and data (Class 2 and Class 3) cables associated with information technology and communications equipment.</u>

725.2 Definitions.

~~**Cable Routing Assembly.** A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support and route conductors and cables. **[ROP 3–118]**~~

760.2 Definitions.

~~**Cable Routing Assembly.** A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support and route conductors and cables. **[ROP 3–171]**~~

770.2 Definitions.

~~**Cable Routing Assembly.** A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support, route and protect high densities of wires and cables, typically communications wires and cables, optical fiber and data (Class 2 and Class 3) cables associated with information technology and communications equipment.~~

800.2 Definitions.

~~**Cable Routing Assembly** A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support, route and protect high densities of wires and cables, typically communications wires and cables, optical fiber and data (Class 2 and Class 3) cables associated with information technology and communications equipment. **[ROP 16–23]**~~

Substantiation: The term *Cable Routing Assembly* is used in articles 725, 760, 770, 800, 820, and 830.

A term used in multiple articles should be defined in article 100. This is the place readers expect to find such definitions.

The term *Cable Routing Assembl*y is currently defined in 725.2, 760.2, 770.2, and 800.2. There are two different definitions for the same term. This leads to confusion. Defining a term in multiple places can easily lead to different definitions.

800.2 [820.2 830.2] Definitions. See Part I of Article 100. For the purposes of this article, the following additional definitions apply. **[ROP 16–82]**

725, 760, & 770 automatically inherits definitions from 100.

800, 820, & 830 have added a reference to definitions from 100.

[Staff Note: This comment has also been submitted to Panel 1 and Panel 3 for action.]

Panel Meeting Action: Reject

Panel Statement: The Correlating Committee has suggested that the definition of "Cable Routing Assembly" be located in a single article of Chapter 8. See Correlating Committee note to Proposals 3-118, and 3-171, and the April 23-27, 2012 Correlating Committee Meeting Minutes CMP 3 Minute Item suggesting "…that 800.2 may be the most appropriate location for the definition." Further, cable routing assemblies are not intended for use with power wiring and the panel continues to be concerned that placing the definition in Article 100 may lead to confusion regarding the application of cable routing assemblies.

Number Eligible to Vote: 18

Ballot Results: Affirmative: 17

Ballot Not Returned: 1 Ballast, D.

16-3 Log #322 NEC-P16 **Final Action: Reject**

(100.Communications Raceway (New))

TCC Action: The Correlating Committee directs that the Action on Comment 16-3 be reported as Reject and the definition of "Communications Raceway" be relocated to Article 100 in accordance with the NEC Style Manual.

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.

Comment on Proposal No: 16-8

Recommendation: Continue to reject proposal 16-8.

Substantiation: The Communications Cable and Connectivity Association supports the panel's action to reject this proposal. Including the definition of communications raceway in Article 100 could give the impression that communications raceways are suitable for electric light and power wiring. They are not listed for use with electric light and power wiring.

Panel Meeting Action: Accept

Number Eligible to Vote: 18

Ballot Results: Affirmative: 17

Ballot Not Returned: 1 Ballast, D.

10-1 Log #1392 NEC-P10 **Final Action: Reject**

(100.Coordination)

Submitter: Dennis Darling, Stantec Consulting Ltd.

Comment on Proposal No: 10-5

Recommendation: Delete text to read as follows:

Localization of an overcurrent condition to restrict outages to the circuit or equipment affected, accomplished by the ~~choice~~ <u>installation</u> of overcurrent protective devices and their ratings or settings <u>for the full range of available overcurrents, from overload to the maximum available fault current, and for the full range of overcurrent protective device opening times associated with those ovcrcurrents.</u>

Substantiation: I oppose the addition of "and for the full range of overcurrent protective device opening times associated with those overcurrents". I promote selective coordination for specific applications.

Panel Meeting Action: Reject

Panel Statement: The definition of "selective coordination" does not preclude the submitter's concern as noted in his substantiation. See panel action and statement on Comment 10-2. The term "installation" remains but is used in a different context.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

10-2 Log #945 NEC-P10 **Final Action: Accept in Part**

(100.Coordination (Selective))

Submitter: Ed Larsen, Schneider Electric USA

Comment on Proposal No: 10-5

Recommendation: Delete text to read as follows:

Coordination (Selective). Localization of an overcurrent condition to restrict outages to the circuit or equipment affected, accomplished by the ~~choice~~ <u>selection and installation</u> of overcurrent protective devices and their ratings or settings ~~for the full range of available overcurrents, from overload to the maximum available fault current, and for the full range of overcurrent protective device opening times associated with those overcurrents.~~

Substantiation: The replacement of the word "choice" with the words "selection and installation" is acceptable for the reasons stated in the submitter's substantiation. The remainder of the proposed text should have been rejected.

As the submitter stated, the selective coordination requirement in 700.27 and similar places has caused confusion, but not for the reason stated by the submitter. Engineers know that all systems are selectively coordinated to some

level, so to simply state that emergency and other systems should be selectively coordinated does not make sense, hence many have asked up to what level such systems should be coordinated to. By reading the statements made by CMPs 13 and 20 in past cycles, it is apparent that what they meant to require is “total” coordination up to the theoretical maximum level of fault current, but unfortunately the Code text does not say that. The correct way to fix this problem would be to add the word “total” in 700.27 and similar places in the Code, not to revise the definition in Article 100. Revising the definition in Article 100 presents numerous
problems.

1. Section 240.87 recognizes that in order to reduce the arc-flash hazard it may be necessary to make use of energy-reducing maintenance switching, which effectively reduces the level of selective coordination. When this function is activated, the system is still coordinated, but just to a lower level.

2. NFPA 99 and NFPA 110 define the selective coordination performance requirements for health care and emergency and standby power systems respectively as has been stated by the Standards Council. Neither of these codes requires “total” coordination as defined by the proposed text accepted in ROP 10-5, thus the proposed change in the Article 100 definition will create additional confusion.

3. If the proposed revision to this definition is adopted, what words will be useable to describe a system that meets the 0.10s selective coordination requirements of NFPA 99 or the “optimized” selective coordination requirement in NFPA 110?

4. The revised definition does not agree with the usage of the term “selective coordination” in the IEEE Color Books which recognize, as Section 240.87 does, that there are times when it is not possible to achieve “total” or “full” or “complete” selective coordination. For example, the Buff Book states, “The device setting process is a compromise between the opposite goals of maximum equipment protection and maximum service continuity; therefore, complete selective coordination may not be achieved in all systems.” Note the use of the word “complete” to describe the level of selective coordination. Other Color Book references could be cited.

5. The proposed text contains a requirement. According to the Manual of Style for NFPA Technical Committee Documents, “2.3.2.3 Definitions shall not contain requirements.”

In summary, the proposed revision is not a generic definition but rather a definition for “total coordination”, which is a term not used anywhere in the NEC. While the proposed revision to the definition agrees with what CMPs 13 and 20 have said they wanted to require in their panel and ballot statements, it conflicts with Section 240.87, the industry recognized usage of the term and the performance requirements in NFPA 99 and 110, and is a violation of the Manual of Style requirement for definitions. The insertion of the words “selection and installation” should be accepted and the remaining proposed text should be rejected.

Panel Meeting Action: Accept in Part

CMP-10 continues to accept the deletion of the term “choice” and insertion of the words “selection and installation”.

The panel rejects the proposed deleted text.

Panel Statement: The wording “accept in principle” accepted by CMP 10 during ROP meeting, clearly does not contain a requirement for when or where selective coordination is required. It does however clarify the definition of “Coordination, Selective”.

The NEC needs to remain the quintessential document for the electrical system safety issue, and while the existing definition has served us well for many years, it is now necessary to clarify the definition, not change the meaning. The proposed changes add the specific clarity that is needed.

The wording accepted by CMP 10 is necessary to distinguish between the word “Coordination” and the phrase “Selective Coordination”. The word “Coordination” is often used to describe the isolation of downstream overcurrent conditions over limited ranges of time and currents, but selective coordination is used to describe the isolation of downstream overcurrent conditions over the complete range of available overcurrents and the times associated with those overcurrents.

The 0.1 second limit for isolation of downstream overcurrent conditions, referred to in the substantiation of the submitter, actually describes “Coordination” down to 0.1 seconds, not “Selective Coordination” down to 0.1 seconds.

The submitter is correct in that some Code Making Panels have agreed that they need “total” coordination for certain life-safety related loads, and it is for these life-safety related loads that they have chosen to use the phrase “selective coordination” or “selectively coordinate”, rather than simply the word “coordination” or “coordinate”. See NEC 620.62, 700.27, 701.27, and 708.54.

“Total Coordination” is synonymous with the phrase “Selective Coordination”. The words “coordinate” or “coordination” alone are simply not sufficiently specific enough to describe the concept as utilized by CMPs 12, 13, and 20.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

10-3 Log #1486 NEC-P10 **Final Action: Reject**

(100.Coordination (Selective))

Submitter: Ed Larsen, Schneider Electric USA

Comment on Proposal No: 10-5

Recommendation: Reject the proposal.

Substantiation: The existing definition of selective coordination in Article 100 is general in nature and serves the purpose. The proposed revision to the definition should be rejected for a number of reasons:

1. It is not a generic definition but rather is the definition for “total” selective coordination. While it may be argued based on their statements that “total” selective coordination is what Code Making Panels 13 and 20 were calling for when they added the requirement for selective coordination to Articles 700, 701 and 708, that is not what they said in the Code text. If the submitter wants to clarify what these articles require, which indeed would eliminate confusion, then he should propose adding the word “total” in those articles (and other articles if necessary) and then propose adding a definition for “total” coordination to Article 100.

2. This definition is contrary to the usage of the term in the IEEE color books. (See Buff Book 1.3, 15.1, 15.7.1; Orange Book 6.2; Red Book 5.15.6, 5.7.1; Gray Book 9.7, 9.7.1, 9.7.2, 9.7.3; Brown Book 15.1, 15.2.)

3. This definition conflicts with the requirements for selective coordination and usage of the term in NFPA 99 and 110.

In summary, the proposed change in the definition is an improper use of the English language and is improper Code text.

Panel Meeting Action: Reject

Panel Statement: The “Accept in Principle” wording accepted by CMP 10 during ROP meeting, clearly does not contain a requirement for when or where selective coordination is required. It does however clarify the definition of “Coordination, Selective”. This clarification is necessary because, as described in the original substantiation;

The NEC needs to remain the quintessential document for the electrical system safety issue, and while the existing definition has served us well for many years, it is now necessary to clarify the definition, not change the meaning. The proposed changes add the specific clarity that is needed.

The wording accepted by CMP 10 is necessary to distinguish between the word “Coordination” and the phrase “Selective Coordination”. The word “Coordination” is often used to describe the isolation of downstream overcurrent conditions over limited ranges of time and currents, but selective coordination is used to describe the isolation of downstream overcurrent conditions over the complete range of available overcurrents and the times associated with those overcurrents.

The 0.1 second limit for isolation of downstream overcurrent conditions, referred to in the substantiation of the submitter in the reference to NFPA 99, actually describes “Coordination” down to 0.1 seconds, not “Selective Coordination” down to 0.1 seconds.

“Total Coordination” is synonymous with the phrase “Selective Coordination”. The words “coordinate” or “coordination” alone are simply not sufficiently specific enough to describe the concept as utilized by CMPs 12, 13, and 20.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

2-1 Log #1339 NEC-P02 **Final Action: Reject**

(100.Demand Factor)

Submitter: James E. Degnan, Sparling

Comment on Proposal No: 2-6

Recommendation: Add text to read as follows:

Demand Factor. The ratio of maximum demand of a system, or part of a system, to the total connected load of a system or the part of the system under consideration. <u>Since demand load cannot be greater than the connected load, the demand factor cannot be greater than unity.</u>

Substantiation: If CMP 2 chooses to reject this proposal the submitter would be appreciative if the panel would answer the following question in their substantiation statement: “Can a demand factor be greater than 1.0?” On the other hand the submitter would also be entirely gracious if the proposal is accepted.

The Panel is requested to consider two documents: The NEC Style manual and the definition of “demand factor” in the IEEE Standard Dictionary of Electrical and Electronic Terms.

From the NEC Style manual: “3.3.4 Word Clarity. Words and terms used in the NEC shall be specific and clear in meaning, and shall avoid jargon, trade terminology, industry-specific terms, or colloquial language that is difficult to understand. “

From IEEE Standard Dictionary of Electrical and Electronic Terms (IEEE 100-2000, 7th Edition):

“demand factor (1) (power operations) The ratio of the maximum coincident demand of a system, or part of a system, to the total connected load of the system, or part of the system under consideration. (PE/PSE)

(2) (electric power systems in commercial buildings) The ratio of the maximum demand of a system to the total connected load of the system. Notes: 1. Since demand load cannot be greater than the connected load, the demand factor cannot be greater than unity. 2. Those demand factors permitted by the NEC (for example services and feeders) must be considered in sizing the electric system (with few exceptions this is 100%); otherwise the circuit may be sized to support the anticipated load. (IA/PSE)

(3) The ratio of the maximum coincident demand of a system or part of a system, to the total connected load of the system, or part of the system, under consideration. The resultant is always 1 or less and can range from 0.8 to 1 to as low as 0.15 to 0.25 for some plants with very low diversity.(IA/PSE)

(4) The ratio of operating load demand of a system, or part of a system, to the

total connected load of the system, or part of the system, under consideration. (IA/MT).”
In the above IEEE 100 text the parenthetic acronyms at the end of the definition help identify the source or usage of the definition, with PE denoting Power Engineering, which is typically a utility environment, and IA denoting Industrial Applications, which is typically a customer environment addressed by the suggested application of the NEC.
In substantiation for rejecting the original proposal CMP2 noted that the NEC definition is consistent with the IEEE definition, which it is, except two of the three (IA) sources in the IEEE definition also makes it clear that the demand factor is less than unity. This was the same intent of the original proposal which added the definition of a “demand load “ as a load less than the connected load, which would result in the demand factor being less than unity. Without further clarification as offered by IEEE, “demand” or “demand factor” could be interpreted in different ways. For example, some industry participants will say that the requirement in NEC-210.19 for branch circuits to be rated at 125% of the continuous load is a “demand factor” resulting in a demand factor greater than unity. Others will say that it is not, and that “Demand or Demand Factor” should be used consistent with the usage of the term by IEEE. The use of “demand” when “demand load” is intended constitutes jargon. Accordingly “demand factor” needs clarification per the style manual.
The proposed text is in keeping with the concept of the original proposal, and is not new material, it just rewords the proposal to align with IEEE, for which the panel indicated an affiliation. Acceptance of this wording or the original proposal meets my intent.
Appendix: IEEE’s web site notes that IEEE-100 has been superseded, the document is no longer available, I believe the 7th edition was the last version of IEEE-100 published. IEEE had the various working groups that make up the organization create their individual definitions and terms, because many terms had meanings that were dependent on specific applications. From the perspective of the power/industrial/commercial users, the closest replacement document is IEEE SA 1459-2010 “IEEE Standard Definitions for the Measurement of Electric Power Quantities Under Sinusoidal, Nonsinusoidal, Balanced, or Unbalanced Conditions” but this new document has no definitions for demand, demand factor, connected load, etc., it mostly focuses on the math associated with the terms used in the title. Without IEEE publishing a current document defining these terms the NEC must stand alone on its content.
Panel Meeting Action: Reject
Panel Statement: For the purposes of the NEC “demand factor” is correctly defined. Adding that the demand factor cannot be greater than unity does not add clarity to the definition.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

5-3 Log #535 NEC-P05 **Final Action: Accept**
(100.Effective Ground-Fault Current Path)

Submitter: James E. Brunssen, Telecordia Technologies Inc. / Rep. Alliance for Telecommunications Industry Solutions (ATIS)
Comment on Proposal No: 5-6
Recommendation: The proposed revised definition is incorrect in the preprint. Revise to state: “**Effective Ground-Fault Current Path.** An intentionally constructed, low-impedance electrically conductive path designed and intended to carry current ~~underground-fault~~ under ground-fault conditions from the point of a ground fault on a wiring system to the electrical supply source and that facilitates the operation of the overcurrent protective device or ground-fault detectors.”
Substantiation: There was a typographical error in earlier versions of the Panel Action on this Proposal where the phrase “under ground-fault” was inadvertently displayed as “underground-fault”. See the comment on affirmative by T. Bowmer. The typo appears to have been corrected in the ROP but somehow found its way into the preprint.
Panel Meeting Action: Accept
Panel Statement: This corrects an error in the ROP draft. The panel action as documented in proposal 5-6 is correct.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

10-4 Log #476 NEC-P10 **Final Action: Accept**
(100.Electronically Actuated Fuse)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 10-7
Recommendation: Revise text to read as follows:
Electronically Actuated Fuse. An overcurrent protective device that generally consists of a control module that provides current sensing, electronically derived time–current characteristics, energy to initiate tripping, and an interrupting module that interrupts current when an overcurrent occurs. Such fuses ~~Electronically actuated fuses~~ may or may not operate in a current-limiting fashion, depending on the type of control selected.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term and the NEC manual of style does not permit the definition to contain the defined term. Definitions are not requirements. The proposed changes eliminate the defined term.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Suggested informational notes as an alternative, eliminating the second sentence:
Informational Note: Electronically actuated fuses may or may not operate in a current-limiting fashion, depending on the type of control selected.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

5-4 Log #687 NEC-P05 **Final Action: Reject**
(100.Equipment Ground-Fault Protection)

Submitter: Christopher M. Jensen, North Logan City
Comment on Proposal No: 5-8
Recommendation: Accept the proposal with the amended text:
Equipment Ground-Fault Protection. A system intended to disconnect the electric circuit from the source of supply when ground-fault current is detected between 30 to 50 milliamps. This protective system is intended to operate upon a condition of excessive ground-fault leakage current from equipment, rather than minimize damage due to arcing faults in services.
Substantiation: Because this new term would be used in more than 1 code article CMP I would be a more appropriate panel to review this proposal.
This new definition is a companion proposal to change the term “Ground fault protection of Equipment” to “Equipment ground fault protection” in NEC sections 426.28 and 427.22
UL has 2 distinct White Book categories for ground fault protection of equipment. Category (KDAX) covers Ground fault protection of Equipment for compliance with 230.95 and 215.10 and the ground fault settings are between 1 and 1200 amperes. Category (DIYA) “Circuit Breakers with Equipment Ground Fault Protection” covers the requirements for 426.28 and 427.22. GFPE in 230.95 is designed to stop damaging arcs from high impedance ground faults that can occur in 480 volt 1000 ampere equipment whereas Equipment ground fault protection from426.28 and 427.22 is designed to detect and interrupt the supply to deicing and snow melting equipment due to leakage current that can occur when the equipment’s insulation breaks down over time.
This is a companion proposal to a change in term in 426.28 and 427.22.
Panel Meeting Action: Reject
Panel Statement: The proposed new definition introduces a term “ground fault leakage current” that is not defined in the NEC. Equipment ground-fault protection can be higher or lower than the 30 to 50 mA proposed depending on design and equipment capability.
Code users may use the current UL information for installations unique to ground fault protection of equipment installations as required in 210.15, 230.95, 426.28 and 427.22.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 14 Negative: 2
Explanation of Negative:
MELLO, C.: The submitter of the original proposal and the comment is correct that the ground fault device referenced in Articles 426 and 427 is neither a “Ground Fault Circuit Interrupter” nor a “Ground Fault Protection for Equipment” device. Applying the definitions from Article 100, GFCI is for protection of people from shock hazards and GPFE is for protection of major power service and distribution equipment from the damage associated with high current ground faults, including arcing faults to ground. GFPE is applied where the voltage exceeds 150 volts to ground and the circuit size exceeds 1000 amps. The devices referenced in Articles 426 and 427 are rated 15 or 20 amps for 120 or 240 Volt applications and are for protection of specific equipment from excessive leakage, as measured in milli-amps to ground. The construction, application and UL listings for each of these devices are different and therefore the Code should recognize the difference. These devices are listed under the UL Category Code DIYA, “Circuit Breakers with Equipment Ground Fault Protection”, therefore the product name as proposed coincides with the product name used in the listing.
PORTER, C.: The panel should have accepted this comment. It should be noted that the correct reference is 215.10, and not 210.15.I disagree that the term Ground Fault Leakage Current is a new term that needs a definition. The term leakage current is used in 440.2, 440.65, 516.10, 517.2, and the term ground-fault is also well understood. There is a difference between the ground-fault protection of equipment that is required for Services and Feeder and what is required for systems covered under Articles 426 and 427. Using the same term for both can be confusing and should not rely on another source for clarity.

1-14 Log #935 NEC-P01 **Final Action: Reject**
(100.Fixed Wiring and 110.27)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 1-118
Recommendation: Add text to read as follows:
100 I Fixed Wiring. Conductors, raceways, etc. installed under Chapter 3 methods.**110.27 Uninterrupted Power Supply (UPS) Connected to Fixed Wiring.**

(A) Labeling.
(1) When a UPS supplies fixed wiring, each place the UPS supplied circuit(s) is accessible shall have a clearly legible marking in letters not less than 6 mm (¼ in.) high reading "UPS Supplied". The label shall comply with 110.21(B).
(2) When a control panel contains a UPS which supplies current to fixed wiring external to the control panel, the control panel shall have a clearly legible sign in letters not less than 6 mm (¼ in.) high reading "Caution this panel contains a UPS". The sign shall comply with 110.21(B).
(B) Disconnecting Means. A disconnect meeting the requirements of 110.25 shall be installed for all output circuits from the UPS.*Exception: The requirements 110.27 do not apply to areas meeting all the requirements of 645 Information Technology Equipment or 646 Modular Data Centers.*
Substantiation: 90.1(A) Practical Safeguarding.
The purpose of this Code is the practical safeguarding of persons and property from hazards arising from the use of electricity.The recent introduction of fixed wiring in buildings fed from UPSs in other than Information Technology Equipment areas has introduced a new hazard. Until recently when you opened the main service disconnect for a building you would be able to assume that fixed wiring was no longer energized. APC and other manufacturers are selling UPS accessories for their products to facilitate connection to fixed wiring. (For example see http://www.apcmedia.com/salestools/A...8L95_R0_EN.pdf). This installation guide does not require an output disconnect.
The recent introduction of UPSs embedded in control panels which feed external fixed wiring presents a similar hazard. I have directly experienced a case of this sort. I was tasked to replace a shunt-trip 3-pole circuit breaker with trip alarm contacts. I opened all the circuits serving the control cabinet. I measured the voltages on the circuit breaker power connections, the shunt-trip, and the trip alarm contacts. I found that the shunt-trip circuit was de-energized, but that the trip alarm contact was still energized. I opened the control cabinet (not something I normally would do, because the cabinet and associated equipment were maintained under contract by a third-party). I found that a standalone style UPS like one might buy in a big box store was inside and its output was energizing the trip alarm contacts. I also confirmed that all external power to the control panel was indeed turned off.
I am proposing the addition of **110.27** and the associated **100 I Fixed Wiring** additions to the NEC to warn electricians of these new hazards. I am suggesting the use of "UPS supplied" as labeling for receptacle outlet covers (and other covers) because it also serves as useful label for non-electrician users.The exception is proposed because those qualified personnel working in 645/646 areas are already expecting UPS supplied receptacles.
Basis for 100 Fixed WiringTerms
akin to Fixed Wiring are used in:
220.14(H) Fixed Multioutlet Assemblies.
250.34(C)(3)<info note> Fixed wiring systems
393.6(B)(4) fixed wiring methods
400.8(1) fixed wiring method
411.3(B)(5) fixed wiring method
500.8(B)<info note> fixed wiring
501.140(A)(2) fixed wiring methods
505.17(A) fixed wiring methods
511.7(A)(1) fixed wiring
511.16(B)(2) fixed wiring system
513.7(A) fixed wiring
513.10(C)(1) fixed wiring
513.10(D)(1) fixed wiring
513.16(B)(2) fixed wiring system
515.7(A) fixed wiring
516.7(A) fixed wiring
517.61(A)(3) fixed wiring
518.4(A) fixed wiring methods
518.4(A)<except> fixed wiring methods
520.5(A) fixed wiring method
520.5(A)<except> fixed wiring methods
530.31 fixed wiring
550.19(A) fixed-type wiring methods
550.32(D) fixed wiring method
620.21(A)(2)(b) fixed wiring
Basis for UPS labeling
I posted a poll on forums.mikeholt.com/showthread.php?t=148012 which asked in essence "would you check for voltage at receptacles and switches after turning off and locking the service main?". There were 26 responses to the poll, 5 said they would NOT check, basically 24%. Three who chose a testing method said they would not turn off main for various reasons. The poll was posted in the Safety forum to bias the answers towards testing.
Changing switches and receptacles
Let's assume you've got a job that consists of changing the receptacles, switches, and cover plates throughout a house from ivory to almond. You ask why and the guy who hired you said it is a directive from "She Who Must Be Obeyed". They are going away for the week. So you show up and decide the simplest way to do this is to put on a head lamp and turn off the main breaker. You turn it off and padlock it.
View Poll Results: Now when you go to each box, what do you do?
Voters 21. This poll is closed
· test for voltage with a non-contact voltage stick 6 28.57%
· test using a wiggly 5 23.81%
· test using a Digital Volt Meter 5 23.81%
· test using a shorting plug (for receptacles) 0 0%
· test? are you crazy, the power is off! 5 23.81%
The response from CMP-1 limited itself to the original example (an elevator control panel, and not to the general cases supplied above).Panel Statement: The problem identified by the submitter relates to productdesign and marking rather than installation. In addition, the submitter isproposing specific requirements in the general section of the code which maybe more appropriate in other sections of the code. In sections such as620.52(B), the submitter's concerns are addressed.
Panel Meeting Action: Reject
Panel Statement: The panel reaffirms its original action on Proposal 1-118. The proposed definition of "Fixed Wiring" would not include those installations that use other than Chapter 3 wiring methods for fixed wiring, such as 501.140(A)(2), 505.17, 511.7 and 513.7. The proposed 110.27 would add specific requirements (UPS), which may be more appropriate in other sections of the code.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

5-5 Log #583 NEC-P05 **Final Action: Accept**
(100.Intersystem Bonding Termination)

Submitter: Trevor N. Bowmer, Telcordia Technologies / Rep. Alliance for Telecommunications Industry Solutions (ATIS)
Comment on Proposal No: 5-17
Recommendation: Continue to reject this proposal as per Panel action.
Substantiation: The Panel acted correctly in rejecting the proposed action. Including an undefined and vague term such as "other systems" into a definition makes the code less clear.
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 15 Negative: 1
Explanation of Negative:
PORTER, C.: This comment should have been rejected. There is nothing in the definition nor in the requirements for this device that limits it only the systems of 770, 800, 810, 820, or 830. There is also nothing to prevent a bus bar meeting the requirements of 250.64(F)(3) from being used for these systems as well as the Service. If the device used has the proper number of and size of terminations for any system required to be connected to the grounding electrode of a structure it should be permitted to be used.

1-15 Log #456 NEC-P01 **Final Action: Accept in Principle**
(100.Location, Damp)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 1-52
Recommendation: Revise text to read as follows:
Location, Damp. Locations protected from weather and not subject to saturation with water or other liquids but subject to moderate degrees of moisture. ~~Examples of such locations include partially protected locations under canopies, marquees, roofed open porches, and like locations, and interior locations subject to moderate degrees of moisture, such as some basements, some barns, and some cold-storage warehouses.~~
Informational Note: Examples of such locations include partially protected locations under canopies, marquees, roofed open porches, and like locations, and interior locations subject to moderate degrees of moisture, such as some basements, some barns, and some cold-storage warehouses.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains a list of examples that is simply informational. The proposed changes eliminate the list and place it as information. If the CMP believes that this information is a requirement it should place it somewhere else, perhaps within an article addressing damp locations.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Panel Meeting Action: Accept in Principle
Panel Statement: The panel reaffirms its accept action and statement on Proposal 1-52.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-16 Log #3 NEC-P01 **Final Action: Reject**
(100.Location, Wet)

Submitter: David L. Hittinger, Independent Electrical Contractors of Greater Cincinnati
Comment on Proposal No: 1-66
Recommendation: Add text to read as follows:
Location, Wet. Installations underground or in concrete slabs or masonry in direct contact with the earth; in locations subject to saturation with water

or other liquids, such as vehicle washing areas; and in unprotected locations exposed to weather.
Informational Note: See 314-15 which addresses boxes, conduit bodies and fittings installed in wet locations.
Substantiation: See Proposals 1-66 and 1-67 where the submitter has identified a situation where the informational note would increase awareness and usability in the Code. At the 2014 ROP Panel 1 discussed this issue and there appears to be a lack of understanding in the industry that fittings installed in a wet location are required to be raintight.
Panel Meeting Action: Reject
Panel Statement: The informational note is unnecessary and addresses requirements that are dealt with generally in Section 110.3(B). No justification has been provided to reference only the requirements in 314.15 when suitability of use applies to all wiring methods and equipment covered by the NEC.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

18-2 Log #500 NEC-P18 **Final Action: Reject**
(100.Luminaire and Informational Note (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 18-6
Recommendation: Revise text to read as follows:
Luminaire. A complete lighting unit consisting of a light source such as a lamp or lamps, together with the parts designed to position the light source and connect it to the power supply. ~~It~~ Such a lighting unit may also include parts to protect the light source or the ballast or to distribute the light. ~~A lampholder itself is not a luminaire.~~
Informational Note: A lampholder itself is not a luminaire.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term and the NEC manual of style does not permit the definition to contain the defined term. Definitions are not requirements. The proposed changes eliminate the defined term. If the CMP believes that this information is a requirement it should place it somewhere else, perhaps within Article 411.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Panel Meeting Action: Reject
Panel Statement: Present code is clear. Since informational notes are not enforceable, the proposed addition removes an important distinction needed for Listed lamp holders.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

9-2 Log #117 NEC-P09 **Final Action: Accept**
(100.Metal-Enclosed Power Switchgear)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-7
Recommendation: It was the action of the Correlating Committee that further consideration be given to the comments expressed in the voting regarding use of a single voltage, rather than “below 600 (or 1000) volts”.
In addition, the NEC standard method of referencing the voltage levels of “600 volts or less” or “1000 volts or less” must be followed for consistency throughout the NEC.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Change “below 600 (or 1000) volts” to “1000 volts or less” in the Informational Note.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:
FERRARO, J.: It is recognized that increasing voltage from 600 volts to 1000 volts may be applicable to specific installations. However, adequate technical substantiation has not been provided to support the change in this Article.

9-3 Log #472 NEC-P09 **Final Action: Accept in Principle**
(100.Metal-Enclosed Power Switchgear and Informational Note (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 9-8
Recommendation: Revise text to read as follows:
Metal-Enclosed Power Switchgear. A switchgear assembly completely enclosed on all sides and top with sheet metal (except for ventilating openings and inspection windows) and containing primary power circuit switching, interrupting devices, or both, with buses and connections. The assembly may include control and auxiliary devices. Access to the interior of the enclosure is provided by doors, removable covers, or both. ~~Metal-enclosed power switchgear is available in non-arc-resistant or arc-resistant constructions.~~
Informational Note: Metal-enclosed power switchgear is available in non-arc-resistant or arc-resistant constructions.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term and the NEC manual of style does not permit the definition to contain the defined term. Definitions are not requirements. The proposed changes eliminate the defined term. If the CMP believes that this information is a requirement it should place it somewhere else, perhaps within Article 408.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Panel Meeting Action: Accept in Principle
Make no further revision to the text accepted under the action on Proposal 9-7 and Comment 9-2 thereto.
Panel Statement: T he panel actions as cited fully accomplish the submitter’s objectives.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-4 Log #876 NEC-P09 **Final Action: Reject**
(100.Metal-Enclosed Power Switchgear)

Submitter: C. Douglas White, Center Point Energy / Rep. Edison Electric Institute/Electric Light & Power Group
Comment on Proposal No: 9-7
Recommendation: Statement of Issue:
The panel action should have been to accept in principle. The IEEE definition for switchgear should be used.
The definition should read as follows:
Switchgear
A general term covering switching and interrupting devices and their combination with associated control, metering, protective, and regulating devices; also assemblies of these devices with associated interconnections, accessories, enclosures, and supporting structures, used primarily in connection with the generation, transmission, distribution and conversion of electric power.
Substantiation: The 2011 NEC definition of “Metal-Enclosed Power Switchgear” has been taken verbatim from IEEE C37.100 “Standard Definitions for Power Switchgear”.
Since the definition name has been changed to “Switchgear”, the definition should be changed to be consistent with IEEE C37.100.
Panel Meeting Action: Reject
Panel Statement: CMP 9 concludes that the definition as stated more accurately tracks the expected NEC usage.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 8 Negative: 3
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:
FERRARO, J.: The 2011 NEC definition of “Metal-Enclosed Power Switchgear” has been taken verbatim from IEEE C.37.100 “Standard Definitions for Power Switchgear”. Since the definition name has been changed to “Switchgear”, the definition should be changed to be consistent with IEEE C37.100.
SENGUPTA, S.: NEC usage is for installation safety.
Over a long-term period, the IEEE C37.100 “Standard Definition for Power Switchgear” has been used by Engineers, Designers, Electrical Equipment Manufacturers, Nationally Recognized Testing Laboratories and Installation Contractors to maintain switchgear’s performance specification and installation safety.
NFPA has always followed industry standards and guidelines established by IEEE, ASTM, ANSI, UL etc. A new definition in NEC may result in confusion. As a result, CMP 9 should maintain NFPA practices of recognizing these standards.
The panel is incorrect in stating in the Informational Note that all switchgear over 1000 V is metal enclosed or metal clad.
YOUNG, R.: The IEEE definition should be used to provide consistency with the standard that covers the equipment design.

3-3 Log #1528 NEC-P03 **Final Action: Reject**
(100.Non-Power-Limited Fire Alarm Circuit (NPLFA) (New) and 760.2)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 16-12
Recommendation: Add definition to Article 100 and delete from 760.2 as follows:
100
Non–Power-Limited Fire Alarm Circuit (NPLFA). A fire alarm circuit powered by a source that complies with 760.41 and 760.43.
760.2
~~**Non–Power-Limited Fire Alarm Circuit (NPLFA).** A fire alarm circuit powered by a source that complies with 760.41 and 760.43.~~
Substantiation: The defined term is referenced in several articles of the NEC: 336, 725, 760, 800, 820, 830, 840. (OK, so I had a typo in the original

submission.)
Panel Meeting Action: Reject
Panel Statement: The text in the introduction to Article 100 and in the NEC Style Manual states that, in general, any word that is used in more than one article within the NEC should have its definition located in Article 100. However, there certainly are exceptions to this general requirement. Where the article and, thus, the definition are used by other industries that do not normally have access to Article 100 or where the definition is an integral part of a table or a section within that article, then the definition should remain in the article or the table, not in Article 100. Article 760 is used by the fire alarm industry; therefore, the definition must remain in Article 760.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

10-5 Log #477 NEC-P10 **Final Action: Accept**
(100.Overcurrent Protective Device, Branch-Circuit)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 10-10
Recommendation: Revise text to read as follows:
Overcurrent Protective Device, Branch-Circuit. A device capable of providing protection for service, feeder, and branch circuits and equipment over the full range of overcurrents between its rated current and its interrupting rating. ~~Branch-circuit overcurrent protective devices~~ Such devices are provided with interrupting ratings appropriate for the intended use but no less than 5000 amperes.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term and the NEC manual of style does not permit the definition to contain the defined term. Definitions are not requirements. The proposed changes eliminate the defined term. If the CMP believes that this information is a requirement it should place it somewhere else, perhaps within Article 240.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
As an alternative consider creating an informational note as follows:
Informational Note: Branch-circuit overcurrent protective devices are provided with interrupting ratings appropriate for the intended use but no less than 5000 amperes.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

3-4 Log #105 NEC-P03 **Final Action: Accept**
(100.Power-Limited Tray Cable Type PLTC)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 7-15
Recommendation: It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 3 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepted the direction of the Correlating Committee and modified the definition in Comment 3-45a (Log #CC3).
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

1-17 Log #1336 NEC-P01 **Final Action: Reject**
(100.Premises (New))

Submitter: Paul Dobrowsky, Holley, NY
Comment on Proposal No: 1-58
Recommendation: Accept the proposal in principle and add a definition of Premises as follows:
Premises. Property consisting of land, with or without buildings or structures
Substantiation: During discussions it appeared that different opinions exist regarding whether land without a building or structure would be considered a premises. Section 90.2(A)(1) uses the word "premises" including "buildings, structures, etc. If the term conductor is removed from the definition of "device" and a change for the 2011 NEC removed the word "material" from the definition of "equipment" it is now unclear if conductors are considered equipment. If a property does not have buildings or structures, but does have wiring and "equipment" does the NEC apply? Adding this definition will provide clarity that the NEC applies to property as stated in 90.1(A) that has no buildings or structures but has "wiring". A panel statement indicating if this position it true would be helpful.
Panel Meeting Action: Reject
Panel Statement: As "premises wiring" is defined, there is no need to add a definition for "premise". Electrical installations that are not specifically excluded by 90.2(B) are under the scope of the NEC regardless of the presence or absence of buildings on the land.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-18 Log #1345 NEC-P01 **Final Action: Reject**
(100.Premises)

Submitter: Louis Barrios, American Chemistry Council
Comment on Proposal No: 1-58
Recommendation: The committee action should have been Accept In Principle and change the definition to the one provided in NFPA Glossary of Terms and NEC 800.2, which states: "The land and buildings of a user located on the user side of the utility-user network point of demarcation."
Substantiation: The need for a definition of "premises" became apparent during panel deliberations when it was not clear following the panel action whether or not premises are required to have structures on them to be considered "premises". The proposed definition is extracted from the NFPA Glossary of Terms and NEC 800.2, " The land and buildings of a user located on the user side of the utility-user network point of demarcation."
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 1-17.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-19 Log #1387 NEC-P01 **Final Action: Reject**
(100.Premises)

Submitter: Greg Marchand, Briggs & Stratton
Comment on Proposal No: 1-61
Recommendation: Add new text to read as follows:
A stand-alone generator that is supplying only cord connected equipment is not considered to be premises wiring.
Generators, including integral outlets are considered to belong to the power source and are not considered to be premises wiring.
Substantiation: We are in full support of the more complete substantiation presented by the Portable Generator Manufacturers Association authored by Joseph Harding and John Loud of Exponent, Inc.
Panel Meeting Action: Reject
Panel Statement: The panel reaffirms its original action on Proposal 1-61 which provides examples of power sources as they relate to premises wiring systems. Also see the panel action and statement on comment 1-23.
The proposed content conflicts with the definition and with the NEC Style Manual 2.2.2.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-20 Log #1536 NEC-P01 **Final Action: Accept**
(100.Premises (New))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 1-58
Recommendation: Continue to Reject.
Substantiation: The proposed definition would literally remove many outdoor electrical installations from the scope of the NEC. It is not possible to occupy a disconnect mounted on a structure to supply HVAC equipment. It is not possible to occupy an outdoor luminaire. There are countless other examples. Read the proposed definition as written, it recognizes a built structure or structures and " the land on which the structures are situated." That means only the land on which the structure sits, it recognizes only the footprint of a structure.
The definition of "Premises Wiring" has served the industry well for decades. Users of the NEC have no problem reading, understanding and applying the defined term "Premises Wiring." While CMP-1 apparently had an interesting discussion on this proposal, we need to focus on the intent of the proposal. A review of proposals and comments in the last NEC cycle and this NEC cycle from this submitter as well as the submitter of proposal 1-60, clearly reveals their intent. The intent is to exclude portable generators supplying power to a structure during a loss of power or any other reason from the scope of the NEC. There is no other reason for this proposal. There is not a problem with this definition. It is crystal clear. Everything on the load side of the service point is included in the scope of the NEC and where there is no service, (power outages or temporary) the power source is also included. If the application of this definition was creating an enforcement issue, CMP-1 would be flooded with proposals. Acceptance of this proposal gives them what they want because the portable generator will occupy land that is not within the footprint of the structure.
If this proposed definition is accepted, there are dozens of NEC rules that must be deleted and the purview of the NEC would be limited only to structures that can be occupied. The NESC will gladly step in and take purview over all electrical installations that can not be occupied.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-21 Log #457 NEC-P01 **Final Action: Reject**
(100.Premises Wiring (System))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 1-59
Recommendation: Revise text to read as follows:
Premises Wiring (System). Interior and exterior wiring, including power, lighting, control, and signal circuit wiring together with all their associated hardware, fittings, and wiring devices, both permanently and temporarily installed. This includes (a) wiring from the service point or power source to the outlets or (b) wiring from and including the power source to the outlets where there is no service point. ~~Such wiring does not include wiring internal to appliances, luminaires, motors, controllers, motor control centers, and similar equipment.~~<u>**Informational Note:** Such wiring does not include wiring internal to appliances, luminaires, motors, controllers, motor control centers, and similar equipment.</u>
Substantiation: I accept the point that NEC definitions need not be in single sentences. However, the last sentence of the existing definition simply gives examples and is definitely not part of the definition. This is consistent with the comments by Mr. Anthony and Mr. Barrios and with action by CMP 1 on some other proposals.
Panel Meeting Action: Reject
Panel Statement: The recommendation does not enhance the clarity or usability of the code.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-22 Log #1293 NEC-P01 **Final Action: Reject**
(100.Premises Wiring (System))

Submitter: Joseph Harding, Portable Generator Manufacturers Association
Comment on Proposal No: 1-61
Recommendation: Revise text to read as follows:
Informational Note <u>No.1:</u> Power sources include, but are not limited to, interconnected or stand-alone batteries, solar photovoltaic systems, other distributed generation systems, or generators.
<u>Informational Note No. 2: Generators. including integral outlets are considered to belong to the power source and are not considered to be premises wiring.</u>
<u>Informational Note No. 3: A stand-alone generator that is supplying only cord-connected equipment is not considered to be premises wiring.</u>
Substantiation: The added Informational Note in Proposal 1-61 will lead to unintended consequences, as detailed below:
1. If the outlets on generators are considered as premises wiring, then this will indirectly mean that isolated output (also known as "floating neutral") generators will no longer be allowed, since 250.26 specifies the conductor to be grounded in AC premises wiring systems. According to a recent PGMA survey, approximately 50% of all portable generators sold in the U.S. are the isolated output type. Portable generators that are used in "stand alone" mode are not normally connected to a grounding electrode (as allowed in 250.34(A)). In this configuration, isolated output generators pose no risk of a shock hazard (please refer to the presentation and videos associated with this comment). It is also the experience of the portable generator industry that there have been no reported incidents of electrical shock associated with these generators over at least the last five years for which data is readily available. Requiring the neutral conductor to be connected to the grounding conductor in a portable generator outlet only serves to increase the risk of electrical shock (again please refer to the presentation and video associated with this comment).
2. If isolated output generators are no longer allowed, then all generators used for backup power during power outages would need to be connected as separately derived systems. This is required because not doing so would result in the system having two points where the neutral is bonded to the grounding electrode (the main bonding jumper and the generator). The dual bonding points allow neutral current to flow on equipment bonding conductors under normal conditions, resulting in nuisance tripping of GFCIs, etc. Connecting a generator as a separately derived system requires the use of an extra pole in the transfer switch in order to switch the neutral conductor. According to industry sources, 99% or more of portable generators used for home backup power are connected as non-separately derived systemsby using single or dual pole transfer switches. If this proposal is accepted, it will then force those owners who subsequently replace their portable generator to also replace their current transfer switch at considerable expense and without any real-world safety benefit. If the owner chooses to operate a new portable generator with the existing transfer switch, the system will not be in compliance with the NEC. Considering the significant expense of replacing a transfer switch, it is the belief of PGMA members that some owners would then attempt to modify their new generator or their existing transfer switch and this would then pose significant safety risks where one would not otherwise exist It is finally noted that the Code currently has a provision for connecting generators as non-separately derived systems (250.30 Informational Note I).
3. There will continue to be considerable uncertainty in the Code regarding what part of a generator, if any, would be considered as premises wiring. In the case of a standby generator, where a service point exists, the question remains regarding where does the "power source" end and the "premises wiring" begin? Also, the current definition states that premises wiring "includes (a) wiring from the service point or power source to the outlets". Are the "outlets" to be considered outlets that may be
present on the generator itself or the "normal" outlets in the home, building, etc.?
There will also continue to be considerable uncertainty in the Code in the case of "stand-alone" generators. A stand-alone generator that operates in the middle of a field supplying only cord-connected equipment is not covered by the scope of the NEC (90.2(A)) and therefore cannot be considered as premises wiring. If it were, then once again the question remains about what part of that system would be considered as premises wiring and what part would not. This similarly draws into question what other devices with internal power sources (e.g. shavers or cell phones) may also be misinterpreted to be a premises wiring system. According to the proposal, since no service point exists. the entire generator is premises wiring. This would include not only the generator outlets but also the alternator windings, spark plug wire etc. Acceptance of this proposal would be in direct conflict of 90.1(C), as it would prescribe very specific design requirements for the internal wiring on generators.
For this reason, as well as the reasons given in unintended consequences 1. and 2. above, it is proposed that no part of the generator should be considered as premises
wiring for clarity.
The proposed addition of Informational Notes 2 and 3 attempts to address all of the unintended consequences outlined above. Please refer to the supporting documentation on this comment (presentation and videos) for further information.
PUMA members represent a significant majority of the portable generator industry. Our member companies include:
- American Honda Motor Co.
- Briggs & Stratton Home Power Products
- Champion Power Equipment
- Genernc Power Systems
- Pramac America
- Subaru Industrial Power
- Techtronic Industries North America
- Wacker Neuson Production Americas LLC
- Yamaha Motor Corp USA

Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: The panel reaffirms its original action on Proposal 1-61 which provides examples of power sources as they relate to premises wiring systems. Also see the panel action and statement on comment 1-23.
The proposed content in Informational Notes 2 & 3 conflicts with the definition.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12
Comment on Affirmative:
ANTHONY, M.: The electrical industry has benefited from the technical points the generator consortia has raised in this comment. Product innovation -- particularly with respect to homeowner use of generators - might result in a resolution to some of the difficulties presented here.

1-23 Log #1299 NEC-P01 **Final Action: Reject**
(100.Premises Wiring (System))

Submitter: James Jongkind, American Honda Motor Co., Inc.
Comment on Proposal No: 1-61
Recommendation: Please reject the proposal.
Substantiation: This proposal seeks to require that all portable generators have their neutral conductors connected to the generator frame by classifying the internal wiring as a "premises wiring system." Most of the portable generators that Honda has sold for the past 40 years are of the floating neutral design and are used safely everyday by millions of consumers. To require that all newly produced I portable generators be bonded is not only unjustified by the lack of incident data, but it would also introduce a safety risk where one did not previously exist. The output on these floating neutral generators is isolated, so there is no path back to the source through I which users can be shocked. This is a well established and proven safety strategy for this type of product and should not be arbitrarily eliminated.
Panel Meeting Action: Reject
Panel Statement: Portable generators are electrical equipment. As such, use of portable generators is included in the purpose of the NEC to provide practical safeguarding of persons and property from hazards arising from the use of electricity. Use of portable generators is also under the scope of the NEC based on 90.2(A), which covers the installation of electrical equipment. Additionally, Sec. 250.34 and Article 590 clearly contain requirements addressing use of portable generators. The requirements, such as bonding and grounding, for portable generators are not under the purview of Panel 1.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12
Comment on Affirmative:
ANTHONY, M.: See my statement on Comment 1-22.

1-24 Log #1462 NEC-P01 **Final Action: Reject**
(100.Premises Wiring (System))

Submitter: Michael O. Flegel, Reliance Controls Corporation
Comment on Proposal No: 1-61
Recommendation: Reject the proposal.
Substantiation: OSHA requires bonded neutral generators in their regulations for construction sites. In reading these regulations, they appear to be identical to the NEC requirements except for this bonding requirement. The interpretation in Appendix A explains their position. To completely understand OSHA's response, please read the request letter by Mr. Iwasa (provided). It appears OSHA incorrectly interprets the NEC. OSHA says a generator in stand-alone use is a separately derived system (see Article 100) and as such needs to be bonded. However, the NEC definition of a separately derived system says it is a premises wiring system. A generator in stand-alone use is not a premises wiring system so it is not separately derived. Please note the OSHA interpretation does not have any safety arguments other than misinterpreting the NEC which leaves it with no technical merit. As such it has no relevance in this discussion because it is circular logic.

What is relevant is the definition of a premises wiring system. Separately derived systems are limited to premises wiring systems by definition and separately derived systems must be bonded. This change now means all portable generators used in stand-alone use must be bonded. A portable generator in stand-alone use (which I define as powering only cord connected equipment) in the middle of a field is not a premises wiring system. It is not a premises wiring system until it is connected to my house as either a separately derived system or a non-separately designed system.

I believe this change in the definition meets a UL objective because they believe all generators should be bonded when, in fact and in theory, using a floating-neutral generator in stand-alone use is safer than a bonded-neutral generator. Using a bonded-neutral generator allows the neutral of the generator to come into contact to the ground more easily since the neutral is connected to the frame. As soon as the frame is grounded, you have the possibility of ground faults, a condition that does not exist for floating-neutral generators. Add to that the numbers of floating neutral generators in use today with no safety problems, and one can see UL is being a bit stubborn in their objective. In addition, many floating-neutral generators are being installed in non-separately derived systems and now the homeowner would be violating the NEC if he used the generator to power only cord connected equipment in his back yard.

If the definition stands and the panel's intent is not to bar floating-neutral generator use in stand-alone applications, then maybe it needs to be taken up by other panels before the change takes place so other sections of the code can be changed as to not affect portable generator use.

Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: The panel reaffirms its original action on Proposal 1-61 which provides examples of power sources as they relate to premises wiring systems. Also see the panel action and statement on Comment 1-23.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12
Comment on Affirmative:
ANTHONY, M.: See my statement on Comment 1-22.

1-25 Log #1482 NEC-P01 **Final Action: Reject**
(100.Premises Wiring (System), Informational Note (New))

Submitter: Richard Torine, BR Forbes
Comment on Proposal No: 1-61
Recommendation: Delete text to read as follows:
~~Informational Note: Power sources include, but are not limited to, interconnected or stand-alone batteries, solar voltaic systems, other distributed systems, or generators.~~
Substantiation: The substantiation for this proposal admits that U.L. is trying to use the NEG to force its own Standards Technical Panel to do something that the panel does not agree with. Defining a stand-alone generator as a premises has many far-reaching implications. A portable generator would then be subject to bonding and grounding standards that are completely unnecessary for a portable generator and that may actually compromise safety. The 2201 STP is fully aware of this and must take this into account when developing the standard. They are a panel of experts that is uniquely qualified to make decisions about the safe use of portable generators.

I support any proper clarification that makes it easier for users of the NEG to do their jobs. However, this Informational Note looks more like a political tool that is being used to force a highly contested issue into the U.L. standard for portable generators.
Panel Meeting Action: Reject
Panel Statement: The panel reaffirms its original action on Proposal 1-61 which provides examples of power sources as they relate to premises wiring systems. Also see the panel action and statement on Comment 1-23.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12
Comment on Affirmative:
ANTHONY, M.: See my statement on Comment 1-22.

1-26 Log #1494 NEC-P01 **Final Action: Reject**
(100.Premises Wiring (System))

Submitter: Jeff Baldwin, JPB Design and Engineering LLC
Comment on Proposal No: 1-61
Recommendation: Please reject this proposal.
Substantiation: This proposal seeks to include batteries and generators in the definition of premises. Merriam-Webster clearly defines premises (when used as a noun) as:
a) a tract of land with the buildings thereon
b) a building or a part of a building usually with its appurtences (as grounds)
Batteries and generators that are not connected to anything don't come close to the Webster definition of premises, and this is confusing. The NFPA Manual of Style clause 2.3.2 prohibits re-defining common words, and premises is certainly a common word.
The NFPA Glossary of Terms defines the following:
Premises: the land and buildings of a user located on the user's side of the utility-user network point of demarcation. Responsible document is NFPA 70 (the NEC).
Also from the NFPA Glossary of Terms:
Premises Wiring: the circuits located on the user side of the network interface unit
The network point is the transformer, meter or service entrance on the premises. Nothing can be on the user side of a utility when there is no utility present. Batteries and generators are not utilities and must not be treated as such. They also do not fit the definition of a premises in the NFPA Glossary of Terms.
This informational note will only increase confusion for users of the NEC.
Panel Meeting Action: Reject
Panel Statement: The panel reaffirms its original action on Proposal 1-61 which provides examples of power sources as they relate to premises wiring systems. Also see the panel action and statement on Comment 1-23.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12
Comment on Affirmative:
ANTHONY, M.: See my statement on Comment 1-22.

1-27 Log #1537 NEC-P01 **Final Action: Accept**
(100.Premises Wiring (System))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 1-60
Recommendation: Continue to Reject.
Substantiation: The proposed revision is an attempt to exclude portable generators used to supply power to a building or structure from the scope of the NEC.
Read the submitters substantiation. The submitter wants to exclude a portable generator used during a power outage or for temporary purposes from all NEC requirements because in his words it is "unrelated to said premises." If CMP-1 agrees with the submitter, there are serious safety implications created and dozens of other changes that must be made throughout the NEC.

The definition of "Premises Wiring" has served the industry well for decades. Users of the NEC have no problem reading, understanding and applying the defined term "Premises Wiring." While CMP-1 apparently had an interesting discussion on this proposal, we need to focus on the intent of the proposal. A review of proposals and comments in the last NEC cycle and this NEC cycle from this submitter as well as the submitter of proposal 1-58, clearly reveals their intent. The intent is to exclude portable generators supplying power to a structure during a loss of power or any other reason from the scope of the NEC. There is no other reason for this proposal. There is not a problem with this definition. It is crystal clear. Everything on the load side of the service point is included in the scope of the NEC and where there is no service, (power outages or temporary) the power source is also included. If the application of this definition was creating an enforcement issue, CMP-1 would be flooded with proposals.

If this proposed definition is accepted, there are dozens of NEC rules that must be deleted and the purview of the NEC would be limited only to the interior of structures. The NESC will gladly step in and take purview over all outdoor electrical installations.
Panel Meeting Action: Accept
Panel Statement: The panel does not agree with all of the submitter's substantiation.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-3 Log #109 NEC-P08 **Final Action: Accept**
(100.Raceway)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 8-24
Recommendation: The Correlating Committee directs the panel to reconsider the action on this proposal dealing with the word change from "metal" to "metallic", since in accordance with the NEC Style Manual, "metal" is the

correct term as it relates to this proposal.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-8 accepts the Correlating Committee's direction to reconsider. CMP-8 reaffirms its position to Accept in Part, Proposal 8-24 with the text as stated in the Panel Action. The Correlating Committee states that "metal" is the correct term to used based on the NEC Style Manual. "Metallic" is also an acceptable term per the NEC Style Manual and is found in the same list as "metal". "Metallic" is used to describe the material and is used in 366.2. It is noted that "metallic" appears 375 locations and CMP-8 is supportive of a task group to correlate the terms "metal" and "metallic" for consistency throughout the entire NEC, per the Style Manual.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-4 Log #468 NEC-P08 **Final Action: Reject**
(100.Raceway and Informational Note (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 8-25
Recommendation: Revise text to read as follows:
Raceway. An enclosed channel of metal or nonmetallic materials designed expressly for holding wires, cables, or busbars, with additional functions as permitted in this *Code*. ~~Raceways include, but are not limited to, rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquidtight flexible conduit, flexible metallic tubing, flexible metal conduit, electrical nonmetallic tubing, electrical metallic tubing, underfloor raceways, cellular concrete floor raceways, cellular metal floor raceways, surface raceways, wireways, and busways~~
Informational Note: Raceways include, but are not limited to, rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquidtight flexible conduit, flexible metallic tubing, flexible metal conduit, electrical nonmetallic tubing, electrical metallic tubing, underfloor raceways, cellular concrete floor raceways, cellular metal floor raceways, surface raceways, wireways, and busways.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term and the NEC manual of style does not permit the definition to contain the defined term. Definitions are not requirements. Moreover, the definition also contains a list that is simply informational. The proposed changes eliminate the defined term and place the list as information, where it belongs. If the CMP believes that this information is a requirement it should place it somewhere else, perhaps within one or more of the raceway articles.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Panel Meeting Action: Reject
Panel Statement: CMP-8 reaffirms its position to accept in part Proposal 8-24. The submitter has revised text that has been removed per Proposal 8-24.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-5 Log #591 NEC-P08 **Final Action: Reject**
(100.Raceway, Informational Note)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 8-24
Recommendation: Revise text to read as follows:
100 Definitions.
Raceway. An enclosed channel of metallic or nonmetallic materials designed expressly for holding wires, cables, or busbars, with additional functions as permitted in this *Code*.
Informational Note: A raceway is identified ~~within specific article definitions.~~ in articles 342 through 390. Communications raceway is identified in article 800.
Substantiation: It would be a good idea to add a little more information to the informational note.
Panel Meeting Action: Reject
Panel Statement: CMP-8 reaffirms its position to accept in part, Proposal 8-24. The submitter revised text would include articles where the wiring method is not identified as a raceway within their definitions. CMP-8 does not want a list of articles within the definition.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

18-3 Log #501 NEC-P18 **Final Action: Reject**
(100.Receptacle, 406.3.1 and 406.3.2 (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 18-8
Recommendation: Revise text to read as follows:
Receptacle. A receptacle is a contact device installed at the outlet for the connection of an attachment plug. ~~A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is two or more contact devices on the same yoke.~~**406.3 1 Single receptacle.** A single receptacle is a single contact device with no other contact device on the same yoke.
406.3.2 Multiple receptacle. A multiple receptacle is a device with two or more contact devices on the same yoke.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term and the NEC manual of style does not permit the definition to contain the defined term. Definitions are not requirements. The proposed changes eliminate the defined term and places the information into Article 406, where it serves as a valid requirement, if the CMP believes this is a requirement.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Alternate approach to eliminating the defined term is to make the second and third sentences into informational notes, as follows:
Informational Note 1: A single receptacle is a single contact device with no other contact device on the same yoke.
Informational Note 2: A multiple receptacle has two or more contact devices on the same yoke.
Another alternative is to make the second and third sentences into new definitions, as follows:
Single receptacle. A single contact device with no other contact device on the same yoke.
Multiple receptacle. A contact device which has two or more contact devices on the same yoke.
Panel Meeting Action: Reject
Panel Statement: The proposed change to place the descriptions as an informational note would render them unenforceable. The terms are used in multiple articles throughout the NEC and are required to be placed in the definitions as required 2.2.2.1 of the NEC Style Manual.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

18-4 Log #233 NEC-P18 **Final Action: Accept**
(100.Retrofit Kit (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 18-9
Recommendation: The Correlating Committee directs that the panel clarify the panel action on this proposal according to the NEC Style Manual as it relates to the use of the word "Listed" which creates a requirement in a definition.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Delete word "listed".
Panel Statement: The panel accepts the direction of the TCC and has removed the word "listed" from the definition. The listing requirement remains in 410.6 and 600.3.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

18-5 Log #1207 NEC-P18 **Final Action: Accept**
(100.Retrofit Kit (New))

Submitter: Leo F. Martin, Sr., Martin Electrical Consulting
Comment on Proposal No: 18-9
Recommendation: Continue to accept in principle in part.
Substantiation: There are many locations in the 2012 UL White Book that address retrofit kits; therefore, it is appropriate to include a definition of this term in Article 100.
Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

5-6 Log #1060 NEC-P05 **Final Action: Accept in Principle**
(100.Separately Derived System)

Submitter: Michael J. Johnston, National Electrical Contractors Association
Comment on Proposal No: 5-20
Recommendation: Continue to accept the proposal in principle and reword the definition for clarity and combine the two sentences into one as follows:
Separately Derived System. A stand-alone electric supply system other than a service, or a system derived from a power supply source other than a service, that has no direct electrical connections to the circuit conductors of that power supply source other than those established by system grounding and bonding connections.
Substantiation: The proposed revisions do not improve clarity for the current definition. As revised by Proposal 5-20 the definition would not be applicable to some systems that are separately derived. Referring to an entire premises

wiring system or portion thereof a "separately derived system" is inaccurate as the defined term and associated requirements are really about the energy source and not what it eventually supplies. Also, stand-alone separately derived systems are not adequately covered by the current or proposed definition. This comment is an attempt to build on the spirit and intent of proposal 5-20.
Panel Meeting Action: Accept in Principle
Revise the definition to read as follows:
Separately Derived System. An electrical source, other than a service, having no direct connection(s) to circuit conductors of any other electrical source other than those established by grounding and bonding connections.
Panel Statement: The proposed language was simplified. It was also modified to be technically correct because separately derived systems have direct connections to the conductors they supply.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

4-1 Log #44 NEC-P04 **Final Action: Accept**
(100.Solar Photovoltaic System)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-8a
Recommendation: The Correlating Committee directs that the panel clarify the panel action on this proposal to correlate with the panel action on Proposal 4-184 and determine the placement of the definition, Article 100 or 690.2.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Move definition of solar photovoltaic system to Article 100.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-28 Log #1093 NEC-P01 **Final Action: Reject**
(100.Source)

Submitter: Ron B. Chilton, Rep. NC Code Clearing Committee
Comment on Proposal No: 1-64
Recommendation: The Panel should have "Accepted" this proposal.
Substantiation: Due to no explanation of the term "source" used extensively throughout the Code, engineers and electrical contractors attempt to make up a definition based on the manner of installation they desire to use for their particular site. The Code Panel statement in itself is substantiation to indicate the need to address this term used in various Sections of the Code. Webster may include several variations of this word based on intentions of use but in the National Electrical Code, the source is the origin of the energy for the system regardless of what that may be as noted, "source of power". In the Panel's response, no conflict in this term was noted as pertaining to how the Code uses the word, and it does meet the Style Manual's criteria for a definition as noted also in the Panel Statement, that being its use to multiple Code Sections.
Panel Meeting Action: Reject
Panel Statement: The panel reaffirms its original action on this proposal. No additional substantiation has been provided to demonstrate the new definition would not be in conflict with how the generic term "source" is used throughout the NEC. See committee action and statement on Proposal 1-61 which provides examples of sources.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

9-5 Log #45 NEC-P09 **Final Action: Accept**
(100.Substation (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-9
Recommendation: The Correlating Committee clarifies that Code-Making Panel 4 has accepted Proposal 4-89 to transfer the text in 225.70 for substations to Article 490 covering equipment over 600 volts. By this transfer of text, the jurisdiction of the definition of "substation" is now assigned to Code-Making Panel 9 and the existing text in 225.70 is transferred to a new section in Article 490.
The Correlating Committee directs that this proposal be forwarded to Code-Making Panel 9 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The final text is that in proposal 9-8a as modified by the panel action on Comment 9-6.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-6 Log #118 NEC-P09 **Final Action: Accept**
(100.Substation (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-8a
Recommendation: The Correlating Committee directs that the panel clarify the panel action on this proposal with respect to the phrase "under the control of qualified persons". This phrase constitutes a requirement within a definition in violation of the NEC Style Manual.
The Correlating Committee understands that the text of 225.70, Substations, was transferred to Code-Making Panel 9 for placement in Article 490 as shown in the panel action on Proposal 4-89.
Accordingly, Code-Making Panel 9 now has jurisdiction over the definition "substation".
It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 4 for information.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Delete phrase "under the control of qualified persons".
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-7 Log #46 NEC-P09 **Final Action: Accept**
(100.Substation (New) and 225.2)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-10
Recommendation: The Correlating Committee clarifies that Code-Making Panel 4 has accepted Proposal 4-89 to transfer the text in 225.70 for substations to Article 490 covering equipment over 600 volts. By this transfer of text, the jurisdiction of the definition of "substation" is now assigned to Code-Making Panel 9 and the existing text in 225.70 is transferred to a new section in Article 490.
The Correlating Committee directs that this proposal be forwarded to Code-Making Panel 9 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The final text is that in proposal 9-8a as modified by the panel action on Comment 9-6.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

1-29 Log #509 NEC-P01 **Final Action: Reject**
(100.Suitable for Wet Locations)

Submitter: Robert A. Jones, IEC Texas Gulf Coast
Comment on Proposal No: 1-66
Recommendation: Accept proposal 1-66.
Substantiation: I appreciate the "comment on affirmative" by Mr. Hickman; however the reference to 314.15 will not clarify the requirement "suitable for wet locations". The following is the panel statement from Panel 4 to my proposal 4-36 - "Regardless of how well an exterior electrical system is designed and installed there is always a possibility that moisture can collect inside of a raceway, this could be from something as simple as condensation, if moisture does collect inside of a raceway it should be arranged so that the moisture will be able to drain from the raceway. Suitable for wet locations does not mean the raceway is raintight."
There is a need for a definition of "suitable for wet locations" since a technical committee has determined the phrase does not mean raintight. What is the criterion that has to be met in order for an exterior raceway system to be judged "suitable for wet locations"? I do not know of any listing as "suitable for wet locations".
Panel Meeting Action: Reject
Panel Statement: The proposed definition is unnecessary and addresses suitability requirements that are already dealt with generally in Section 110.3(B).
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-30 Log #1242 NEC-P01 **Final Action: Reject**
(100.Suitable for Wet Locations)

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 1-66
Recommendation: I recommend the panel accept proposal 1-66 and add the following definition.
Suitable for Wet Locations. Constructed so that water or other liquids will not enter or accumulate within a raceway, enclosure, outlet box, junction box or

fitting.
Substantiation: There should be a definition in Article 100 for "Suitable for Wet Location". When a product is tested by a testing laboratory there is a very different interpretation for "Suitable for Damp Locations" and Suitable for "Wet Locations" Article 314.15 appears to treat both damp and wet the same.
Panel Meeting Action: Reject
Panel Statement: The proposed definition is unnecessary and addresses suitability requirements that are already dealt with generally in Section 110.3(B).
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

9-8 Log #473 NEC-P09 **Final Action: Accept in Principle**
(100.Switchboard and Informational Note (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 9-13
Recommendation: Revise text to read as follows:
Switchboard. A large single panel, frame, or assembly of panels on which are mounted on the face, back, or both, switches, overcurrent and other protective devices, buses, and usually instruments. ~~Switchboards are generally accessible from the rear as well as from the front and are not intended to be installed in cabinets.~~
Informational Note: Switchboards are generally accessible from the rear as well as from the front and are not intended to be installed in cabinets.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term and the NEC manual of style does not permit the definition to contain the defined term. Definitions are not requirements. The proposed changes eliminate the defined term. An alternative, if CMP 9 believes this is a requirement is to place the information into Article 408, where it would serve as a valid requirement.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Alternate approach, could be as follows (with renumbering of sections 408.3 through 408.5):
408.3 Switchboard. Switchboards shall not be installed as cabinets and shall be permitted to be accessible from the rear as well as from the front.
Panel Meeting Action: Accept in Principle
Revise text to read as follows:
Switchboard. A large single panel, frame, or assembly of panels on which are mounted on the face, back, or both, switches, overcurrent and other protective devices, buses, and usually instruments. These assemblies ~~Switchboards~~ are generally accessible from the rear as well as from the front and are not intended to be installed in cabinets.
Panel Statement: The panel changed the word "switchboards" to "These assemblies" therefore negating the need for an informational note.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

19-2 Log #234 NEC-P19 **Final Action: Reject**
(100.Thermal Protected (as applied to devices), and Thermally Protected (as applied to devices)-(New), 406.4(D)(7) and 550.13(3))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 18-10
Recommendation: It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 19 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Reject
Panel Statement: CMP-19 agrees with the action taken by CMP-18 on Proposal 18-10. Proposal 19-7 is identical to Proposal 18-10 and CMP-19 also rejected the proposal with a very similar statement.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

2-2 Log #264 NEC-P02 **Final Action: Accept**
(100.Uninfinished Basement (New) and 210.8(A)(5))

Submitter: Code-Making Panel 3,
Comment on Proposal No: 2-10
Recommendation: Continue to Reject Proposal 2-10.
Substantiation: Code-Making Panel 3 agrees with the action taken by Code-Making Panel 2 on Proposal 2-10.
This comment was developed by a CMP-3 Task Group and balloted through the entire panel with the following ballot results:
15 Eligible to Vote
13 Affirmative
2 Ballots Not Returned (A.D. Corbin and D.T. Mills)
No Comments on Vote were received
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

1-31 Log #394 NEC-P01 **Final Action: Accept**
(100, Part II Scope)

Submitter: Thomas L. Adams, Macomb, IL
Comment on Proposal No: 1-71
Recommendation: Continue to reject the Proposal.
Substantiation: A review and comparison of the present text of Part II of Article 100 with OSHA 1926 shows the OSHA document breaks at 600 Volts. Changing the Scope of Article 100, Part II will create a conflict between the two documents causing voltages from 600 Volts to 1000 Volts to be in violation of OSHA requirements. In addition, a Note within the OSHA document states that "If the electrical installation is made in accordance with the National Electrical Code ANSI/NFPA 70-1984, exclusive of Formal Interpretations and Tentative Interim Amendments, it will be deemed to be in compliance with 1926.403 through 1926.408, except for 1926.404(b)(1) and 1926.405(a)(2)(ii)(E), (F), (G), and (J)." This would further conflict with the proposed text without significant amendment.
Panel Meeting Action: Accept
Panel Statement: A joint task group appointed by the Technical Correlating Committee consisting of representatives from HVTG, CMP 1 and CMP 8 reviewed proposals rejected by CMP 1 and CMP 8 related to replacing 600V to 1000V. The joint task group concluded that neither the joint task group nor the High Voltage Task Group has the necessary background research to further justify technical substantiation for the rejected proposals. Such substantiation would likely need to come from entities such as the manufacturers or the NFPA Research Foundation. The joint task group recommended that CMP 1 and CMP 8 not change the original actions taken during the 2014 proposal stage. In addition, the Panel does not necessarily agree with all of all the substantiation for the comment.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-32 Log #517 NEC-P01 **Final Action: Accept in Principle**
(100, Part II)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 1-72
Recommendation: Revise text to read as follows:
100 Definitions.
II. Over 600 Volts, Nominal
~~Part II contains definitions applicable only to the articles and parts of articles specifically covering installations and equipment operating at over 600 volts, nominal.~~
The definitions in Part I are intended to apply wherever the terms are used throughout this *Code*. The definitions in Part II are applicable only to articles and parts of the articles specifically covering installations and equipment operating at over 600 volts, nominal.
Substantiation: There is no point in duplicating the same phrase in the adjacent paragraph.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel statement on comment 1-10 which meets the intent of the submitter.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ARTICLE 110 — REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

1-33 Log #1273 NEC-P01 **Final Action: Reject**
(110)

Submitter: Elliot Rappaport, Electro Technology Consultants
Comment on Proposal No: 1-73
Recommendation: Accept proposal.
Substantiation: The term "equipment grounding conductor" has a definite purpose that is not uniquely expressed in the term, i.e. "bond the equipment to a terminal at the source of voltage". As a result, there is a misconception that "grounding", without bonding to the source, will make a system safe. On the contrary, connecting equipment to ground without providing the bonding connection back to the source can make equipment less safe by increasing the time to clear the fault.
The Panel statement that the equipment grounding conductor is used to both bond and ground does not place sufficient significance of the importance of bonding over grounding. Bonding provides sufficient ground fault current back to the source of voltage to operate an overcurrent device and clear the fault quickly. Connection to ground limits the voltage to ground on normally non-current-carrying parts during non-fault conditions. During fault conditions, the value of grounding is minimal since the primary safety concern is to remove the fault voltage as quickly as possible. A path to ground for fault current is not necessary since ground fault current must return to the source of voltage, not to ground.

Renaming this conductor as an "Equipment Bonding Conductor (EBC)" will clarify that the primary purpose of this conductor is to bond to the source in order to provide a known path for ground fault current that will facilitate rapid fault clearing.

It is recognized that the term "EGC" has been in use for a long time and that changing it to EBC will cause some concerns including changing written literature that uses the EGC term. After the initial period of understanding, users will correctly understand the purpose of this conductor and this will enhance the safety of personnel.

The fundamental purpose of this and companion proposals is to clearly state that "systems" are "grounded" and "equipment" is "bonded". The fact that the bonding conductor may be grounded also is secondary to the primary function of bonding.

Panel Meeting Action: Reject

Panel Statement: No evidence has been presented to indicate that the existing definition of Equipment Grounding Conductor has caused confusion. CMP-1 also notes that all components of an electrical system that are bonded together are ultimately bonded to ground, in accordance with Article 250.

The panel reaffirms its original position and action on this proposal and remains consistent with the actions of CMP-5 on this proposal. No additional information has been provided to reverse the original panel action on this proposal. NEC CMP-5 rejected these concepts and proposals during the 2005 NEC cycle through the collective work of a TCC assigned Task Group. The results of that work retained the term "equipment grounding conductor" and included an informational note that provides the clarification that the EGC performs bonding functions.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 1 Abstain: 1

Explanation of Negative:

FLOYD, H.: The panel should accept the original proposal. The proposal improves the technical accuracy of the use of the terms "equipment grounding conductor" and "equipment bonding conductor". The IEEE has reviewed all the statements on this subject by various panels. The following represents the IEEE position on the issue of equipment grounding conductor or equipment bonding conductor. Similar proposals have been presented in the past and have been rejected. Reasons given often relate to cost, significant changes in documentation required, or the fact that knowledgeable people understand the use of this conductor. There is no justification for retaining an incorrect and potentially hazardous electrical installation just because this definition has been used in the NEC for many years. Costs associated with documentation changes should never be an argument where safety is concerned. Further, not all electrical practitioners are knowledgeable in the main intent of this conductor. The intent of the proposed change is to provide a descriptive name to a construction element that has resulted in much misunderstanding with possible hazardous operating conditions in electrical installations. The use of the term "grounding" implies that grounding is its principal function. Although grounding may be desirable, providing an effective fault current path (i.e. bonding) is and should be the emphasis. There are many who assert that a connection to a water pipe meets the needs of equipment grounding, however, this connection does not perform the necessary effective fault current path back to the source. There are two conductors described in the Code performing the same function but named differently. The "bonding jumper" is a short conductor that assures the electrical integrity of enclosure to raceway. The longer conductor, intended to provide a low impedance path to the source, is presently named a "grounding" conductor instead of its real function as a "bonding" conductor. Technically, the definition in Article 100 may be adequate for Panel members and those that teach. Practically, the definition is confusing if the terminology does not fit the function performed. The equipment bonding conductor, as it should be called, provides its primary function whether or not it is grounded. For a grounded system, it is grounded because the system is grounded. For an ungrounded system, it is grounded to limit the voltage due to a lightning strike or contact with a higher voltage system. Changing the name will assist in educating users of the Code as to why they are installing a conductor that needs to be continuous all of the way back to the source.

Explanation of Abstention:

ANTHONY, M.: This concept is one of several in the NEC with more tradition/cultural difficulties than technical difficulties. This change has been needed for a very long time but no one knows the safest way to get us there. If it were easier to drive through the vocabulary of our industry without the risk of Babylonian confusion (likely to create safety risk as a new generation of electrical professionals acclimates itself to the clarification possible with the use of the word "bonding") this committee, and other committees, would accept this concept. But it isn't easy and therein lies the technical problem. I will not add to the difficulty of keeping the discussion alive for the future, however.

1-34 Log #1348 NEC-P01 **Final Action: Reject**
(110)

Submitter: Louis Barrios, American Chemistry Council

Comment on Proposal No: 1-73

Recommendation: The committee should have accepted this proposal.

Substantiation: The primary function of the conductor presently defined as an "equipment grounding conductor" is actually a bonding function. The grounding electrode conductor grounds systems and equipment. Accepting this change will help increase usability and understanding of the associated requirements.

Panel Meeting Action: Reject

Panel Statement: No evidence has been presented to indicate that the existing definition of Equipment Grounding Conductor has caused confusion. CMP-1 also notes that all components of an electrical system that are bonded together are ultimately bonded to ground, in accordance with Article 250.

The panel reaffirms its original position and action on this proposal and remains consistent with the actions of CMP-5 on this proposal. No additional information has been provided to reverse the original panel action on this proposal. NEC CMP-5 rejected these concepts and proposals during the 2005 NEC cycle through the collective work of a TCC assigned Task Group. The results of that work retained the term "equipment grounding conductor" and included an informational note that provides the clarification that the EGC performs bonding functions.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 2

Explanation of Negative:

BARRIOS, L.: The ACC continues to support that changing the term "equipment grounding conductor" to "equipment bonding conductor" would help clarify the primary function of this conductor and to help clarify existing confusion in industry associated with bonding and grounding.

FLOYD, H.: The panel should accept the original proposal. The proposal improves the technical accuracy of the use of the terms "equipment grounding conductor" and "equipment bonding conductor". The IEEE has reviewed all the statements on this subject by various panels. The following represents the IEEE position on the issue of equipment grounding conductor or equipment bonding conductor. Similar proposals have been presented in the past and have been rejected. Reasons given often relate to cost, significant changes in documentation required, or the fact that knowledgeable people understand the use of this conductor. There is no justification for retaining an incorrect and potentially hazardous electrical installation just because this definition has been used in the NEC for many years. Costs associated with documentation changes should never be an argument where safety is concerned. Further, not all electrical practitioners are knowledgeable in the main intent of this conductor. The intent of the proposed change is to provide a descriptive name to a construction element that has resulted in much misunderstanding with possible hazardous operating conditions in electrical installations. The use of the term "grounding" implies that grounding is its principal function. Although grounding may be desirable, providing an effective fault current path (i.e. bonding) is and should be the emphasis. There are many who assert that a connection to a water pipe meets the needs of equipment grounding, however, this connection does not perform the necessary effective fault current path back to the source. There are two conductors described in the Code performing the same function but named differently. The "bonding jumper" is a short conductor that assures the electrical integrity of enclosure to raceway. The longer conductor, intended to provide a low impedance path to the source, is presently named a "grounding" conductor instead of its real function as a "bonding" conductor. Technically, the definition in Article 100 may be adequate for Panel members and those that teach. Practically, the definition is confusing if the terminology does not fit the function performed. The equipment bonding conductor, as it should be called, provides its primary function whether or not it is grounded. For a grounded system, it is grounded because the system is grounded. For an ungrounded system, it is grounded to limit the voltage due to a lightning strike or contact with a higher voltage system. Changing the name will assist in educating users of the Code as to why they are installing a conductor that needs to be continuous all of the way back to the source.

1-35 Log #900 NEC-P01 **Final Action: Reject**
(110.9)

Submitter: Lawrence W. Forshner, Bard, Rao + Athanas Consulting Engineers LLC

Comment on Proposal No: 1-86

Recommendation: This proposal should be accepted, or accepted in principle with an informational note referencing 705.16.

Substantiation: "705.16 Interrupting and Short-Circuit Current Rating. Consideration shall be given to the contribution of fault currents from all interconnected power sources for the interrupting and short-circuit current ratings of equipment on interactive systems." Code rules from Chapter 7 can modify rules from Chapter 1. However there is still no clear direction for the designer when two sources interconnect for 6 cycles (100 milliseconds). The general consensus of all the equipment manufacturer's application engineers that I have spoken to, is that the probability of a fault to ground or bolted short circuit during a.1 second closed transition event, is so unlikely that engineering judgment can be used to rule it out. Thus they have given *consideration* of the fault current contributions from two interactive power sources and have determined that the risk is insufficient to warrant the cost of **higher** AIC rated equipment., bigger rooms etc.

Panel Meeting Action: Reject

Panel Statement: The submitter provided multiple options and has not provided specific language that the panel can consider and is therefore not in

proper format in accordance with 4.4.5(c) and (d) of the Annual 2013 NFPA Regulations Governing Committee Projects.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-36 Log #1350 NEC-P01 **Final Action: Accept**
(110.9)

Submitter: Louis Barrios, Shell Global Solutions
Comment on Proposal No: 1-85a
Recommendation: Change the first sentence in the panel's proposed text to "Equipment intended to interrupt current at fault levels shall have an interrupting rating at nominal circuit voltage sufficient for the current that is available at the line terminals of the equipment."
Substantiation: This was an important change made by the panel to revert back to the 2008 Code language to improve the clarity of this section. One more improvement can be made, and that is to make both statements parallel structure. This proposed change relocates "nominal circuit voltage" in the sentence to indicate the "interrupting rating at nominal circuit voltage" and now makes both statements in this section parallel in structure.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-37 Log #19 NEC-P01 **Final Action: Accept**
(110.9(A) and (B) (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 1-88
Recommendation: The Correlating Committee directs that the panel clarify the panel action on this proposal as it relates to the action taken on Proposal 1-85a for the accepted text revisions.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: Proposal 1-85a clarifies existing text. Proposal 1-88 excludes methods for other than fault levels such as load factor inclusion of load current and was rejected by this Panel. It has no impact on the Panel's action on 1-85a. 110.9 should read as follows per the Panel's action on Proposal 1-85a as modified by Comment 1-36:
110.9 Interrupting Rating. Equipment intended to interrupt current at fault levels shall have an interrupting rating at nominal circuit voltage sufficient for the current that is available at the line terminals of the equipment.
Equipment intended to interrupt current at other than fault levels shall have an interrupting rating at nominal circuit voltage sufficient for the current that must be interrupted.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-38 Log #901 NEC-P01 **Final Action: Reject**
(110.10)

Submitter: Lawrence W. Forshner, Bard, Rao + Athanas Consulting Engineers LLC
Comment on Proposal No: 1-89
Recommendation: This proposal should be accepted, or accepted in principle with an informational note referencing 705.16.
Substantiation: "705.16 Interrupting and Short-Circuit Current Rating. Consideration shall be given to the contribution of fault currents from all interconnected power sources for the interrupting and short-circuit current ratings of equipment on interactive systems." Code rules from Chapter 7 can modify rules from Chapter 1. However there is still no clear direction for the designer when two sources interconnect for 6 cycles (100 milliseconds). The general consensus of all the equipment manufacturer's application engineers that I have spoken to, is that the probability of a fault to ground or bolted short circuit during a.1 second closed transition event, is so unlikely that engineering judgment can be used to rule it out. Thus they have given *consideration* of the fault current contributions from two interactive power sources and have determined that the risk is insufficient to warrant the cost of higher AIC rated equipment., bigger rooms etc.
Panel Meeting Action: Reject
Panel Statement: The submitter provided multiple options and has not provided specific language that the panel can consider and is therefore not in proper format in accordance with 4.4.5(c) and (d) of the Annual 2013 NFPA Regulations Governing Committee Projects.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-39 Log #291 NEC-P01 **Final Action: Reject**
(110.12(C) (New))

Submitter: T. J. Woods, Wyoming Electrical JATC
Comment on Proposal No: 1-92
Recommendation: Add new text to read as follows:
110.12<u>(C) Installation. All wiring, protection, wiring methods, materials, and equipment in this code shall be installed by qualified persons.</u>
<u>Informational Note: See Article 100 for the definition of qualified person.</u>
Substantiation: Only qualified persons should be installing electrical systems because of its hazardous nature, to protect persons and property. I respectfully disagree with the panel's decision to reject this proposal. I, in agreement with panel members Palmer Hickman and David Hittinger, cannot think of any situation where it would be practical or legitimate for anyone other than a qualified person to perform electrical installations. Please grant this proposal a reconsideration.
Panel Meeting Action: Reject
Panel Statement: The NEC references to qualified persons are in contemplation of specific requirements and not to be applied generally.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11 Negative: 1
Explanation of Negative:
HICKMAN, P.: We reaffirm our ballot statement from Proposal 1-92. It is not unreasonable to expect that electrical equipment be installed by one who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved.

1-40 Log #1412 NEC-P01 **Final Action: Reject**
(110.12(C))

Submitter: Keith Fager, Bayer CropScience
Comment on Proposal No: 1-92
Recommendation: Add text to read as follows:
<u>110.12(C) Installation. All wiring, protection, wiring methods, materials, and equipment in this code shall be installed by qualified persons.</u>
<u>Informational Note: See Article 100 for the definition of qualified person.</u>
Substantiation: The panel action should have been Accept. A qualified person is "one who has the skills and knowledge related to the construction and operation …". The proposal is consistent with 90.1 (A) and 90.1 (C). Installation of electrical systems by unqualified persons is not likely to safeguard persons and property from electrical hazards. In many cases, the AHJ also licenses electricians to ensure electrical installations within their jurisdictions are installed by qualified persons.
Panel Meeting Action: Reject
Panel Statement: The NEC references to qualified persons are in contemplation of specific requirements and not to be applied generally.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11 Negative: 1
Explanation of Negative:
HICKMAN, P.: See our explanation of negative vote on Comment 1-39.

1-41 Log #1317 NEC-P01 **Final Action: Reject**
(110.14)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 1-93
Recommendation: Revise text to read as follows:
110.14 Electrical Connections.
Informational Note: Many terminations and equipment are either marked with tightening torque or are identified as to tightening torque in the installation instructions provided. <u>If this information is unavailable, see Informative Annex.</u>
[ROP 1–93]
Substantiation: Let's put a little more information in the informational note.
Panel Meeting Action: Reject
Panel Statement: The proposed text is unnecessary, because Chapter 9, Table 10 is already referenced in the requirement. The recommended Informational Note is contrary to the requirements of 110.3(B).
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-42 Log #453 NEC-P01 **Final Action: Reject**
(110.14(A))

Submitter: Robert G. Fahey, City of Janesville
Comment on Proposal No: 1-94
Recommendation: Revise text to read:
110.14(A) Terminals. Connection of conductors to terminal parts shall ensure a thoroughly good connection without damaging the conductors and shall be made by means of pressure connectors (including set-screw type), solder lugs, or splices to flexible leads. Connection by means of wire-binding screws or studs and nuts that have upturned lugs or the equivalent shall be permitted for 10 AWG or smaller conductors. <u>Device terminals utilized for stranded wire shall be constructed to encapsulate all strands of the conductors with clamps or similar means.</u> Terminals for more than one conductor and terminals used to connect aluminum shall be so identified.
Substantiation: I have provided pictures of recent installations where standard THHN, THWN stranded wires, not fine stranded wire, are terminated on devices which Underwriters Laboratories (UL) have indicated are listed for stranded conductors. The pictures illustrate the problems in which I encounter in many installations where the stranded wire, typically #14 through #10 are

terminated on devices such as switches, receptacles and lighting fixtures in which the device terminal does not capture all of the strands of the conductor which is terminated. The termination's which present the issues are the lower grade of devices (residential grade devices) in which the terminals do not appear to be manufactured for stranded conductors, but instead are more compatible for solid conductors. I would encourage the Code Panel members would reconsider the rejection of the additional language I have proposed, the new text would provide a much better and safer termination of these conductors.

Note: Supporting Material is available for review at NFPA headquarters.

Panel Meeting Action: Reject

Panel Statement: The proposed change is more appropriately addressed in the product standards for wiring devices that include terminals for connecting stranded or solid conductors. Unless otherwise marked, product terminations are evaluated for solid and stranded conductors.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

Comment on Affirmative:

ANTHONY, M.: This practice probably appears in one of the National Electrical Installation Standards developed by the National Electrical Contractors Association.

1-43 Log #20 NEC-P01 **Final Action: Accept**
(110.14(C)(1))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 1-98

Recommendation: The Correlating Committee directs that the panel clarify the panel action on this proposal as it relates to the accepted text by following the same format for the new second sentence. The action should be clarified as to which table is being referenced.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Panel Statement: See committee actions and statements on Comments 1-44 and 1-45.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

1-44 Log #1112 NEC-P01 **Final Action: Accept in Principle**
(110.14(C)(1))

Submitter: Phil Simmons, Simmons Electrical Services

Comment on Proposal No: 1-98

Recommendation: Revise the text of the 2014 NEC ROP Draft as follows:

(1) Equipment Provisions. The determination of termination provisions of equipment shall be based on 110.14(C)(1)(a) or (C)(1)(b). Unless the equipment is listed and marked otherwise, conductor ampacities used in determining equipment termination provisions shall be based on Table 310.15(B)(16) as appropriately modified by 310.15(B)(7). ~~Table 400.5(A)(1) ampacities shall be used for flexible cords and cables.~~

Substantiation: The new text allowing Table 400.5(A)(1) ampacities to be used for flexible cords should be deleted. Some of these ampacities are higher than provided for in Table 310.15(B)(16). No documentation was submitted to show that electrical equipment manufacturers have designed or tested their equipment at these higher ampacities. It also seems the UL Safety standard would have to be revised to determine that the terminals can function safely at these elevated ampacities.

Panel Meeting Action: Accept in Principle

Panel Statement: See committee action on Comment 1-45 which meets the submitter's intent.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

1-45 Log #1499 NEC-P01 **Final Action: Accept**
(110.14(C)(1))

Submitter: Alan Manche, Schneider Electric

Comment on Proposal No: 1-98

Recommendation: The panel should reconsider and reject this proposal 1-98.

Substantiation: A few fundamental issues exist with this proposal. The first concern is that Table 400.5 does not exist, as there are multiple ampacity tables in NEC 400.5. The more significant concern is the permission to use the ampacities found in these tables. Thermal testing of equipment is performed in accordance with wire using the ampacities found in Table 310.15(B)(16). Unless the equipment is specifically Listed for the use of smaller conductors at the same ampacity such as Table 400.5(A)(2) will permit, the general permission granted by the acceptance of proposal 1-98 places thermal performance of equipment at risk and more specifically the terminal integrity itself. The existing language permits equipment to be Listed for such use. This proposal should be rejected.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

1-46 Log #272 NEC-P01 **Final Action: Accept**
(110.15 (New))

Submitter: Code-Making Panel 19,

Comment on Proposal No: 1-131

Recommendation: Reject Proposal 1-131.

Substantiation: The consensus of Code Making Panel 19 (CMP-19) Task Force is we do not believe that this Proposal is needed, and in any case, is probably unenforceable, mainly due to inspection before occupancy and before the arrangement of furniture and appliances after occupancy.

CMP-19 is periodically asked to incorporate Article 100 definitions and normally responds that specific requirements should be located in specific sections for clarity of purpose. L. Barrios of Panel 1 had a similar concern stated in his comment on negative balloting on Proposal 1-131.

GFCI receptacles have been around for decades and as a matter of course, GFCI receptacles are not always periodically tested. Making them "readily accessible" will not change this fact. As an example, kitchen counter backsplashes are probably the most readily accessible area in a home but questioning of people over the years leads to the conclusion that they aren't tested. An example of a readily accessible area that could quickly become inaccessible is a circuit breaker panel on the outside of a home where gardening tools, etc., have been stored against or in front of the panel door.

CMP-19's response to the submitter of Proposal 1-131's substantiation is that it is very dated. The field survey mentioned in the substantiation was completed in January of 2001, 11 years ago. The results of this survey caused a revision to UL Standard 943 that by UL's testing of GFCI's a year after the change, showed a greatly improved survivability rate.

Some people don't periodically test their GFCI's, regardless of the recommendation of the manufacturer, therefore, some manufacturers have produced self-testing devices, which are not presently required by the UL Standard or by the NEC. This has led to proposed revisions in UL Standard 943 to require self-testing and shutoff at end of life in the next edition.

This comment was developed by a CMP-19 Task Group and balloted through the entire panel with the following ballot results:

14 Eligible to vote

10 Affirmative

2 Negative (See voting comments below)

2 Ballots Not Returned (S.R. Goodman and B.A. Hopkins)

NEGATIVE:

W. ELLIOTT: I agree with Mr. P. Hickman: There is inadequate substantiation to include AFCI in this proposal. We should not be in the business of anticipating future commercial products. Furthermore, very little substantiation is provided concerning accessible versus readily accessible.

M.L. ZIEMAN: I concur with Mr. Barrios' negative comment that specific requirements should be placed in the specific sections that apply to these devices and not in Article 110. I concur with Mr. Hickman's negative comment that "This proposed recommendation is overly broad and restrictive". Based on the above, I also concur with Mr. Hittinger's negative comments.

The proposal would make it a code violation to place a chair, waste can our similar piece of common household or office furniture in front of a wall receptacle.

Panel Meeting Action: Accept

Panel Statement: The panel does not necessarily agree with all of the submitter's substantiation.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

1-47 Log #119 NEC-P01 **Final Action: Accept**
(110.16)

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 9-14a

Recommendation: The Correlating Committee understands that the panel action on this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7.

It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 1 for action.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

1-48 Log #969 NEC-P01 **Final Action: Reject**
(110.16)

Submitter: Daleep C. Mohla, DCM Electrical Consulting Services, Inc.

Comment on Proposal No: 1-103

Recommendation: The proposal should have been accepted.

Substantiation: Evaluating the potential arc flash hazard during the design stage will provide user/owner of the degree of hazard before equipment installation is done and an opportunity to reduce the hazards by an alternative design. Alternative design could use current limiting devices and/or smaller size transformers to reduce the hazard These options cannot be easily exercised after equipment is installed. This is the essential principle of safety by design- eliminate or reduce the hazard during design. Providing a label with arc flash hazard warning without quantifying the hazards transfers the problem to operating and maintenance personnel with no possibility of reducing the hazard. Personal Protective Equipment (PPE) does not protect against all arc flash hazards and only reduces the risk if proper PPE is used. Optimum protection is reduction of hazards during the design stage. Calculations have to be done to ensure equipment has proper interrupting rating and short circuit raing. At the same time, arc flash hazard calculation should be done to improve the safety. This will also ensure that AHJ can check and enforce this requirement before equipment is put in service.

Panel Meeting Action: Reject

Panel Statement: The panel reaffirms its original position and action on Proposal 1-103. Additional substantiation has not been provided that would warrant including the proposed additional requirements for the label. The concerns of the submitter are addressed in NFPA 70E, *Standard for Electrical Safety in the Workplace*, which deals with workplace safety requirements and not installations. Refer to Informational Note 1.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 11 Abstain: 1

Explanation of Abstention:

ANTHONY, M.: The practical effect of the submitter's original proposal and comment is that PPE information would be required for a certificate of occupancy. The committee prefers the requirement remain in NFPA 70E where workplace safety practices are more fully developed and includes the recommendation that equipment be de-energized instead -- the safest practice -- thus removing the need for PPE.

1-49 Log #970 NEC-P01 **Final Action: Reject**
(110.16)

Submitter: Daleep C. Mohla, DCM Electrical Consulting Services, Inc.

Comment on Proposal No: 1-104

Recommendation: Revise text to read as follows:

Arc-Flash Hazard Warning. Electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers, that are in other than dwelling units, and are likely to require **<u>opening and closing of disconnecting device</u>**, examination, adjustment, servicing, or maintenance while energized shall be field marked to warn qualified persons of potential electric arc flash hazards. The marking shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

Substantiation: Operation has been replaced by a descriptive term "opening and closing of disconnect device which is normally understood to mean operation of the equipment.

Opening and closing of the disconnect devices is likely to pose the greatest risk to person performing this work due to possibility of failure of the equipment and resulting arc flash. Risk of arc flash is greatest during change of state of the disconnect device. Personnel opening or closing the disconnect device need to be warned of such risk.

Panel Meeting Action: Reject

Panel Statement: Inadequate substantiation has been provided to support the submitter's claim that opening and closing disconnecting devices is "likely to pose the greatest risk to persons performing this work."

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 1 Abstain: 1

Explanation of Negative:

HICKMAN, P.: Panel 1 asked the submitter to clarify what was meant by "operation" in Proposal 1-104. He has done so. We submit that "operation" and "opening and closing of disconnecting device" appears to be no more restrictive than the existing provisions such as "examination" for example.

Explanation of Abstention:

ANTHONY, M.: This one of those "common sense" concepts with a lot of anecdotal evidence that supports the submitter's claim (especially under load) but is difficult, uneconomical, or both, to substantiate with sufficient data.

1-50 Log #1306 NEC-P01 **Final Action: Reject**
(110.16)

Submitter: James M. Imlah, Hillsboro, OR

Comment on Proposal No: 1-104

Recommendation: Revise text to read as follows:

110.16 Arc-Flash Hazard Warning.

Electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers, that are in other than dwelling units, and are likely to require <u>operation,</u> examination, adjustment, servicing, or maintenance while energized shall be field marked to warn qualified persons of potential electric arc flash hazards. The marking shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

Substantiation: Asking the panel to reconsider their action of "Reject" to "Accept" by the addition of the word "operation" within 110.16 NEC.

Operation as defined in Webster's dictionary is performance of practical work or something involving a practical application. "Operation" is the exertion of power (force) or a method of functioning that can be manual or automatic with the use of preset protection devices. Operation is showing the intent of action or intent of purpose either manual operation or sensing action (device tripping or fuse blowing) as part of the system deisgn. It is when there is an action (intentional) or reaction (unintentional) condition to occur when a higher fault current usually exits.

Why as electricians and inspectors are we taught to not stand in front of electrical equipment of any type when it is being energized, or de-energized, one should always be to the side from the possible direct action of power flow? Why are their arc shields on disconnects, but for arc fault condition upon opening and closing of any electrical devices. It is important to re-affirm that an arc-flash hazard does exist so persons are aware, please remember not all persons are qualified, trained, or understand the affects of arc-flash when and if they perform an action.

Panel Meeting Action: Reject

Panel Statement: The use of the term "operation" as proposed is overly broad and implies that all the equipment identified in this section poses an arc-flash hazard.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 11 Negative: 1

Explanation of Negative:

HICKMAN, P.: See our explanation of negative vote on Comment 1-49.

1-51 Log #1318 NEC-P01 **Final Action: Reject**
(110.16 and 110.24)

Submitter: James F. Williams, Fairmont, WV

Comment on Proposal No: 1-112

Recommendation: Revise text to read as follows:

110.16 Arc-Flash Hazard Warning. Electrical equipment, such as switchboards, switchgear, panelboards, industrial control panels, meter socket enclosures, and motor control centers, ~~that are in other than dwelling units,~~ and are likely to require examination, adjustment, servicing, or maintenance while energized shall be field or factory marked to warn qualified persons of potential electric arc flash hazards. The marking shall meet the requirements in Section 110.21(B) and shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

<u>*Exception: Service equipment in dwellings with services not greater than 400A and not greater than 240V line-to-line shall not be subject to the requirements of Section 110.16.*</u>

110.24 Available Fault Current.

(A) Field Marking. Service equipment ~~in other than dwelling units~~ shall be legibly marked in the field with the maximum available fault current. The field marking(s) shall include the date the fault current calculation was performed and be of sufficient durability to withstand the environment involved.

<u>*Exception: Service equipment in dwellings with services not greater than 400A and not greater than 240V line-to-line shall not be subject to the requirements of Section 110.24.*</u>

Substantiation: THIS IS A SAFETY ISSUE. Arc flash hazard is a function of voltage and available current. The location of the equipment is not a factor in arc flash.

Multi-family building and massive single family dwellings may present arc flash hazards comparable to industrial installations.

The intent of the changes is to apply Sections 110.16 and 110.24 to equipment that presents a hazard in buildings containing dwellings.

Panel Meeting Action: Reject

Panel Statement: The submitter has not provided adequate technical substantiation to support this comment and the current and voltage levels indicated.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

1-52 Log #1413 NEC-P01 **Final Action: Accept in Part**
(110.16)

Submitter: Keith Fager, Bayer CropScience

Comment on Proposal No: 1-101

Recommendation: Revise proposal text as follows:

110.16 Arc-Flash Hazard Warning. Electrical equipment, such as switchboards<u>, switchgear</u>, panelboards, industrial control panels, meter socket enclosures, and motor control centers, that are in other than dwelling units, and are likely to require examination, adjustment, servicing, or maintenance while energized shall be field marked to warn qualified persons of potential arc flash hazards. The marking shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment. <u>The marking shall include the necessary information to select the work practices and PPE appropriate for the level of hazard to which the qualified person will be exposed.</u>

Substantiation: Panel Action should have been Reject. The durability of the marking is covered by 110.21. The detailed information in the proposal is too restrictive and doesn't coordinate with the requirements in NFPA 70E. The label information requirements in NFPA 70 should be the minimum information required for a worker to use the proper work practices and PPE to protect himself or herself. If more detailed hazard information is not included

there is no reason to require the marking or label at all. By definition a qualified person is already aware of the arc flash hazard. The proposed text is general and will not have to be revised to coordinate with revisions to NFPA 70E. Marking durability is covered by 110.21. Informing the worker of the level of the hazard is related to the equipment installation and enables the worker to select the proper work practices and PPE as outlined in NFPA 70E.
Panel Meeting Action: Accept in Part
Panel Statement: The panel accepts the part to add "switchgear" in the first sentence according to the Panel's action on Comment 1-47 (Proposal 9-14a). The panel rejects the new sentence on marking according to the panel action and statement on Comment 1-48.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-53 Log #1414 NEC-P01 **Final Action: Accept in Part**
(110.16)

Submitter: Keith Fager, Bayer CropScience
Comment on Proposal No: 1-103
Recommendation: Panel action should have been "Accept in Principle". Revise proposal text as follows:
110.16 Arc-Flash Hazard Warning. Electrical equipment, such as switchboards<u>, switchgear</u>, panelboards, industrial control panels, meter socket enclosures, and motor control centers, that are in other than dwelling units, and are likely to require examination, adjustment, servicing, or maintenance while energized shall be field marked to warn qualified persons of potential arc flash hazards. The marking shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment. <u>The marking shall include the necessary information to select the work practices and PPE appropriate for the level of hazard to which the person will be exposed.</u>
Substantiation: By definition, a qualified person is aware of the potential arc flash hazard. If the degree of the hazard or the minimum PPE requirements are not included on the label, the label does not contribute to the safety of the electrician in the field. The design and installation of the electrical system determines the incident energy level of the arc flash hazard, so the level of the hazard is related to installation and not work practices. This information would then be used to develop procedures and work practices required for the work on that specific equipment and its associated hazard.
Panel Meeting Action: Accept in Part
Revise text to read as follows:
110.16 Arc-Flash Hazard Warning. Electrical equipment, such as switchboards<u>, switchgear</u>, panelboards, industrial control panels, meter socket enclosures, and motor control centers, that are in other than dwelling units, and are likely to require examination, adjustment, servicing, or maintenance while energized shall be field marked to warn qualified persons of potential arc flash hazards. The marking shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.
Panel Statement: The panel accepts the part to add "switchgear" in the first sentence according to the Panel's action on Comment 1-47 (Proposal 9-14a). The panel rejects the new sentence on marking according to the panel action and statement on Comment 1-48.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-54 Log #1415 NEC-P01 **Final Action: Accept in Part**
(110.16)

Submitter: Keith Fager, Bayer CropScience
Comment on Proposal No: 1-105
Recommendation: Panel action should have been Reject. Paragraph should be revised as follows:
110.16 Arc-Flash Hazard Warning. Electrical equipment, such as switchboards<u>, switchgear</u>, panelboards, industrial control panels, meter socket enclosures, and motor control centers, that are in other than dwelling units, and are likely to require examination, adjustment, servicing, or maintenance while energized shall be field marked to warn qualified persons of potential arc flash hazards. The marking shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment. <u>The marking shall include the necessary information to select the work practices and PPE appropriate for the level of hazard to which the qualified person will be exposed.</u>
Substantiation: By definition, a qualified person is already aware of the potential arc flash hazard. A factory applied label can not be anything more than a general warning of the hazard. The current requirements for the label don't include listing specific incident energy levels or PPE requirements and it's not clear who is responsible for applying the marking or label (see Proposal 1-105 explanation of negative). The installing contractor may or may not have the resources and information to conduct an arc flash study, and if they do their contract would have to include that in the scope of work. If the degree of the hazard or minimum level of PPE is not going to be identified on the label, the required label does nothing to increase the safety of the qualified person(s) working on the equipment. The proposed text is general and will not have to be revised to coordinate with revisions to NFPA 70E.
Panel Meeting Action: Accept in Part
Panel Statement: The panel accepts the part to add "switchgear" in the first sentence according to the panel's action on Comment 1-47 (Proposal 9-14a). The panel rejects the new sentence on marking according to the panel action and statement on Comment 1-48.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-55 Log #1416 NEC-P01 **Final Action: Reject**
(110.16)

Submitter: Keith Fager, Bayer CropScience
Comment on Proposal No: 1-105
Recommendation: Panel action should have been Reject. Paragraph should be deleted.
~~**110.16 Arc-Flash Hazard Warning.** Electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers, that are in other than dwelling units, and are likely to require examination, adjustment, servicing, or maintenance while energized shall be field marked to warn qualified persons of potential electric arc flash hazards. The marking shall be located so as to be visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.~~
Substantiation: By definition, a qualified person is already aware of the potential arc flash hazard. A factory applied label can not be anything more than a general warning of the hazard. The current requirements for the label don't include listing specific incident energy levels or PPE requirements and it's not clear who is responsible for applying the marking or label (see Proposal 1-105 explanation of negative). The installing contractor may or may not have the resources and information to conduct an arc flash study, and if they do their contract would have to include that in the scope of work. If the degree of the hazard or minimum level of PPE is not going to be identified on the label, the required label does nothing to increase the safety of the qualified person(s) working on the equipment. This paragraph is not coordinated with 70E. If the AHJ has adopted 70E, would the installation have to have the label required by 110.16 and the more detailed label required by 70E?
Panel Meeting Action: Reject
Panel Statement: Adequate technical substantiation has not been provided to delete this section. The panel reaffirms the need for arc-flash hazard warnings covered by this section.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-56 Log #1417 NEC-P01 **Final Action: Accept in Part**
(110.16)

Submitter: Keith Fager, Bayer CropScience
Comment on Proposal No: 1-107
Recommendation: Panel action should have been Reject. Paragraph should be revised as follows:
110.16 Arc-Flash Hazard Warning. Electrical equipment, such as switchboards<u>, switchgear</u>, panelboards, industrial control panels, meter socket enclosures, and motor control centers, that are in other than dwelling units, and are likely to require examination, adjustment, servicing, or maintenance while energized shall be field marked to warn qualified persons of potential arc flash hazards. The marking shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment. <u>The marking shall include the necessary information to select the work practices and PPE appropriate for the level of hazard to which the qualified person will be exposed.</u>
Substantiation: By definition, a qualified person is already aware of the potential arc flash hazard. A factory applied label can not be anything more than a general warning of the hazard. The current requirements for the label don't include listing specific incident energy levels or PPE requirements and it's not clear who is responsible for applying the marking or label (see Proposal 1-107 explanation of negative). The installing contractor may or may not have the resources and information to conduct an arc flash study, and if they do their contract would have to include that in the scope of work. If the degree of the hazard or minimum level of PPE is not going to be identified on the label, the required label does nothing to increase the safety of the qualified person(s) working on the equipment. The proposed text is general and will not have to be revised to coordinate with revisions to NFPA 70E.
Panel Meeting Action: Accept in Part
Panel Statement: The panel accepts the part to add "switchgear" in the first sentence according to the panel's action on Comment 1-47 (Proposal 9-14a). The panel rejects the new sentence on marking according to the panel action and statement on Comment 1-48.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-57 Log #405 NEC-P01 **Final Action: Reject**
(110.17 (New))

Submitter: Russel LeBlanc, The Peterson School of Engineering
Comment on Proposal No: 1-110
Recommendation: Continue to accept this proposal as modified by the CMP.
Substantiation: Thank you. This has been a long battle (since the 2002 NEC) for me trying to get the wording just right and trying to get this requirement in the NEC. This workspace encroachment problem has been and continues to be a real threat to worker safety. While no signage is ever a guarantee for safety, if just one injury or catastrophe is prevented because somebody DID pay attention to the sign, then it is worth the time and effort to install the signage!
Panel Meeting Action: Reject
Panel Statement: After further consideration and discussion by the panel, the value of additional marking to support existing requirements is not clear. In addition to the substantiation provided with Comment 1-59, the panel is concerned about the need for a label as the clear space requirements are already in the Code.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12
Comment on Affirmative:
HITTINGER, D.: The panel should have removed the reference to the substantiation in comment 1-57. See my explanation on comment 1-59.

1-58 Log #1007 NEC-P01 **Final Action: Reject**
(110.17 (New))

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 1-110
Recommendation: Revise text to read as follows:
110.17 Working Space Marking. Equipment working space required <u>by 110.27(A)</u> ~~elsewhere in this code~~ shall be field marked to indicate the working space required…(remainder unchanged).
Substantiation: According to the opening statement of Section 110.27, *all* electrical equipment requires working space. Section 110.27(A) gives specific dimensions for equipment that is likely to require examination, adjustment, etc. while energized. As currently proposed, literally every piece of electrical equipment would have to have the markings discussed in this section.
Panel Meeting Action: Reject
Panel Statement: The action taken on Comment 1-59 removed the section this comment is directed toward and therefore it is no longer needed. In addition, there may be other sections where this text is in the code that were not included in the comment.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-59 Log #1346 NEC-P01 **Final Action: Accept**
(110.17 (New))

Submitter: Louis Barrios, American Chemistry Council
Comment on Proposal No: 1-110
Recommendation: The committee action should have been to reject this proposal.
Substantiation: Equipment markings to indicate safe working spaces are typically intended for non-qualified persons who may place boxes and other obstacles in front of electrical equipment within the working space. Labels on equipment and lines on the floor have not proven to be a 100% effective deterrent in preventing obstacles from being placed in the safe working space. There is also a concern that additional labeling will add additional clutter on the front panels of electrical equipment, further complicating the ability to read the other safety markings.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
HICKMAN, P.: We find the negative vote and ballot statement of Mr. Hittinger persuasive.
HITTINGER, D.: The Panel voted 11-1 to accept proposal 1-110. They reversed and rejected based on one comment. The comment substantiation states “labels on equipment and lines on the floor have not been an effective deterrent in preventing obstacles from being placed in the safe working space”. The proposal was to add a label that does not exist. There is no compelling substantiation to reject the proposal.
Comment on Affirmative:
ANTHONY, M.: Our interest urges electrical manufacturers to innovate product solutions that resolve the site specific factors that make conformity to the NEC work space rules difficult from an operations and maintenance standpoint.
LABRAKE, JR., N.: Final Code compliance and maintenance of that compliance is the responsibility of the owner.

1-60 Log #1500 NEC-P01 **Final Action: Accept in Principle**
(110.21)

Submitter: Alan Manche, Schneider Electric
Comment on Proposal No: 1-114
Recommendation: The panel should reconsider this proposal and only accept the newly proposed Informational Note and reject the prescriptive marking requirements in the new text proposed in 110.21(B).
~~(B) Field-Applied Markings. Where caution, warning, or danger signs or labels are required by this code, the labels shall meet the following requirements.~~
~~1. The following colors shall be used for the hazard labels.~~
~~a. DANGER Label: Black text, with white and red background~~
~~b. WARNING Label: Black text with white and orange background~~
~~c. CAUTION Label: Black text with yellow and white background~~
~~2. The label shall be permanently affixed to the equipment or wiring method and shall not be hand written.~~
~~3. The label shall be suitable for the environment where it is installed.~~
Substantiation: ANSI Z535.4 is the industry standard that establishes appropriate markings. Attempting to boil this industry standard down into a few bullets has multiple issues:
1) The language is not enforceable. Look at the Danger label requirement – Black Text with white and Rd background. The inspector would have to accept a candy-cane stripe background with black letters or how about yellow poke-a-dots on a white background with black letters, that is far from the requirements in ANSI Z535.4
2) The language can be in conflict with the ANSI Z535.4 requirements which can drive an ambiguous requirement that makes a compliant ANSI Z535 compliant label not acceptable to the enforcer. ANSI Z535 has very definite lettering and color schemes and if the installer and enforcer has specific concerns about the lack of warning signage on equipment, they have the Informational Note to lean on as serving to provide an acceptable means to mark the equipment.
3) Manufacturers of electrical equipment have rigorous safety messaging that can be called into question based on the proposed prescriptive requirements. The addition of the Information Note is a good addition; however the prescriptive requirements in (B) should be rejected.
Panel Meeting Action: Accept in Principle
Panel Statement: See committee action and statement on Comment 1-61 which meets the intent of the submitter.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-61 Log #1061 NEC-P01 **Final Action: Accept in Part**
(110.21(A) and (B))

Submitter: Michael J. Johnston, National Electrical Contractors Association
Comment on Proposal No: 1-114
Recommendation: Revise original proposal as follows:
110.21 Marking.
(<u>A</u>) Manufacturers Markings. The manufacturer’s name, trademark, or other descriptive marking by which the organization responsible for the product can be identified shall be placed on all electrical equipment. Other markings that indicate voltage, current, wattage, or other ratings shall be provided as specified elsewhere in this *Code*. The marking shall be of sufficient durability to withstand the environment involved.
(B) <u>Field-Applied Hazard</u> Markings. Where caution, warning, or danger signs or labels are required by this code, the labels shall meet the following requirements.
1. The <u>marking shall adequately warn of the hazard using effective words and/or colors and/or symbols</u> ~~following colors shall be used for the hazard labels.~~
~~a. DANGER Label: Black text, with white and red background~~
~~b. WARNING Label: Black text with white and orange background~~
~~c. CAUTION Label: Black text with yellow and white background~~
<u>Informational Note: ANSI Z535.4-2011, Product Safety Signs and Labels, provides guidelines for suitable font sizes, words, colors, symbols and location requirements for labels.</u>
2. The label shall be permanently affixed to the equipment or wiring method<u>,</u> <u>shall be clearly visible,</u> and shall not be hand written.
<u>*Exception to 2: Portions of labels or markings that are variable or could be subject to changes, shall be permitted to be hand written and shall be legible.*</u>
3. The label shall be <u>of sufficient durability to withstand the environment involved</u> ~~suitable for the environment where it is installed~~.
Informational Note: ANSI Z535.4-2011, Product Safety Signs and Labels, provides guidelines for the design and durability of safety signs and labels for application to electrical equipment. ~~This standard provides more specific information related to suitable font sizes, colors, various symbols and location requirements for labels.~~
Substantiation: This comment incorporates editorial adjustments to address concerns expressed in the negative balloting. The revisions to the original proposal are in the interest of resulting in practical requirements for these markings that are applied consistently across the NEC where the signal words “danger” “caution” and “warning” are used. The new exception to list item 2 is an effort to allow hand written information on some labels or markings that may be subject to change periodically to remain accurate, such as labels

required by Section 110.22 for series rated systems and 110.24 for available fault current.

Panel Meeting Action: Accept in Part

Revise text to read as follows:

110.21 Marking.

(A) Manufacturers Markings. The manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified shall be placed on all electrical equipment. Other markings that indicate voltage, current, wattage, or other ratings shall be provided as specified elsewhere in this *Code*. The marking shall be of sufficient durability to withstand the environment involved.

(B) Field-Applied Hazard Markings. Where caution, warning, or danger signs or labels are required by this code, the labels shall meet the following requirements.

1. The marking shall adequately warn of the hazard using effective words and/or colors and/or symbols ~~following colors shall be used for the hazard labels.~~

~~a. DANGER Label: Black text, with white and red background~~

~~b. WARNING Label: Black text with white and orange background~~

~~c. CAUTION Label: Black text with yellow and white background~~

Informational Note: ANSI Z535.4-2011, Product Safety Signs and Labels, provides guidelines for suitable font sizes, words, colors, symbols and location requirements for labels.

2. The label shall be permanently affixed to the equipment or wiring method and shall not be hand written.

Exception to 2: Portions of labels or markings that are variable or could be subject to changes, shall be permitted to be hand written and shall be legible.

3. The label shall be of sufficient durability to withstand the environment involved ~~suitable for the environment where it is installed~~.

Informational Note: ANSI Z535.4-2011, Product Safety Signs and Labels, provides guidelines for the design and durability of safety signs and labels for application to electrical equipment. ~~This standard provides more specific information related to suitable font sizes, colors, various symbols and location requirements for labels.~~

Panel Statement: The Panel rejects the change of the title of 110.21(B) from "Field Applied Markings" to "Hazard Markings". Other ANSI standards have accepted product markings schemes that do not necessarily follow ANSI Z535; the proposed title change may cause significant unintended impact. The Panel also rejected inserting the words "shall be clearly visible" based upon the content of ANSI Z535.4 which addresses this issue. The Panel accepts the other changes in the comment.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

1-62 Log #1347 NEC-P01 **Final Action: Accept in Principle**

(110.21(A) and (B))

Submitter: Louis Barrios, American Chemistry Council

Comment on Proposal No: 1-114

Recommendation: Modify the committee action by deleting the phrase "and shall not be hand written" in 110.21(B)(2).

Substantiation: There may be some content on labels that changes periodically, where it may be acceptable or desirable to "hand write" the information with durable markers suitable for the environment.

Panel Meeting Action: Accept in Principle

Panel Statement: See committee action and statement on Comment 1-61 which meets the intent of the submitter.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

1-63 Log #770 NEC-P01 **Final Action: Reject**

(110.22(B) and (C))

Submitter: James Dorsey, Douglas County Electrical Inspector

Comment on Proposal No: 1-117

Recommendation: Revise text to read as follows:

The marking shall meet the requirements in 110.21(B) and (C) and shall be readily visible and state the following

CAUTION – SERIES COMBINATION SYSTEM RATED ________ AMPERES. IDENTIFIED REPLACEMENT COMPONENTS REQUIRED.

The field markings shall also include, the sum of the motors full load current in amperes and the date the calculation was performed.

Substantiation: I have been a commercial inspector for 11 years in a county which has high fault currents. A large portion of the projects end up with a series rating installation. The problem I would like the code panel to address is requiring that the labeling includes the sum of the motor loads and the date of installation somewhat mirroring 110.24. I have witnessed on multiple occasions where the breakers may add up to well over the 1% for perhaps an oversight, inefficient design or for whatever reason, but with manipulating of the fla's and non-coincidental loads the engineer can often brings the fla's say to just under 1% in the original installation.

The problem becomes when future build outs or simply adding a roof top unit, exhaust fan or any other motor load. The service electrician, inspector or owner has no ideal that they have now exceeded the 1% and has put the installation in a vulnerable and dangerous predicament. The additional labeling would give all parties the knowledge to design and install in a safe manner. This may also change the original design to a fully rated panel for present and future motor loads. With the premise of the NEC & practical Safeguarding, I hope you consider this additional verbiage to the original proposal. Thank you

Panel Meeting Action: Reject

Panel Statement: Proposal 1-117 addressed format of the label. The comment to add a requirement for the sum of the motor loads is not in accordance with 4.4.5(d) of the NFPA Regulations Governing Committee Projects. In addition, there is no section 110.21 (C).

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

1-64 Log #448 NEC-P01 **Final Action: Accept**

(110.24)

Submitter: William Fiske, Intertek

Comment on Proposal No: 1-121

Recommendation: Accept Proposal 1-121 in Principle, and Accept Proposal 1-124 as submitted.

Substantiation: Available fault current is a factor in determining arc-flash hazard, but it is not the only factor. It is misleading to say that marking the Available Fault Current relates only to short-circuit current ratings of the equipment. Note also Mr. Hickman's comment in vote on the ROP ballot of Proposal 1-124.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

Comment on Affirmative:

HICKMAN, P.: We do not necessarily agree with all of the substantiation in Proposal 1-124.

1-65 Log #765 NEC-P01 **Final Action: Reject**

(110.24)

Submitter: Rob Redfoot, Eaton Corp.

Comment on Proposal No: 1-123

Recommendation: Delete the following text:

~~110.24 Available Fault Current..."~~

Substantiation: The submitter recommended deleting this section in it's entirety because they were worried the information on the field label would not remain accurate. I think this valuable information to have shown and I don't recommend deleting it but there is merit to the idea that the information may not always be accurate. In my experience, most contractors will take fault current shown on engineers drawings and use that for their field markings. The problem is that the engineers use worse case values from the utility and the true values could vary widely from project to project. The calculations should be done using actual transformer KVA and impedance. I would recommend adding these values to the field label as a means to verify accuracy of the available fault current.

Panel Meeting Action: Reject

Panel Statement: The panel reaffirms its original action on the proposal. No additional or new substantiation has been provided beyond Comments 1-114, 1-116, 1-117, 1-118, 1-119, 1-120, 1-122 and 1-123 in the 2010 ROC, to indicate that the section should be deleted.

The comment is not clear for the recommended action for the substantiation according to 4.4.5(c) of the A2013 NFPA Regulations Governing Committee Projects.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

1-66 Log #1397 NEC-P01 **Final Action: Accept in Principle**

(110.24)

Submitter: Vincent J. Saporita, Cooper Bussmann

Comment on Proposal No: 1-121

Recommendation: Change to read as follows

Arc Flash hazard analysis information is available in NFPA 70E. Maximum available fault current at the service is intended for application ~~to~~ of the interrupting ratings of equipment, the short-current ratings of equipment, and the use of the "Table Method" of Hazard/Risk Category Classifications per NFPA 70E-2012 Table 130. 7(C)(15)(a). ~~and not for arc flash hazard analysis.~~ It is not for calculation of incident energies.

Substantiation: (1) It needs to be clarified that the maximum available fault current is also needed for compliance with equipment short-circuit current ratings (NEC 110.10)

(2) The maximum available fault current is also perfectly suited for use with the "Table" method in NFPA 70E.

(3) Clarity would be improved if "arc flash hazard analysis" were replaced with "calculation of incident energies".

Panel Meeting Action: Accept in Principle

Panel Statement: See panel action on Comment 1-64 which meets the intent of the submitter.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

1-67 Log #1418 NEC-P01 **Final Action: Reject**
(110.24)

Submitter: Keith Fager, Bayer CropScience
Comment on Proposal No: 1-121
Recommendation: The panel action should be Reject.
~~110.24 Informational Note: Arc Flash hazard analysis information is available in NFPA 70E. Maximum available fault current at the service is intended for application to the interrupting ratings of the equipment and not for arc flash hazard analysis.~~
Substantiation: This informational note should be in NFPA 70E instead of NFPA 70. Arc flash hazard analysis relates to work practices rather than installation and is outside the scope of the NEC. If someone performing an arc flash hazard analysis needs to be advised of data to be used in the analysis, that advisement should be in the applicable code.
Panel Meeting Action: Reject
Panel Statement: The panel reaffirms its original action on Proposal 1-121 and subsequent action on Comment 1-64. The panel maintains that the added informational note improves usability and clarity relative to the application of 110.24 and differentiating between arc flash hazard analysis studies addressed by NFPA 70E, *Standard for Electrical Safety in the Workplace*.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-68 Log #1419 NEC-P01 **Final Action: Reject**
(110.24)

Submitter: Keith Fager, Bayer CropScience
Comment on Proposal No: 1-124
Recommendation: The panel action should be Reject.
~~Informational Note: The available fault current marking(s) addressed in 110.24 are related to required short-circuit current ratings of equipment. NFPA 70E-2012, Standard for Electrical Safety in the Workplace, provides assistance in determining severity of potential exposure, planning safe work practices, and selecting personal protective equipment.~~
Substantiation: This informational note relates to work practices rather than installation and is outside the scope of the NEC.
Panel Meeting Action: Reject
Panel Statement: The panel reaffirms its original action on Proposal 1-121 and subsequent action on Comment 1-64. The panel maintains that the added informational note improves usability and clarity relative to the application of 110.24 and differentiating between arc flash hazard analysis studies addressed by NFPA 70E, *Standard for Electrical Safety in the Workplace*.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-69 Log #1422 NEC-P01 **Final Action: Reject**
(110.24)

Submitter: Keith Fager, Bayer CropScience
Comment on Proposal No: 1-123
Recommendation: The panel action should be Accept. Delete this section.
Substantiation: This section was added to make it easier to enforce sections 110.9 and 110.10. As part of the permitting process, our AHJ requires documentation on the construction drawings that the requirements of those sections are met. The inspector only has to verify the equipment installed has the short-circuit current rating indicated on the approved permit drawings. The field marking requirement in 110.24 has obviously created some confusion, based on the proposals submitted to add an informational note to explain the purpose of the posted value. It is important to know the maximum available fault current and the service equipment short circuit current rating, but the field marking requirement is not the best way to communicate that information.
Panel Meeting Action: Reject
Panel Statement: The panel reaffirms its original action on the proposal. No additional or new substantiation has been provided beyond Comments 1-114, 1-116, 1-117, 1-118, 1-119, 1-120, 1-122 and 1-123 in the 2010 ROC, to indicate that the section should be deleted.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-70 Log #1543 NEC-P01 **Final Action: Reject**
(110.24)

Submitter: Frederic P. Hartwell, Rep. Massachusetts Electrical Code Advisory Committee
Comment on Proposal No: 1-123
Recommendation: Accept the proposal to delete this section.
Substantiation: The panel statement rejecting the proposal asserts that it provides no new substantiation beyond that submitted during the comment period in the prior cycle. That statement is only partially true, and entirely beside the point. This proposal included additional information relative to the placement of this section in Part I of the article and thereby making it applicable to medium voltage installations. The available fault currents on these networks change frequently. In addition, CMP 1 has failed to provide any arguments that respond to the other merits of this proposal, either directly or by reference. In the prior cycle all comments were dealt with through a reference to Comment 1-115. That comment came from a task group formed to correlate actions between CMP 1 and 10. That task group recommended a minor wording change that was designed to address concerns that the posted fault current would be used for arc flash calculations. CMP 1 correctly addressed that concern, both in the previous cycle and on Proposal 1-121 in this cycle and the Advisory Committee recognizes this as a positive development.
However, the new section is still fatally flawed for reasons unaddressed by CMP 1 up to this point. The marking can and likely will become dangerously outdated after it has been posted. As such it requires wording that should not be believed, in order for safety to be served. Only contemporaneous consultations with the serving utility can prevent the misapplication of equipment. This is why NFPA 70E (a workplace safety standard) diverges in scope from NFPA 70 (an installation standard). Section 90.1(B) expressly provides notice that an NEC compliant installation is essentially free from hazard, but not necessarily adequate in the future. This proposal made the argument that Section 110.24 “would require an action to be taken on an electrical installation even if no activity, by reason of simple maintenance or otherwise, were performed on site.” As such, the requirement exceeds the scope of the NEC and cannot be enforced after the final inspection has been completed. The Advisory Committee respectfully requests that CMP 1 reconsider the merits of this section.
Panel Meeting Action: Reject
Panel Statement: The panel reaffirms its original action on the proposal. No additional or new substantiation has been provided beyond Comments 1-114, 1-116, 1-117, 1-118, 1-119, 1-120, 1-122 and 1-123 in the 2010 ROC, to indicate that the section should be deleted.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12
Comment on Affirmative:
LABRAKE, JR., N.: As has been noted in the discussions on this Section during both this cycle and previous ones, the required markings cannot be considered accurate beyond the immediate moment. To require labeling of this number invites assumptions of safety requirements that may not be appropriate for the situation at the time.

1-71 Log #245 NEC-P01 **Final Action: Reject**
(110.25)

Submitter: Edward G. Kroth, Verona, WI
Comment on Proposal No: 1-111
Recommendation: Rather than number the new section as 110.25 this new section should be numbered 110.21 and current 110.21 could be renumbered 110.20 (see also proposal 1-130).
Alternatively, 110.25 could be numbered 110.23 and current 110.23 could be renumbered 110.25. In either case other proposals submitted by the task group would need to be modified since those proposals specifically mention new 110.25.
Substantiation: From a codeology view point it would seem to make sense to have sections 110.22 numerically proceed or follow this new proposal since both are concerned with disconnects and a person looking for general rules on disconnects may not read far enough to get to the lockable rule. Refer also to my comment proposal 1-130.
Panel Meeting Action: Reject
Panel Statement: The submitter provided multiple options and has not provided specific language that the panel can consider and is therefore not in proper format in accordance with 4.4.5(c) of the Annual 2013 NFPA Regulations Governing Committee Projects.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-72 Log #246 NEC-P01 **Final Action: Reject**
(110.25)

Submitter: Edward G. Kroth, Verona, WI
Comment on Proposal No: 1-130
Recommendation: Rather than number the new section as 110.25 this new section should be numbered 110.21 and current 110.21 could be renumbered 110.20 (see also proposal 1-111).
Alternatively, 110.25 could be numbered 110.23 and current 110.23 could be renumbered 110.25. In either case other proposals submitted by the task group would need to be modified since those proposals specifically mention new 110.25.
Substantiation: From a codeology view point it would seem to make sense to have sections 110.22 numerically proceed or follow this new proposal since both are concerned with disconnects and a person looking for general rules on disconnects may not read far enough to get to the lockable rule. Refer also to my comment proposal 1-111.
Panel Meeting Action: Reject
Panel Statement: The submitter provided multiple options and has not provided specific language that the panel can consider and is therefore not in proper format in accordance with 4.4.5(c) and (d) of the Annual 2013 NFPA Regulations Governing Committee Projects.

Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-73 Log #263 NEC-P01 **Final Action: Accept**
(110.25 (New))

Submitter: Code-Making Panel 3,
Comment on Proposal No: 1-131
Recommendation: Reject Proposal 1-131.
Substantiation: Code-Making Panel 1 should have rejected the proposal. General statements were used to substantiate the proposal. The inadequate substantiation does not justify the need to add new material describing GFCI and AFCI shall be in a readily accessible location as opposed to accessible..

This comment was developed by a CMP-3 Task Group and balloted through the entire panel with the following ballot results:
15 Eligible to Vote
13 Affirmative (see affirmative comment below)
2 Ballots Not Returned (A.D. Corbin and D.T. Mills)
The following Comments on Vote were received:
AFFIRMATIVE:
S.L. STENE: The ready access for both GFCI and AFCI devices should not be mandated by Panel 1 but rather by the Panel having jurisdiction over the use of GFCI and AFCI devices for their particular application. An example of requiring the GFCI devices to be accessible as applied to equipment versus readily accessible would be the GFCI devices required by 620.85 that each 125-volt, single-phase, 15- and 20-ampere receptacle installed in pits, in hoistways, on elevator car tops, and in escalator and moving walk wellways shall be of the ground-fault circuit-interrupter type. The difference would be that these receptacles are accessible, rather than the readily accessible required by the proposed new text in 110.25. Even though 90.3 permits Chapters 5, 6, and 7 to modify or supplement the text in Article 110, this additional text makes the NEC more complex without any technical substantiation for the change.
Accessible (as applied to equipment). Admitting close approach; not guarded by locked doors, elevation, or other effective means.
Accessible, Readily (Readily Accessible). Capable of being reached quickly for operation, renewal, or inspections without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to portable ladders, and so forth.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-74 Log #274 NEC-P01 **Final Action: Accept**
(110.25 (New))

Submitter: Code-Making Panel 18,
Comment on Proposal No: 1-131
Recommendation: This proposal should be Rejected.
Substantiation: The current wording of 210.8, requires that all GFCIs required in this section, regardless of type, to be installed in a readily accessible location. Any other locations in the code are special applications such as for temporary wiring or vending machines, etc. and those panels responsible for those applications are better suited to take into consideration the possibly unique characteristics of these different types of installations that will affect the accessibility requirements for a GFCI. The accessibility of a GFCI should be considered within the context of the specific Article that requires installation of these products. No substantiation was provided to support the inclusion of an AFCI in this proposed requirement.
This comment was developed by a CMP-18 Task Group and balloted through the entire panel with the following ballot results:
12 Eligible to vote
9 Affirmative
1 Abstention (see below)
2 Ballots Not Returned (M.N. Ber and K.J. Clemente)
The following Affirmative Comment on Vote was received:
M.S. O'BOYLE: I agree that the proposal should be Rejected. I also agree that accessibility should be considered within the context of specific articles that require installation of a device. Additionally, I agree that no substantiation was provided to support inclusion of AFCI devices.
As defined in Article 100, "Readily Accessible" means that a device is capable of being reached for inspections without climbing over or removing obstacles. When a GFCI (or AFCI) is installed in an outlet box, it is not always possible to predict if furniture or another obstacle might be placed in a way that would render the device not readily accessible. Accordingly, the requirement would be difficult to enforce.
The following Negative Comment on Vote was received:
M.J. KOCHAN: All three negative votes by L. Barrios, P. Hickman and D. Hittinger have stated the substantiation does not justify the approval of the proposal. In this I concur. In the Informational Note Mr. Larsen suggests and assumes that by placing the GFCI in a readily accessible location will facilitate periodic testing required by the product installation instruction that are supplied with the receptacle. Not so, the electrician who is installing the GFCI does what they know to do and installs the GFCI receptacle and throws the box and instructions away. When a new homeowner or business facility moves in there is no instruction and if there were, who would see that these receptacles are tested periodically. Maybe the electrical contractor should be responsible to notify all homeowners and business facilities with a list of all GFCI receptacles and their locations and a copy of all instructions. In many cases, the GFCI has been installed in a readily accessible location like a kitchen, bathroom or a garage, but not always. There is that whirlpool tub in the master bathroom where the GFCI receptacle is located under the tub. There are bathrooms in national chains that require a key access as well as office buildings that require key access.
210.8 states GFCI receptacles be installed in a readily accessible location which is too broad of a statement. Mr. Larsen also mentions that the 2 dozen or so other areas in the code should be addressed the same way. Many of those come under Chapters 5, 6 and 7 which does allow for modifications and should be addressed in accordance with the articles of those chapters.
I would like a better understanding as to why this proposal is being placed as 110.25. The SCOPE of Article 110 states the following:
"This article covers general requirements for the examination and approval, installation and use, access to and space about electrical conductors and equipment enclosures intended for personnel entry; and tunnel installations."
The following Abstention was received:
F.L. CARPENTER: There was no clear consensus on whether NEMA should support or oppose the proposed comment on Proposal 1-131.
Panel Meeting Action: Accept
Panel Statement: The panel does not necessarily agree with all of the submitter's substantiation.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-75 Log #279 NEC-P01 **Final Action: Accept**
(110.25 (New))

TCC Action: The Correlating Committee directs that the proposed renumbering of 110.26 Spaces About Electrical Equipment to 110.27 be returned to its original location (110.26) since Proposal 1-131 was not accepted as a result of the action taken on Comment 1-75. As a result of this action, all references to 110.27 should be changed to 110.26.
Submitter: Code-Making Panel 2,
Comment on Proposal No: 1-131
Recommendation: Reject the entire proposal.
Substantiation: The proposal is overly broad and does not take into consideration the possibly unique characteristics of different types of installations covered by the code that will affect the accessibility requirements for GFCIs and AFCIs. The current wording of 210.8 requires all GFCIs required in this section, regardless of type, to be installed in a readily accessible location. CMP 2's action on Proposal 2-116 would require all AFCIs specified by section 210.12, regardless of type, to likewise be installed in a readily accessible location. Any other locations in the code where these protection devices are required are special applications such as for temporary wiring or vending machines, and the panels responsible for those applications are better suited to take into consideration the possibly unique characteristics of these different types of installations that will affect the accessibility requirements for GFCI's and AFCI's. The accessibility of GFCI's and AFCIs should be considered within the context of the Articles that require installation of these products.
This comment was developed by a CMP-2 Task Group and balloted through the entire panel with the following ballot results:
11 Eligible to vote
7 Affirmative
3 Negative (See voting comments below)
1 Ballot Not Returned (R.E. Duren)
The following Comments on Vote were received:
NEGATIVE:
M.R. Hilbert: The recommendation on Proposal 1-131 should have been to accept in principle.
CMP 2 addressed the accessibility issues for branch circuit GFCI devices covered under 210.8(A) – (C) in the 2011 NEC and has accepted a proposal for 2014 that would do the same for branch circuit AFCI devices. Therefore, it seems logical to include a general requirement in Article 110. This requirement can, as it already is in some cases, be modified for a specific application.
Although including a general requirement in Article 110 as proposed has merit, consideration should be given to expanding it to address all AFCI and GFCI devices not just the receptacle type. Shouldn't the same ready access requirements apply to the test and reset buttons for all AFCI and GFCI devices?
For example, take a vending machine located indoors. If the vending machine comes equipped with GFCI protection integral with the attachment cap or cord, there is no specific requirement in 422.51 to provide ready access to the GFCI device. However with a general requirement in Article 110 for receptacle type devices, a receptacle type GFCI device installed for a vending machine without integral GFCI protection would require the ready access. These accessibility requirements would be better afforded to all types of devices.
For consistency in terminology, the heading of the proposed new section

should be changed to read "Ground-Fault Circuit–Interrupter and Outlet Branch-Circuit Arc-Fault Circuit-Interrupter receptacles."

In my opinion, a general requirement in Article 110 will not create any conflict with the ready access to a GFCI device installed on a rooftop as part of a branch circuit to meet 210.63. As defined in Article 100, equipment is readily accessible when it is capable of being reached by "those to whom ready access is requisite." In the case of a receptacle placed on a rooftop for servicing heating or air conditioning equipment, it is the rooftop service personnel to whom the access is requisite and therefore a receptacle type GFCI device would only need to be readily accessible from on the rooftop.

J. Pauley: NEMA voted affirmative on proposal 1-131 during the ROP stage. Both
GFCIs and AFCIs have test and reset functions that need ready access. The GFCI industry has over
many years gotten a black eye with consumers because they lose power on a circuit and then
cannot find the reset mechanism (or find whether a GFCI is even installed) because it is buried
behind furniture, equipment or similar items.
Proposal 1-131 would require that all AFCIs and GFCIs be readily accessible. I cannot think of a single instance where ready access is inappropriate. Some have brought up the issue of being
located on a rooftop and that this would not be readily accessible. That's not an accurate
assessment. The definition of readily accessible is specific to include the words "those to whom
ready access is requisite". In a rooftop situation, the people who require access are already on the
roof and as such the device is readily accessible. I believe we are missing a significant opportunity
by not putting in a simple rule that will help everyone who uses a GFCI and/or an AFCI.

R.G. Wilkinson: The substantiation does not support the frequency of failures. Monthly testing and recording has been addressed.

Panel Meeting Action: Accept

Panel Statement: The panel does not necessarily agree with all of the submitter's substantiation.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

1-76 Log #351 NEC-P01 **Final Action: Accept in Principle**
(110.25 (New))

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)

Comment on Proposal No: 1-130

Recommendation: Revise the text of the Panel Action on Proposal 1-130 to read as follows:

110.25 Lockable Disconnecting Means. Where a disconnecting means is required to be lockable open, elsewhere in this Code, it shall be capable of being locked in the open position. The provisions for locking shall remain in place with or without the lock installed.

<u>*Exception: Where a disconnecting means for cord-and-plug-connected equipment is required to be lockable open and is permitted to be an attachment plug, the provision for locking of the attachment plug shall remain in place with the lock installed.*</u>

Substantiation: Without addition of the Exception indicated above, the new 110.25 requirement and many companion requirements proposed throughout the Code do not draw any distinction between lockable disconnecting means for permanently connected equipment and lockable disconnecting means for cord-and-plug-connected equipment where the attachment plug serves as the disconnecting means. As such, these unconditional provision-for-locking-without-the-lock-installed requirements negate substantive compliance with OSHA's lock-out regulations for worker safety [29 CFR 1910.147] regarding cord-and-plug-connected equipment. Where the attachment plug serves as the disconnecting means, provision for locking consists of lockable "clamshell" that surrounds the attachment plug, thereby precluding energization of cord-and-plug-connected equipment being serviced. When not locking out such equipment, the "clamshell" is stored on the flexible cable above the plug. In either mode of "clamshell" usage or storage, it is intended that the lock must be used. This "provision for locking" therefore does NOT "remain in place … without the lock installed."

Many requirements for disconnecting means, including 410.130(G)(1) Exception No. 3, 422.33(A), 426.50(A), 427.55(B), 430.109(F), 440.13, 440.63, 517.71(C) and 590.4 and references thereto, permit attachment plugs to serve as the disconnecting means for cord-and-plug-connected equipment. Requirements proposed and accepted throughout the Code in this Code cycle that disconnecting means be lockable are generalized and in many instances are located in other Sections or by reference.

Note: Supporting material is available for review at NFPA Headquarters.

Panel Meeting Action: Accept in Principle

Add new text to read as follows:

110.25 Lockable Disconnecting Means. Where a disconnecting means is required to be lockable open, elsewhere in this Code, it shall be capable of being locked in the open position. The provisions for locking shall remain in place with or without the lock installed.

<u>*Exception: Cord-and-plug connection locking provisions shall not be required to remain in place without the lock installed.*</u>

Panel Statement: The panel reworded the proposed exception for clarity and to meet the Style Manual.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 11 Negative: 1

Explanation of Negative:

HICKMAN, P.: We believe an exception has been created to provide an exception from something that is not required. We are not aware of a cord-and-plug connection that would be required to be "lockable open" as required by 110.25. However, if there were a case where a cord-and-plug connection would be required to be "lockable open" then we conclude that the provisions for locking need to remain in place with or without the lock installed.

1-77 Log #382 NEC-P01 **Final Action: Reject**
(110.25 (New))

Submitter: John Houdek, Allied Industrial Marketing, Inc.

Comment on Proposal No: N/A

Recommendation: Add new text to read as follows:

<u>Total power factor at the utility service point of a facility, shall be 0.90 or higher (lagging).</u>

<u>Motor loads totaling 50 HP or higher shall have a power factor of 0.90 or higher.</u>

<u>Harmonic voltage distortion shall be limited to 5% THD-v or less at the primary side of the utility transformer serving a facility.</u>

Substantiation: The NEC needs to define requirements for electrical power quality to assure the most efficient supply of electricity by utilities and to minimize disturbances caused by one facility from disrupting the service to another (neighboring) facility.

Both low power factor and elevated harmonic distortion are wasteful of electricity. Total power factor is a function of both fundamental frequency displacement power factor and distortion power factor. Low power factor causes elevated current to flow into the branch circuit conductors, transformer and switchgear. It is more costly for utilities to distribute electricity when power factor is low. To maximize total power factor, minimize distribution losses and losses within facilities, total power factor should be near 1.0.

Panel Meeting Action: Reject

Panel Statement: The proposed wording is outside the purpose of the NEC as stated in 90.1 as it does not apply to the safeguarding of persons or property.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 11 Negative: 1

Explanation of Negative:

HICKMAN, P.: We do not necessarily agree with the panel statement.

1-78 Log #518 NEC-P01 **Final Action: Reject**
(110.25)

Submitter: James F. Williams, Fairmont, WV

Comment on Proposal No: 1-130

Recommendation: Revise text to read as follows:

110.25 Lockable Disconnecting Means. Where a disconnecting means is required to be lockable open, elsewhere in this *Code*, ~~it shall be capable of being locked in the open position. T~~ <u>t</u>he provisions for locking shall remain in place with or without the lock installed.

Substantiation: The deleted phrase is redundant and adds nothing to the section. Requiring something to be capable of meeting the requirement is overkill.

Panel Meeting Action: Reject

Panel Statement: The language proposed to be removed is not redundant. Rather, it is the central point of the Code provision. No substantiation has been provided to remove the concept and requirement for the disconnecting means being capable of being locked in the open position. There are disconnects that are incapable of being locked in the open position and are unacceptable for installation in conformance with this section.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

Comment on Affirmative:

LABRAKE, JR., N.: The Comment could have been accepted in principle with the following text:

"Where a lockable disconnecting means is required to be <u>lockable open</u> elsewhere in this Code, it shall be capable of being locked in the open position. The provisions for locking shall remain in place with or without the lock installed."

This suggestion revises the original text from being too broad by removing the first comma in the original text of Proposal 1-130 and redundant text.

1-79 Log #979 NEC-P01 **Final Action: Reject**
(110.25 (New))

Submitter: Charles J. Palmieri, Town of Norwell
Comment on Proposal No: 1-131
Recommendation: The panel should continue to accept this proposal see my substantiation to Proposal 1-81 Log #1641 70-A2013-ROP below.
Substantiation: The installation of ground fault circuit interrupter and arc fault circuit interrupter type receptacles is expanding throughout this Code. The 2011 edition has introduced language-recognizing devices such as AFCI receptacles (see articles 210.12(B), and 406.4(D)(4)). It is important that these devices be located so their listing instructions requiring periodic testing may be performed without discouragement. During the 2011 renew process Code Panel 2 adopted language requiring GFCI type receptacles be readily accessible for the aforementioned testing. They did not include a similar requirement in 201.12(A), or (B) regarding the use of listed outlet type AFCI Receptacles. Note that the definition of the term “Equipment” in article 100 includes the word devices amongst the general terms included in that definition. The scope of Article 110 states in part, “This article covers general requirements for the examination and approval, installation and use, access to and spaces about electrical conductors and equipment”. Clearly it is appropriate to include a requirement in this article that equipment be readily accessible when the listing instructions require periodic testing.
Panel Meeting Action: Reject
Panel Statement: Specific accessibility requirements associated with ground-fault and arc-fault circuit interrupters should be located in specific sections that apply to these devices and not in Article 110. CMP 1 accepted comments to reject Proposal 1-131 submitted by Panels 2, 3,18 and 19.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-80 Log #1351 NEC-P01 **Final Action: Accept**
(110.25)

Submitter: Louis Barrios, Shell Global Solutions
Comment on Proposal No: 1-131
Recommendation: The panel action should have been to reject this proposal.
Substantiation: Specific requirements associated with ground-fault and arc-fault circuit interrupters should be located in specific sections that apply to these devices and not in Article 110.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-81 Log #1501 NEC-P01 **Final Action: Reject**
(110.25)

Submitter: Alan Manche, Schneider Electric
Comment on Proposal No: 1-131
Recommendation: Continue to accept this proposal.
Substantiation: The committee’s decision to require a general accessibility requirement for AFCIs and GFCIs is an appropriate addition to support the use of these products in accordance with the Listing and markings found on these products. In order to test monthly, the device must be readily accessible. So one might infer that this requirement already exists as part of the listing and labeling of these protective devices, unfortunately they are often located where they cannot be reach to do the monthly test placing the protection for which there were designed at risk from improper maintenance.
The reason for this comment is to address the voting comments.
The HVAC roof-top unit which has s disconnect is required in accordance with 404.8 to be readily accessible, the same requirement exists where an overcurrent device is located with that HVAC unit, it must readily accessible in accordance with 240.24 so I would suggest that a receptacle located on the roof is also readily accessible. The GFCI protection can be relocated at grade level and feed the receptacle on the roof for monthly testing thereby enhanced worker safety by position the device where it can be periodically tested.
A thought conveyed by the voting comments is that accessibility should be addressed by each panel that has each location GFCI protection. I do not see any requirement in the code that would permit AFCI or GFCI protection to NOT be readily accessible and provide the occupant the appropriate installation to periodically test the devices in accordance with the Listing of the products. I would contend each code panel should be required to consider any location for permitting a device in a non-accessible location. This would be the reflected as an exception that would most likely be in direct conflict with the installation and operational instructions.
Once again this comment supports the code panel’s actions on this proposal establishing a general location requirement to facilitate monthly testing in accordance with the product Listing and marking.
Panel Meeting Action: Reject
Panel Statement: Specific accessibility requirements associated with ground-fault and arc-fault circuit interrupters should be located in specific sections that apply to these devices and not in Article 110. CMP 1 accepted comments to reject Proposal 1-131 submitted by Panels 2, 3,18 and 19.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-82 Log #242 NEC-P01 **Final Action: Reject**
(110.26)

Submitter: Mike Weaver, C&M Enterprises
Comment on Proposal No: 1-131
Recommendation: Revise text to read as follows:
110.26 Ground-Fault and Arc-Fault Circuit Interrupter Receptacles <u>and Dead Front Devices</u>. Ground-fault circuit-interrupter receptacles and outlet branch circuit type arc-fault circuit-interrupter receptacles <u>and dead front configurations of these devices</u> shall be installed in a readily accessible location.
Informational Note: Locating GFCI and outlet branch circuit type AFCI receptacles <u>and dead front configurations of these devices</u> in a readily accessible location will facilitate the periodic testing required by the product instructions.
Substantiation: The literal Code language (as proposed and as it appears in the draft document) excludes dead front configurations of GFCI and AFCI devices. Dead front configurations of GFCI devices are often installed and should be afforded the same accessibility requirement which is now mandated for AFCI and GFCI receptacle devices, for the same reason depicted in the informational note.
Panel Meeting Action: Reject
Panel Statement: The terms AFCI and GFCI include all types including the type suggested in this comment. The panel concludes that the additional text is unnecessary. See Panel action on Comment 1-80 which deletes the proposed section.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-83 Log #120 NEC-P01 **Final Action: Accept**
(110.26(A)(1))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-14b
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of “Metal Enclosed Power Switchgear” to “Switchgear” in Proposal 9-7.
It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 1 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-84 Log #395 NEC-P01 **Final Action: Accept**
(Table 110.26(A)(1))

Submitter: Thomas L. Adams, Macomb, IL
Comment on Proposal No: 1-138
Recommendation: Continue to reject the Proposal.
Substantiation: A review and comparison of the present Table to the requirements of Table K-1 of OSHA 1926.403(i)(1)(i) shows the dimensions to be the same in both for the stated voltages. Changing Table 110.26(A)(1) will create a conflict between the two documents causing voltages above 600 Volts to be in violation of OSHA requirements. Further, there was no Proposal to change the title of Part II of Article 110 which would result in confusion. In addition, a Note within the OSHA document states that “If the electrical installation is made in accordance with the National Electrical Code ANSI/NFPA 70-1984, exclusive of Formal Interpretations and Tentative Interim Amendments, it will be deemed to be in compliance with 1926.403 through 1926.408, except for 1926.404(b)(1) and 1926.405(a)(2)(ii)(E), (F), (G), and (J).” This would further conflict with the proposed text without significant amendment.
Panel Meeting Action: Accept
Panel Statement: A joint task group appointed by the Correlating Committee consisting of representatives from HVTG, CMP 1 and CMP 8 reviewed proposals rejected by CMP 1 and CMP 8 related to replacing 600V to 1000V. The joint task group concluded that neither the joint task group nor the High Voltage Task Group has the necessary background research to further justify technical substantiation for the rejected proposals. Such substantiation would likely need to come from entities such as the manufacturers or the NFPA Research Foundation. The joint task group recommended that CMP 1 and CMP 8 not change the original actions taken during the 2014 proposal stage. In addition, the panel does not necessarily agree with all of all the substantiation for the comment.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-85 Log #1008 NEC-P01 **Final Action: Reject**
(110.26(C))

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 1-145
Recommendation: Reject the proposal.
Substantiation: Requiring listed hardware makes no sense. I can have a door with no hardware at all and be as safe (if not safer) than a door with listed panic hardware. A door with no latch that utilizes a push/pull plate style hardware is safer than panic hardware as well. Furthermore, there was no substantiation that unlisted hardware is not safe.
Panel Meeting Action: Reject
Panel Statement: The panel reaffirms its action on proposal 1-145. The Code requires suitable hardware to facilitate egress. The requirement for listed hardware clarifies the expected performance and facilitates safe egress. In addition, this is consistent with the language used in the model building codes.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-86 Log #1172 NEC-P01 **Final Action: Reject**
(110.26(C)(1))

Submitter: Salvatore DiCristina, Rutgers University / Rep. NFPA Building Code Development Committee (BCDC)
Comment on Proposal No: 1-140
Recommendation: Accept the original proposal in principle and revise the text to read as follows:
110.26 C 1 Minimum Required. At least one entrance of sufficient area shall be provided to give access to and egress from working space about electrical equipment., and provide continuous and unobstructed travel between the entrance and the working space.
Substantiation: We agree with Panel members Anthony and Hickman that without this change, "none of the NEC rules for access and working space are practical if these spaces are crowded with obstructions" and that this concept would "enhance safety". As to the Panel's reference to "large equipment" in 110.26(C) (2) (a), already providing for this path, this section merely requires that if the single egress path is not continuous or obstructed (undefined by the way), then a second possibly obstructed path is required. No where does the NEC require a continuous unobstructed path.
Further, it is the intent to expand the requirement beyond equipment rated 1200A or more. Equipment of 1200A or greater is traditionally found in dedicated electrical equipment rooms. This proposal is precisely intended to address rooms and spaces containing unrelated equipment such as air handlers, piping, ductwork, etc, which is often given priority to location and routing and electrical equipment being secondary regardless of voltage or amperage. Reading the commentary for 110.26 (C) in the handbook, regarding Entrance to and Egress from Working Space, "This section was revised for the 2008 Code. The requirements are intended to provide access to electrical equipment. However, the primary intent is to provide egress from the area so that workers can escape if there is an arc flash incident". The hazard associated with arc flash does not begin at 1200A. This proposal seeks to provide direction to designers and contractors who continue to unnecessarily put mechanics at risk of well documented hazards by overcrowding spaces containing electrical equipment.
This also assists the first responder in attending to victims who may be incapable of evacuating the area after an incident.
Panel Meeting Action: Reject
Panel Statement: The submitter has not provided additional substantiation to justify a requirement that would apply to all equipment beyond "large equipment" in 110.26(C)(2)(a).
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
ANTHONY, M.: Many safety concepts are intuitively understood but lack technical substantiation sufficient for the committee. "Common sense", for example, is frequently difficult to substantiate
technically.
HICKMAN, P.: We reaffirm our negative vote and statement on Proposal 1-140.

1-87 Log #1595 NEC-P01 **Final Action: Reject**
(110.26(C)(2))

Submitter: Scott Cline, Monterey Park, CA
Comment on Proposal No: 1-143
Recommendation: Replace "1200 amperes" with "1000 kW" in the first paragraph: (2) Large Equipment. For equipment rated 1000 kW or more and over 1.8 m (6 ft) wide that contains overcurrent devices, switching devices, or control devices, there shall be one entrance to and egress from the required working space not less than 610 mm (24 in.) wide and 2.0 m (61/2 ft) high at each end of the working space.
Substantiation: The hazard addressed by this Section is long-term arc-burning of equipment trapping a worker. Power (voltage and amperage) is the measure of arc-flash hazard, not amperage alone. [With a reduction from 1200 Amps to 800 Amps, then the correct kW figure to use would be 666 kW.] Your Panel Statement says: "The industry normally rates the electrical equipment within 110.26(C)(2) in amperes and not in kW." I believe that is my point of the problem. For other sections/sub-sections, amperage is fine. But for this sub-section "amperes" ignores the reality of the physics hazard to be addressed by this rule – power, not amperage. An 800-amp 208Y/120-volt piece of equipment presents no where near the long-term arc-burning, electrician-killing hazard which an 800-amp 480Y/277-volt system does. Yet we treat them the same with the existing language. The switch to 1,000kW [or 666 kW] solves the discrepancy, and still leaves equivalent power capacity, lower-voltage systems (which can almost never sustain an arc-fault at all) fully protected.
Panel Meeting Action: Reject
Panel Statement: The panel reaffirms its original action on proposal 1-143. No additional substantiation has been provided to indicate that the proposed revision (changing amperes to kW) adds clarity or improves usability of this requirement. The equipment that this section applies to is rated in amperes not kW.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-88 Log #121 NEC-P01 **Final Action: Accept**
(110.26(D))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-14c
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7.
It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 1 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-89 Log #768 NEC-P01 **Final Action: Reject**
(110.26(D))

Submitter: James Dorsey, Douglas County Electrical Inspector
Comment on Proposal No: 1-147
Recommendation: Revise text to read as follows:
110.26 (D) Illumination.
Illumination shall be provided for all working spaces about service equipment, switchboards, panelboards, or motor control centers installed ~~indoors~~ and shall not be controlled by automatic means only. (The remainder of the article left alone)
Substantiation: The original submitter requested a minimum of 10 foot candles of illumination. The panel rejected claiming that there is no substantiation of what amount of light is sufficient. OSHA standard for general construction is 5' & 10' candles for electrical equipment rooms, which I have attached. Without being too restrictive on how much illumination to require, the deletion of indoors would be a step in the right direction

standard 1926.56(a)
Requires 5 foot candles for General Construction & 10 foot candles for mechanical and electric rooms
Justifying the requirement for illumination outdoor as well as indoors could aid the rapidly growing requirements of labeling. The NEC requires labeling in many areas of the code, such as 240.86 series rating stickers, 230.2 placcarding for more than 1 service, 110.24 fault current calculation. 408.4 identification for Feeder panels. 705 interconnected systems, the list does go on, having the ability to read those labels would be a plus. For every electrician or homeowner that has the unfortunate task of servicing or resetting a breaker & having the ability to flip a switch and not have to have a flashlight under ones chin would be to their advantage.
Panel Meeting Action: Reject
Panel Statement: The submitter cites OSHA for a minimum illumination requirement,but it only applies to indoor installations. The proposed text is too restrictive to assume that all outdoor equipment needs to be serviced at night.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 9 Negative: 3
Explanation of Negative:
ANTHONY, M.: Electrical safety professionals who write the NEC should own this concept not OSHA.
HICKMAN, P.: We submit that the words "installed indoors" should have been the recommendation.
HITTINGER, D.: The Panel should have accepted the comment and the proposal. There was substantiation for the proposal. The Panel statement that the OSHA requirement is for indoor installations is not correct. It is applicable only to construction areas and does not differentiate indoor or outdoor. The submitter was providing a reference to the OSHA standard as a guide for the committee. Illumination for equipment that must be serviced is necessary regardless of where it is located.

1-90 Log #122 NEC-P01 **Final Action: Accept**
(110.26(E))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-14d
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7.

It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 1 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-91 Log #1308 NEC-P01 **Final Action: Reject**
(110.26(E)(1) Exception No. 2 (New))

Submitter: Mike Weitzel, Bechtel
Comment on Proposal No: 1-151
Recommendation: *Exception* ***1****: Control equipment that by its very nature or because of other rules of the Code must be adjacent to or within sight of its operating machinery shall be permitted in those locations.*
Add new text to read as follows:

Exception 2. Equipment such as switchboards, panelboards, industrial control panels, motor control centers, meter sockets, enclosed switches, transfer switches, power outlets, circuit breakers, adjustable speed drive systems, pullout switches, portable power distribution equipment, termination boxes, general-purpose transformers, fire pump controllers,and motor controllers rated not over 600 volts and installed in industrial installations shall not require dedicated space above the equipment where designed and listed for wiring methods to be installed bottom entry only.
Substantiation: Listed equipment installed in a new or upgraded industrial installations often face challenges to fit in electrical rooms or machinery spaces. Where designed and listed for the purpose, (and installed and used in accordance with the manufacturer's instructions), wiring methods will have the required space to enter and exit the equipment, and the objective of the *Code* will be met.

This Exception is proposed as limited to industrial locations only.

Requiring the equipment to be designed and listed is provided as justification for this new exception. This new language is offered as an alternative for "Engineered and constructed" language originally proposed, as a more palatable alternative to CMP 1, and adds enforceability for the AHJ. Some AHJ's are comfortable with making a determination based upon their experience. Other AHJ's or some federal regulators will not consider any exception or deviation from verbatim *Code* text. This Exception provides the verbatim text in the *Code*.

The substantiation supports the objective of the dedicated space requirements. The requirement for design, listing, (and AHJ approval per 90.4 – which any NEC section requires) is consistent with other permitted Exceptions in the *Code*. This Exception provides and recognizes the reality that sometimes in a new or replacement installation, it may be difficult to route cables, conduits, or other wiring methods into equipment from above the equipment. There are structural or space constraints that make it difficult or near impossible to comply with the *Code* verbatim. This exception provides a workable alternative in those situations. The proposal does not duplicate the requirements in Section 110.3(B). It simply provides a limited exception to an existing Code rule for space above equipment, that's all.
Panel Meeting Action: Reject
Panel Statement: The panel reaffirms its original action and statement on the proposal. The space for equipment is necessary in order to safely install, service, and replace that equipment.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-92 Log #396 NEC-P01 **Final Action: Accept**
(110.27, Informational Note)

Submitter: Thomas L. Adams, Macomb, IL
Comment on Proposal No: 1-157
Recommendation: Continue to reject the Proposal.
Substantiation: The present text of OSHA 1926.403(i) limits that paragraph to applications up to 600 Volts. 1926.403(i)(2)(i)(D) requires the same 8 ft as the present NEC text. Table K-3 of OSHA 1926.403(j)(3)(iii) shows the requirements in the present NEC text meet the requirements in the OSHA Table above 600 Volts. Changing the application of the text in 110.27(A)(4) will create a conflict between the two documents causing voltages from 601 to 1000 Volts to be in violation of OSHA requirements. In addition, a Note within the OSHA document states that "If the electrical installation is made in accordance with the National Electrical Code ANSI/NFPA 70-1984, exclusive of Formal Interpretations and Tentative Interim Amendments, it will be deemed to be in compliance with 1926.403 through 1926.408, except for 1926.404(b)(1) and 1926.405(a)(2)(ii)(E), (F), (G), and (J)." This would further conflict with the proposed text without significant amendment.
Panel Meeting Action: Accept
Panel Statement: A joint task group appointed by the Correlating Committee consisting of representatives from HVTG, CMP 1 and CMP 8 reviewed proposals rejected by CMP 1 and CMP 8 related to replacing 600V to 1000V. The joint task group concluded that neither the joint task group nor the High Voltage Task Group has the necessary background research to further justify technical substantiation for the rejected proposals. Such substantiation would likely need to come from entities such as the manufacturers or the NFPA Research Foundation. The joint task group recommended that CMP 1 and CMP 8 not change the original actions taken during the 2014 proposal stage. In addition, the panel does not necessarily agree with all of all the substantiation for the comment.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-93 Log #927 NEC-P01 **Final Action: Reject**
(110.27(A)(a))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 9-14b
Recommendation: Revise text to read as follows:
110.27 Spaces About Electrical Equipment.
(A) Working Space.
(a) ***Dead-Front Assemblies.*** Working space shall not be required in the back or sides of assemblies, such as dead-front switchboards, switchgear, or motor control centers, where all connections and all renewable or adjustable parts, such as fuses or switches, are accessible from locations other than the back or sides. Where rear or side access is required to work on nonelectrical parts on the back of enclosed equipment, a minimum horizontal working space of 762 mm (30 in.) shall be provided. **[ROP 9–14b]**
Substantiation: If we need to access it from the side we need working space.
Panel Meeting Action: Reject
Panel Statement: No technical substantiation has been provided to include "side access" in this provision.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-94 Log #864 NEC-P01 **Final Action: Accept**
(110.27(A)(4))

Submitter: C. Douglas White, Center Point Energy / Rep. Edison Electric Institute/Electric Light & Power Group
Comment on Proposal No: 1-158
Recommendation: The Panel action should have been to Accept in Principle the Proposal with the following changes:

By elevation ~~of 2.5 m (8 ft) or more~~ above the floor or other working surface as shown in (a) or (b) below:
(a) a minimum of 2.5 m (8 ft) for 50 - 300 Volts
(b) a minimum of 2.6 m (8-1/2 ft) for 301 to 600 Volts.
Substantiation: This is based on the negative ballot by Neil LaBrake in the ROP.

As stated in that ballot, "Clearances of any sort typically are composed of several components. One is some base number or reference height for the activity in the vicinity of the thing to be cleared. Section 230.24(B), for example, lists requirements for four different types of "activity" under overhead service conductors. The clearance is different for each activity.

Similarly, the voltage of the line or live part is another component; the higher the voltage, the larger the clearance required. Table 110.34(E) is an example of that requirement.
While the reference height for personnel is not explicitly stated in the NEC, it should be noted that 8 ft is often used as the assumed height of a person with arms extended over head. This, in fact, may also be where the 8 ft listed in NEC Section 110.27(A)(4) came from. But to just use only this reference value without consideration for the voltage involved would not be reasonable.

Considering the values shown in Table 110.34(E), it would be reasonable to infer that a median value for voltages under 600 Volts would be 0.5 ft.
The total then for all components would be 8-1/2 ft.

Lastly, Table 124-1 of the NESC does separate voltages of 300 (phase-to-phase) and below from those 301 to 600. 300 Volts and below is listed as "not specified" and for that reason the Panel could accept a similar separation."

The ballot statement also references and restates OSHA requirements and those are not repeated here for the sake of brevity.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-95 Log #1519 NEC-P01 **Final Action: Reject**
(110.27(E)(2))

TCC Action: The Correlating Committee directs that the panel action on Comment 1-95 be reported as reject since Proposal 1-131 was not accepted as a result of the action taken on Comment 1-75.
Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 1-155
Recommendation: Revise text to read as follows:
110.27 Spaces About Electrical Equipment.
(E) Dedicated Equipment Space.
(2) Outdoor. Outdoor installations shall comply with ~~110.26~~ 110.27(E)(2)(a) and (b)
Substantiation: 600 volt clearance has moved from 110.26 to 110.27.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-96 Log #123 NEC-P01 **Final Action: Accept**
(110.28)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-14e
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7.
It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 1 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-97 Log #397 NEC-P01 **Final Action: Accept**
(110, Part III - Title)

Submitter: Thomas L. Adams, Macomb, IL
Comment on Proposal No: 1-161
Recommendation: Continue to reject the Proposal.
Substantiation: A review and comparison of the present text of Part III of Article 110 with OSHA 1926 shows the OSHA document breaks at 600 Volts. Changing the Title of Article 1I0, Part III will create a conflict between the two documents causing voltages from 600 Volts to 1000 Volts to be in violation of OSHA requirements. Secondly, there was no Proposal to change the title of 110, Part II which would result in confusion. In addition, a Note within the OSHA document states that "If the electrical installation is made in accordance with the National Electrical Code ANSI/NFPA 70-1984, exclusive of Formal Interpretations and Tentative Interim Amendments, it will be deemed to be in compliance with 1926.403 through 1926.408, except for 1926.404(b)(1) and 1926.405(a)(2)(ii)(E), (F), (G), and (J)." This would further conflict with the proposed text without significant amendment.
Panel Meeting Action: Accept
Panel Statement: A joint task group appointed by the Correlating Committee consisting of representatives from HVTG, CMP 1 and CMP 8 reviewed proposals rejected by CMP 1 and CMP 8 related to replacing 600V to 1000V. The joint task group concluded that neither the joint task group nor the High Voltage Task Group has the necessary background research to further justify technical substantiation for the rejected proposals. Such substantiation would likely need to come from entities such as the manufacturers or the NFPA Research Foundation. The joint task group recommended that CMP 1 and CMP 8 not change the original actions taken during the 2014 proposal stage. In addition, the panel does not necessarily agree with all of all the substantiation for the comment.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-98 Log #1243 NEC-P01 **Final Action: Accept**
(110, Part III, Title)

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 1-161
Recommendation: I recommend the panel continues to reject this proposal which would change 600 volts to 1000 volts.
Substantiation: Replacing 600 volts with 1000 volts will have a major impact on installers, component manufacturers, and industry standards. Increased spacing must be considered when going from 600 volts to 1000 volts. Personal safety must also be considered.
Because the proposer has not provided enough information to the public to justify and understand all the ramifications of the proposal, the committee should continue to reject the submitter's proposal.
Panel Meeting Action: Accept
Panel Statement: A joint task group appointed by the Correlating Committee consisting of representatives from HVTG, CMP 1 and CMP 8 reviewed proposals rejected by CMP 1 and CMP 8 related to replacing 600V to 1000V. The joint task group concluded that neither the joint task group nor the High Voltage Task Group has the necessary background research to further justify technical substantiation for the rejected proposals. Such substantiation would likely need to come from entities such as the manufacturers or the NFPA Research Foundation. The joint task group recommended that CMP 1 and CMP 8 not change the original actions taken during the 2014 proposal stage. In addition, the panel does not necessarily agree with all of all the substantiation for the comment.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-99 Log #458 NEC-P01 **Final Action: Accept in Principle**
(110.31, Informational Note 1)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 1-163
Recommendation: Revise ASTM E119-2011a to read ASTM E119-2012a.
Substantiation: Date update of ASTM E119 standard.
Panel Meeting Action: Accept in Principle
Revise ASTM E119-2011a to read ASTM E119-12a.
Panel Statement: The panel modified to reflect the official ASTM designation.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-100 Log #124 NEC-P01 **Final Action: Accept**
(110.31(B)(1))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-14f
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7.
It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 1 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-101 Log #125 NEC-P01 **Final Action: Accept**
(110.33(A)(1))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-14g
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7.
It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 1 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: Panel 1 requests the TCC look at the replacement of the terms. In some of Panel 9's actions the term switchgear was added to a list including switchboards while in other action switchgear replaced switchboards and Panel 9 did not substantiate the reason for the differences.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-102 Log #126 NEC-P01 **Final Action: Accept**
(110.34(A) Exception)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-14h
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7.
It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 1 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: Panel 1 requests the TCC look at the replacement of the terms. In some of Panel 9's actions the term switchgear was added to a list including switchboards while in other action switchgear replaced switchboards and Panel 9 did not substantiate the reason for the differences.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-103 Log #942 NEC-P01 **Final Action: Reject**
(110.34(A) Exception)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 9-14h
Recommendation: Revise text to read as follows:
110.34 Work Space and Guarding.
(A) Working Space.
Exception: *Working space shall not be required in back of equipment such as switchgear or control assemblies where there are no renewable or adjustable parts (such as fuses or switches) on the back and where all connections are accessible from locations other than the back. Where rear* <u>*or side*</u> *access is required to work on nonelectrical parts on the back of enclosed equipment, a minimum working space of 762 mm (30 in.) horizontally shall be provided.*
[ROP 9–14h]
Substantiation: If we need to access it from the side we need working space.
Panel Meeting Action: Reject
Panel Statement: No technical substantiation has been provided to include “side access” in this provision.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-104 Log #519 NEC-P01 **Final Action: Accept**
(110.34(C))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 1-175
Recommendation: Revise text to read as follows:
(C) Locked Rooms or Enclosures. The entrance to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at over 600 volts, nominal, shall be kept locked unless such entrances are under the observation of a qualified person at all times. ~~Where the voltage exceeds 600 volts, nominal, p~~ <u>P</u>ermanent and conspicuous danger signs shall be provided. The danger sign shall meet the requirements in 110.21(B) and shall read as follows:
DANGER — HIGH VOLTAGE — KEEP OUT
Substantiation: The first sentence in 110.34(C) already identifies the exposed voltage. The first part of the second sentence is redundant.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-105 Log #127 NEC-P01 **Final Action: Accept**
(110.34(F))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-14i
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of “Metal Enclosed Power Switchgear” to “Switchgear” in Proposal 9-7.
It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 1 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-106 Log #398 NEC-P01 **Final Action: Accept**
(110, Part IV Title)

Submitter: Thomas L. Adams, Macomb, IL
Comment on Proposal No: 1-180
Recommendation: Continue to reject the Proposal.
Substantiation: A review and comparison of the present text of Part IV of Article 110 with OSHA 1926 shows the OSHA document breaks at 600 Volts. Changing the title of Article 1I0, Part IV will create a conflict between the two documents causing voltages from 600 Volts to 1000 Volts to be in violation of OSHA requirements. Secondly, there was no Proposal to change the title of 110, Part II which would result in confusion. In addition, a Note within the OSHA document states that “If the electrical installation is made in accordance with the National Electrical Code ANSI/NFPA 70-1984, exclusive of Formal Interpretations and Tentative Interim Amendments, it will be deemed to be in compliance with 1926.403 through 1926.408, except for 1926.404(b)(1) and 1926.405(a)(2)(ii)(E), (F), (G), and (J).” This would further conflict with the proposed text without significant amendment.
Panel Meeting Action: Accept
Panel Statement: A joint task group appointed by the Correlating Committee consisting of representatives from HVTG, CMP 1 and CMP 8 reviewed proposals rejected by CMP 1 and CMP 8 related to replacing 600V to 1000V. The joint task group concluded that neither the joint task group nor the High Voltage Task Group has the necessary background research to further justify technical substantiation for the rejected proposals. Such substantiation would likely need to come from entities such as the manufacturers or the NFPA Research Foundation. The joint task group recommended that CMP 1 and CMP 8 not change the original actions taken during the 2014 proposal stage. In addition, the panel does not necessarily agree with all of all the substantiation for the comment.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-107 Log #1520 NEC-P01 **Final Action: Reject**
(110.53)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 1-181
Recommendation: Revise text to read as follows:
110.53 Conductors. High-voltage conductors in tunnels shall be installed in metal conduit <u>(IMC or RMC)</u> or other metal raceway <u>(EMT or FMT)</u> , Type MC cable, or other approved multiconductor cable. Multiconductor portable cable shall be permitted to supply mobile equipment.
Substantiation: The list of metal conduit or other metal raceways suggested above may include those not suitable for high-voltage conductors in tunnels. If that is the case, then it should be pruned. This addresses the committee’s objection to listing only RMC.
Panel Meeting Action: Reject
Panel Statement: Submitter has not substantiated that FMC and LFMC are not suitable for carrying conductors rated above 600 V. In addition, other metal raceways, including Cellular Metal Floor Raceways (Article 374), Metal Wireways (Article 376) and Surface Metal Raceways (Article 386) are also permitted to carry conductors rated higher than 600 V.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-108 Log #1577 NEC-P01 **Final Action: Reject**
(110.74(A))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 9-28
Recommendation: Revise text to read as follows:
110.74 Conductor Installation.
(B) Over 600 Volts, Nominal. Conductors operating at over 600 volts shall be provided with bending space in accordance with <u>314.28</u>, 314.71(A) and (B), as applicable.
Substantiation: The voltage boundary in 110 is 600. The voltage boundary (changed by ROP 9-28) in 314 is 1000. The voltage span in 110.74(B) is included in both 314.28 and 314.71.
Panel Meeting Action: Reject
Panel Statement: The Panel 1 did not accept proposals or comments to change 600 volts to 1000 volts. The panel requests the Correlating Committee review these items for correlation with Panel 9.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ARTICLE 200 — USE AND IDENTIFICATION OF GROUNDED CONDUCTORS

5-7 Log #1145 NEC-P05 **Final Action: Reject**
(200.1 and 285.27)

Submitter: Paul Dobrowsky, American Chemistry Council
Comment on Proposal No: 5-27
Recommendation: The proposal should have been accepted.
Substantiation: The term Equipment Grounding Conductor needs to be replaced. Those opposed have no technical reason for their opposition or any other valid reason. It is not worth the effort and everyone understands what is meant are common responses.
It is very simple: Grounding electrode conductors are the connection to the earth and accomplish grounding. In the present NEC, Equipment Grounding Conductors and bonding jumpers provide a “path back” to the source. Both are always performing a bonding function. If the Grounding Electrode connection is removed or broken, the bonding function remains intact.
Section 250.4 does not permit the earth (ground) to be used as an effective ground fault current path but the term equipment grounding conductor inherently incorrectly contains the word “ground”.
Visualize equipment supplied by a portable generator. The generator frame is not required to be connected to the earth. The “green” wire in the flexible cord is not performing a grounding function but is performing a bonding function.
Visualize building one supplied by a service, having the grounded conductor connected to the grounding electrode system by a grounding electrode conductor. A feeder supplies a second building and a grounding electrode conductor is required for grounding any equipment in the second building. An

equipment grounding conductor is required to be installed from building 1 to building 2. Not for grounding, but for bonding, providing an effective fault current path.

Making this change has the added benefit of being more harmonized with other international standards and usage of terminology.

Experienced NEC users have to ignore other concepts in other definitions and requirements to use the existing term. This does not help the future NEC user or provide clarity in the existing NEC. Changing the term is the right thing to do and should be supported.

Panel Meeting Action: Reject

Panel Statement: See panel action and statement on Comment 5-1.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 13 Negative: 3

Explanation of Negative:

DOBROWSKY, P.: See my negative ballot comment on 5-1.

MOHLA, D.: See my explanation of negative vote on Comment 5-1.

WILLIAMS, D.: See my negative vote substantiation written for Comment 5-1

Comment on Affirmative:

PORTER, C.: See my statement in comment 5-1.

5-8 Log #1304 NEC-P05 **Final Action: Reject**
(200.1)

Submitter: James M. Imlah, Hillsboro, OR

Comment on Proposal No: 1-178

Recommendation: Revise text to read as follows:

200.1 Scope.

This article provides requirements for the following:

(1) Identification of terminals

(2) Grounded conductors in premises wiring systems

(3) Identification of grounded conductors

Informational Note <u>No. 1:</u> See Article <u>100</u> for definitions of *Grounded Conductor, Equipment Grounding Conductor,* and *Grounding Electrode Conductor*.

<u>Informational Note No. 2: See 250.26 for when a grounded conductor is a neutral conductor.</u>

Substantiation: As noted in the negative comment there appears to be an inconsistency of the rejection of the new informational Note 2 in 200.1 and the actions to accept the change in 250.26 NEC (ROP 5-77). The informational note is important as 200.1 explains the scope of identification of a grounded conductor, and with the new Note 2 would clarify how the grounded conductor is to be installed as permitted in 250.26. Even the handbook commentary tries to explain the grounded conductor that may become a neutral conductor and conductor identification. This reference new Note 2 to 250.26 would enhance clarity, intent, and purpose for the AC systems. Please re-consider the action from reject as to accept the proposal as submitted.

Panel Meeting Action: Reject

Panel Statement: The correct reference is to proposal 5-26.
The addition of a reference to 250.26 is not needed. Whether a grounded conductor is a neutral or not is not relevant to the requirements of Article 200.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 15 Negative: 1

Explanation of Negative:

MELLO, C.: The panel should have accepted the added informational note. The actions taken at the ROP stage on Proposal 5-77, not revised at the ROC stage, confirm the use of the term “neutral” in 250.26 for those systems having a neutral meeting the definitions in Article 100 of these terms. This is different than the broader “grounded conductor”. The panel statement is incorrect in stating that the conductor being a “grounded conductor” or a “neutral” is not relevant to the requirements in Article 200. The action taken by the panel on Comment 5-10 now utilizes the term “neutral” in the title of 200.4 as well as the requirements so why is the term “neutral” not relevant? The scope in 200.1 should be clear that for the purposes of Article 200 both “grounded conductors” and “neutral conductors” are included within the overall scope of Article 200.

5-9 Log #1322 NEC-P05 **Final Action: Reject**
(200.2(A))

Submitter: James F. Williams, Fairmont, WV

Comment on Proposal No: 5-28

Recommendation: Revise text to read as follows:

200.2 General.

(A) Insulation. The grounded conductor, if insulated, shall have insulation that is (1) suitable, other than color, for any ungrounded conductor of the same circuit for ~~systems of 1000 volts or less, or~~ impedance grounded neutral systems~~ of over 1000 volts~~, or (2) rated not less than 600 volts for solidly grounded neutral systems ~~of over 1000 volts as described in 250.184(A).~~ **[ROP 5–28]**

Substantiation: The reword is simpler, removes the insulation value inversion between 601 and 999 volts. It also matches the rules found in 250 II and X.

Panel Meeting Action: Reject

Panel Statement: This comment changes requirements without technical substantiation. There are distinctly different insulation requirements for 1000 Volt and below systems and those systems over 1000 Volts. The changes as accepted by the panel bring clarity and note the different requirements at the 1000 Volts change over point. The substantiation is incorrect that a void exists between 601 and 999 Volts.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-10 Log #280 NEC-P05 **Final Action: Accept in Principle**
(200.4)

Submitter: Code-Making Panel 2,

Comment on Proposal No: 5-29

Recommendation: Continue to Accept in Principle but add the following text to the Exception:

“<u>or if the conductors are identified at their terminations with numbered wire markers corresponding to the appropriate circuit number.</u>”

Substantiation: This additional text correlates the requirement with the action taken by CMP 2 on Proposal 2-19.

This comment was developed by a CMP-2 Task Group and balloted through the entire panel with the following ballot results:

11 Eligible to vote

7 Affirmative (See voting comments below)

3 Negative (See voting comments below)

1 Ballot Not Returned (R.E. Duren)

AFFIRMATIVE:

M.R. Hilbert: Although I do not agree with Proposal 5-29 in general, I voted with the panel as the “accept in principle” recommendation will at least allow recognition of other methods of circuit identification such as the long standing 200.6(D).

The grouping requirement in 210.4(D) is for a specific application at the point of supply where it is necessary to be able to identify the ungrounded conductors and associated neutral of a multi-wire circuit for safe disconnection. However, expanding the grouping requirements as proposed in 5-29 is overly restrictive, will be difficult to enforce and seems to be without good substantiation.

I do not agree that without the proposed language one would be in violation of 200.4 as stated in the substantiation. Section 200.4 states that a neutral conductor cannot be used for more than one branch circuit, multi-wire branch circuit or one set of feeder conductors unless permitted elsewhere in the Code. This section does not contain any grouping requirements and there was no other substantiation provided to justify the changes. In fact the neutral bus referred to in the substantiation is often located at the point of supply of the branch circuit which is already addressed by 210.4(D).

The proposed changes will be difficult for the enforcement community as all junction and splice points where there are multiple circuits with neutrals would have to be open for inspection of the grouping requirements and then an additional inspection will be required to assure all covers are in place. This will be extremely challenging where suspended ceilings are involved as it is common for the ceiling contractor to be on site waiting for the ceiling to be passed by the electrical inspector so he can drop tiles.

NEGATIVE:

F. COLUCCIO: Although not prohibited, the identification of conductors in multiwire branch circuits, to the extent recommended by the submitter, would be overly excessive for most installers. The requirements in 210.4(B) and (D) are sufficient to provide reasonable assurances that a multiwire branch circuit is present and proper connection is achieved.

D.M. King: Proposal 5-29: Continue to accept this proposal in principal. I disagree with the Panel action text. Identification at termination points alone should not be considered an effective means to replace grouping of conductors of a multiwire branch circuit. Positive identification of all conductors of a multi-wire branch circuit is critical to the safety of qualified persons who service these circuits and grouping provides a secure physical means of this identification that should not be compromised by less effective alternative methods.

R.G. Wilkinson: Too restrictive. Initial installation addresses grouping.

Panel Meeting Action: Accept in Principle

Revise 200.4 as follows:

200.4 <u>**Neutral Conductors.** Neutral conductors shall be installed in accordance with (A) and (B).</u>

<u>**(A) Installation.**</u> Neutral conductors shall not be used for more than one branch circuit, for more than one multiwire branch circuit, or for more than one set of ungrounded feeder conductors unless specifically permitted elsewhere in this Code.

<u>**(B) Multiple Circuits.** If more than one neutral conductor associated with different circuits is in an enclosure, grounded circuit conductors of each circuit shall be identified or grouped to correspond with the ungrounded circuit conductor(s) by wire markers, cable ties, or similar means in at least one location within the enclosure.</u>

<u>**Exception 1:** The requirement for grouping or identifying shall not apply if the branch circuit or feeder conductors enter from a cable or a raceway unique to the circuit that makes the grouping obvious.</u>

<u>**Exception 2:** The requirement for grouping or identifying shall not apply where branch circuit conductors pass though a box or conduit body without a loop as described in 314.16(B)(1) or without a splice or termination.</u>

Panel Statement: The concept for identifying the conductors with wire markers was incorporated into the positive text of 200.4 (B). Exception 2 was added to allow conductors to be pulled through a box without grouping or identification. Where no loop or coil (as provided in 314.16(B)(1)) is left for splices it is not necessary to group the circuit conductors.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-11 Log #938 NEC-P05 **Final Action: Accept in Principle**
(200.4(B) Exception)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 5-29
Recommendation: Revise text to read as follows:
200.4 Neutral Conductors.(B) Multiple Circuits. Where more than one neutral conductor associated with different circuits is in an enclosure, the ungrounded and grounded circuit conductors of each circuit shall be grouped by cable ties or similar means in at least one location within the enclosure.
~~*Exception: The requirement for grouping shall not apply if the circuit conductors enter from a cable or a raceway unique to the circuit that makes the grouping obvious.*~~
Exception: The requirement for grouping shall not apply if the circuit enters from a cable or raceway unique to the circuit that makes the grouping obvious or if the conductors are identified at their terminations with wire markers corresponding to the appropriate circuit.
Substantiation: The exception text is copied from 210.4(D) Exception: and since both exceptions describe the treatment of the same conductors treated as a circuit, the exception text should match.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and statement on Comment 5-10.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

ARTICLE 210 — BRANCH CIRCUITS

2-3 Log #978 NEC-P02 **Final Action: Reject**
(210.2 (New))

Submitter: Charles J. Palmieri, Town of Norwell
Comment on Proposal No: 2-11
Recommendation: The panel should reconsider this opportunity to provide clarity to installers and inspectors alike by providing a definition of when renovations constitute a circuit modification that compels the installer to install AFCI Protection. I continue to suggest the following language. From the previous proposal. Relocate and renumber the existing language of 210.2 and install the following definition. New Definition as 210.02 Definitions.
Modifications (Circuits). For the purpose of this article the term modifications shall include changes to an existing structures branch circuit wiring installation, which results in the replacement, relocation or extension for the purpose of serving outlets or utilization equipment. The term modifications in this section shall not apply to short sections of spliced conductors consistent with panelboard, device or luminaire replacement.
Substantiation: I am submitting this comment on proposal 2-11 70-A2013 ROP to provide CMP 2 with another opportunity to clarify, under what conditions manipulation of existing circuitry during panel board and device replacement is it intended to require the addition of AFCI Protection.
Panel Meeting Action: Reject
Panel Statement: The panel continues to affirm that use of the term "modified" in Sec. 210.12(B) is a specific context that must be considered by the AHJ as to the extent of the changes being made to the branch circuit and the necessity for requiring AFCI protection. The panel also notes that the exception added to 210.12(B) during the proposal stage also addresses the submitters concern.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13
Comment on Affirmative:
HILBERT, M.: The NEC Style Manual prohibits a requirement from being placed in a definition so an exception was added to 210.12(B) during the proposal stage to address the submitters concern. See Proposal 2-115.

2-4 Log #1047 NEC-P02 **Final Action: Reject**
(210.4)

Submitter: George M. Stolz, II, Quicksilver Electrical Training
Comment on Proposal No: 2-13
Recommendation: Accept the proposal in principle as follows:
Exception: Simultaneous disconnection of ungrounded conductors of a dedicated multiwire branch circuit supplying a combination pump controller and alarm may be omitted if all supply conductors are contained within the same wiring method at the controller. A warning label shall be placed on the panelboard that clearly states that both phases supplying the pump and alarm require disconnection prior to maintenance or repair.
Substantiation: A pump controller featuring a 120V pump on the first line and a 120V alarm on the second line of a multiwire branch circuit with no stops in between should not pose a surprise to qualified personnel if all conductors are present and terminate within the same enclosure. A pump that trips the OCPD and inadvertently also trips the supply to the alarm defeats the entire purpose of having the alarm. The label was added as an afterthought to protect these wildly underqualified people we're so concerned about.
Panel Meeting Action: Reject
Panel Statement: The panel continues to affirm that the need for simultaneous disconnection of all ungrounded conductors in a multiwire branch circuit is to address the potential for an electric shock hazard, and that adding exceptions will introduce a potentially hazardous condition.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-5 Log #21 NEC-P02 **Final Action: Accept**
(210.4(C))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 2-17a
Recommendation: The Correlating Committee directs that the panel provide further clarification for the exact location of the Informational Note.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Identify the existing Informational Note following 210.4(A) as Informational Note No. 1.
Relocate the Informational Note proposed to follow 210.4(C) by Proposal 2-17a to follow the existing Informational Note in 210.4(A) and number it as Informational Note No. 2.
Panel Statement: The panel relocated the Informational Note to follow the existing Informational Note in 210.4(A) which is the proper location.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-6 Log #1202 NEC-P02 **Final Action: Reject**
(210.4(D))

Submitter: Michael L. Last, Na'Alehu, HI
Comment on Proposal No: 2-18
Recommendation: Revise text to read as follows:
(D) Grouping. The ungrounded and grounded circuit conductors of each multiwire branch circuit shall be grouped by cable ties or similar means and indicated as such in at least one location within the panelboard or other point of origination. The means of identification shall be permanent by tagging or similar methods.
Substantiation: The proposal should be reconsidered and accepted based on the fact that the submitter's substantiation identifies a significant problem with the existing requirement. The requirement set forth in the 2011 NEC does not accurately offer identification fr multiwire branch circuits. The grouping of conductors does not indicate the reason for such bundling (grouping). Nor does the exception address this same concern. The fact that the ungrounded and grounded circuit conductors are in some way grouped (bundled) does not in and of itself indicate they constitute a multiwire branch circuit. This proposal will quickly and easily indicate the reason for such grouping; as well as reduce the possibility of unintentional consequences caused by compromising the integrity of the grounded circuit conductor.
Panel Meeting Action: Reject
Panel Statement: The panel continues to affirm that the grouping requirement is sufficient to identify the grounded conductor that is associated with the ungrounded conductor(s) in a multiwire branch circuit.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-7 Log #1305 NEC-P02 **Final Action: Reject**
(210.4(D))

Submitter: James M. Imlah, Hillsboro, OR
Comment on Proposal No: 2-19
Recommendation: Delete text to read as follows:
210.4 Multiwire Branch Circuits.
A. Unchanged
B. Unchanged
C. Unchanged
D. **Grouping.** The ungrounded and grounded circuit conductors of each multiwire branch circuit shall be grouped by cable ties or similar means in at least one location within the panel board or other point of origination. Or if the conductors are identified at their terminations with numbered wire markers corresponding to the appropriate circuit.
Substantiation: Please reject this proposal as it does not enhance or add clarity to the existing exception. Numbered wire markers work well for a period of time, but over time and due to environmental conditions tags are usually found inside the bottom of the panel, un-readable, or altogether missing. The submitter has not provided clarity as to how a multiwire branch circuit with a common neutral (grounded conductor) shall be identified such as a circuit 2 &

4 and then you identify the neutral is it actually 2 & 4 or is that 24, grouping does provide one of the methods for assuring circuit groups. If this exception is allowed to be added, grouping by cable ties or other similar means is not done, only number marking would be acceptable which could be considered as overly restrictive. This would be an enforcement nightmare if a deficiency is cited for numbering only when the exception is applied. Identification is already allowed in the charging statement (similar means) and does not belong as another condition to the exception.

Panel Meeting Action: Reject

Panel Statement: The permission to use the alternate method of identifying conductors with wire markers is considered an acceptable and equivalent method of identifying these conductors.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 12 Negative: 1

Explanation of Negative:

KING, D.: This comment should be accepted. The proposed text is vague and does not specifically address the need for the grounded conductor along with the ungrounded conductor to be clearly identified in lieu of grouping. Positive identification of all conductors of multiwire branch circuits is critical to the safety of qualified persons who service these circuits.

2-8 Log #1203 NEC-P02 **Final Action: Reject**
(210.4(E))

Submitter: Michael L. Last, Na'Alehu, HI

Comment on Proposal No: 2-20

Recommendation: Accept the proposal and add new text to read as follows:

(E) Identification of Ungrounded and Associated Grounded Conductors. At the locations indicated in 210.4(D), and at all other locations where it is permissible to interrupt the integrity of the grounded (neutral) conductor of a multiwire branch circuit, all the ungrounded (phase or line) and grounded circuit conductors of each multiwire branch circuit shall be individually grouped by cable ties or similar means and identified as such. At all locations where more than one multiwire branch circuit is present, each separate multiwire branch circuit shall be uniquely identified whereby each grounded conductor is readily identified with the corresponding ungrounded conductors of that particular multiwire branch circuit. The means of identification shall be permanent by tagging or similar methods.

Substantiation: The proposal should be reconsidered and accepted based on the fact that the submitter's substantiation identifies a significant problem with the existing requirement. The requirement set forth in the 2011 NEC® does not accurately offer identification of multiwire branch circuits. While 210.4(D) does provide some indication that a multiwire branch circuit possibly could exist, it is possible that the bundling of conductors could have been provided for some other reason. A readily identified tag (or other means) will definitely indicate the actual purpose of bundling, i.e. that of a multiwire branch circuit. The complete and proper identification of multiwire branch circuit(s) as proposed could not be considered overly excessive when it increases the margin of safety.

Panel Meeting Action: Reject

Panel Statement: The panel continues to affirm that the requirements in 210.4(B) and (D) are sufficient to provide reasonable assurances that a multiwire branch circuit is present and proper disconnection is achieved.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 12 Negative: 1

Explanation of Negative:

KING, D.: The Submitter's substantiation accurately describes a safety concern encountered frequently by personnel. I disagree with the panel statement that "the requirements in 210.4(B) and (D) are sufficient to provide reasonable assurances that a multiwire branch circuit is present and proper disconnection is achieved." The additional requirements would implement a practical means to ensure proper identification of multiwire branch circuits thus minimizing the hazards to persons and property that exist with the use of these circuits.

2-9 Log #1274 NEC-P02 **Final Action: Reject**
(210.5(B), 215.6, and 215.12)

Submitter: Elliot Rappaport, Electro Technology Consultants

Comment on Proposal No: 2-21

Recommendation: Accept proposal.

Substantiation: The term "equipment grounding conductor" does not have a unique meaning since the words themselves do not express the purpose of that conductor. The term "equipment grounding conductor" has a definite purpose that is not uniquely expressed in the term, i.e. "bond the equipment to a terminal at the source of voltage". As a result, there is a misconception that "grounding", without bonding to the source, will make a system safe. On the contrary, connecting equipment to ground without providing the bonding connection back to the source can make equipment less safe by increasing the time to clear the fault.

The Panel statement that the equipment grounding conductor serves a dual purpose of providing a path to ground as well as a path for fault current does not place sufficient significance on the importance of bonding over grounding. Bonding provides sufficient ground fault current back to the source of voltage to operate an overcurrent device and clear the fault quickly. Connection to ground limits the voltage to ground on normally non-current-carrying parts during non-fault conditions. During fault conditions, the value of grounding is minimal since the primary safety concern is to remove the fault voltage as quickly as possible. A path to ground for fault current is not necessary since ground fault current must return to the source of voltage, not to ground.

Renaming this conductor as an "Equipment Bonding Conductor (EBC)" will clarify that the primary purpose of this conductor is to bond to the source in order to provide a known path for ground fault current that will facilitate rapid fault clearing.

It is recognized that the term "EGC" has been in use for a long time and that changing it to EBC will cause some concerns including changing written literature that uses the EGC term. After the initial period of understanding, users will correctly understand the purpose of this conductor and this will enhance the safety of personnel.

The fundamental purpose of this and companion proposals is to clearly state that "systems" are "grounded" and "equipment" is "bonded". The fact that the bonding conductor may be grounded also is secondary to the primary function of bonding.

Panel Meeting Action: Reject

Panel Statement: The panel continues to affirm that the term "equipment-grounding conductor" has a unique meaning and needs to remain in the NEC. The panel does not agree that renaming this conductor as an "Equipment Bonding Conductor" will provide additional clarity to the meaning or purpose for this conductor. As noted in the Informational Note to the existing definition, an equipment-grounding conductor serves a dual purpose of providing a path to ground (earth) as well as a bonding path for fault current.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 11 Negative: 2

Explanation of Negative:

BOYNTON, C.: The term "equipment grounding conductor" needs to be replaced with "equipment bonding conductor" throughout the NEC. Yes, the term equipment grounding conductor in Article 100 would need to be changed to the term equipment bonding conductor.

Some have argued that it is just a problem of education. Having the word "grounding" in a term describing conductor that is used primarily for a bonding function is not a problem to be solved by education.

The use of the term "equipment grounding conductor" is confusing both for those new to the electrical industry and even for some experienced users. The problem is compounded when dealing with other international standards.

No technical reason has been provided for not making the change. This conductor always provides a bonding function but does not always provide a grounding function such as in the case of a portable generator installed as a separately derived system.

MITCHEM, J.: The IEEE agrees with the submitter's substantiation. The comment should have been accepted because it is technically correct. The proposal improves the technical accuracy of the use of the terms "equipment grounding conductor" and "equipment bonding conductor". The IEEE has reviewed all the statements on this subject by various panels. The following represents the IEEE position on the issue of equipment grounding conductor or equipment bonding conductor. Similar proposals have been presented in the past and have been rejected. There is no justification for retaining an incorrect and potentially hazardous electrical installation just because this definition has been used in the NEC for many years. Not all electrical practitioners are knowledgeable in the main purpose of this conductor. The intent of the proposed change is to provide a descriptive name to a construction element that has resulted in much misunderstanding with possible hazardous operating conditions in electrical installations. The use of the term "grounding" implies that grounding is its principal function. Although grounding may be desirable, providing an effective fault current path (i.e. bonding) is and should be the emphasis. There are many who assert that a connection to a water pipe meets the needs of equipment grounding, however, this connection does not perform the necessary effective fault current path back to the source. There are two conductors described in the Code performing the same function but named differently. The "bonding jumper" is a short conductor that assures the electrical integrity of enclosure to raceway. The longer conductor, intended to provide a low impedance path to the source, is presently named a "grounding" conductor instead of its real function as a "bonding" conductor.

2-10 Log #22 NEC-P02 **Final Action: Accept**
(210.5(C))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 2-23

Recommendation: The Correlating Committee directs that this proposal be reconsidered and correlated with the actions taken on Proposals 2-217, 4-262, 4-234, 4-375, 5-220, 5-221 and 13-33 with regard to the 50 volt/60 volt nominal level.

The Correlating Committee also directs that the word "and" in 210.5(C) be reviewed to see if "or" would be more applicable.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Revise 210.5 (C) as follows:

Identification of Ungrounded Conductors. Ungrounded conductors shall be identified in accordance with 210.5(C)(1) ~~and~~ or (2) as applicable.

In proposed 210.5(C)(2) replace 60 volts with 50 volts.

Panel Statement: The panel has reviewed 210.5(C) and agrees that changing the word "and" in 210.5(C) to "or" is more appropriate.

The change from 60 volts to 50 volts is to correlate with the CMP 13 action on Proposal 13-33.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

18-6 Log #23 NEC-P18 **Final Action: Accept**

(210.8)

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 2-29

Recommendation: It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 18 for action.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Panel Statement: Panel 18 supports the action by Panel 2 as Panel 18 also rejected a similar proposal 18-11 in the ROP stage as well.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

2-12 Log #24 NEC-P02 **Final Action: Accept**

(210.8)

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 2-31

Recommendation: The Correlating Committee directs that the action on this proposal be correlated with the action taken on Proposal 1-131.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Panel Statement: The panel accepts the direction from the Correlating Committee. The general rule accepted by Panel 1 in Proposal 1-131 is applicable to receptacle GFCIs only whereas the current code wording of 210.8 applies to all GFCI types. Therefore, the action on 2-31 needs to remain unchanged.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-13 Log #381 NEC-P02 **Final Action: Reject**

(210.8)

Submitter: Keith M. Whitesel, Whitesel Electric

Comment on Proposal No: 2-28

Recommendation: Proposal 2-28 Log #533 NEC–P02.

Reconsider this exception to the GFCI requirement.

While a sump pump, refrigerator or freezer will operate correctly when correctly connected to a GFCI if the GCFI device nuisance trips, and they still do, the basement could flood or the contents of the refrigerator or freezer could be lost.

This came home to me recently when during a lightning storm one of my GFCI's tripped and I lost $500.00 worth of food from my freezer. I live in an area where lightning storms are frequent and at least one of my seven GFCI devices trips almost every storm. It can be any one of my GFCI's. I have both GFCI breakers installed on some circuits and GFCI receptacles on other circuits. Any of them can trip during any storm. My house is also in a flood prone area. If my sump pumps were connected to GFCI's and they were to nuisance trip, my basement would flood and the potential damage could be thousands of dollars.

Substantiation: 90.1 clearly states that the purpose of the NEC is to protect both people and PROPERTY. Protecting ones home from flooding and from lose of food certainly should fall into this category of protection. These receptacles were formerly except from the GFCI requirement in past codes.

Panel Meeting Action: Reject

Panel Statement: No substantiation has been provided to show that listed GFCIs are not compatible with sump pumps or freezers.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

Comment on Affirmative:

HILBERT, M.: I agree with the panel action and statement. Section 240.15(B)(1) permits individual circuit breakers with identified handle ties to be used on multi-wire branch circuits that are serving on line-to-neutral loads. This application would address the submitter's concern with simultaneous disconnection of the alarm circuit by a fault in the pump circuit.

2-14 Log #1161 NEC-P02 **Final Action: Reject**

(210.8, Informational Note (New))

Submitter: Thomas A. Domitrovich, Eaton Corporation

Comment on Proposal No: 2-32

Recommendation: This proposal should have been accepted.

Substantiation: The Code panel rejected this proposal stating "The receptacle GFCI short circuit ratings are readily available from manufacturers of these devices if this information is necessary to comply with the requirements of 110.10."

However, the case of a GFCI receptacle is much different than most products in that many people are not even aware that these devices have a short circuit rating.

The UL 943 Standard requires a 2000A test for the typical device, and permits an Optional 10kA Short Circuit Current Test, but does NOT permit it to be marked 10kA. UL 943 States the following:

"SA3.1 A ground-fault circuit-interrupter that complies with SA2.1 and SA2.2 shall not be marked to indicate the ability to withstand a 10kA short circuit current as a result of these tests."

The rating information for these products, especially for the inspector reviewing the installation after these products have been installed, is often unchecked. This enables the misapplication of these life saving devices beyond their ratings. There are many areas where these devices are applied, especially in commercial and industrial environments, where the available fault currents may exceed the rating of the device.

This informational note is important for safety as it raises the awareness to installers and inspectors alike who are not aware of the short circuit capabilities of these devices. This will go a long way for ensuring these devices are applied within their rating.

Panel Meeting Action: Reject

Panel Statement: Short circuit ratings are available from manufacturers. The original proposal and this comment concentrates only on GFCIs and does not consider other parts of the wiring systems such as regular receptacles that are tested for only 1000 A withstand and switches which are not tested for withstand.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-15 Log #25 NEC-P02 **Final Action: Accept**

(210.8(A) Exception to (5))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 2-36

Recommendation: The Correlating Committee requests that Panel 2 review the text contained in the Informational Note following the "Exception to (5)" and clarify if changes are warranted since the term "fire alarm" was removed in this proposal.

The Correlating Committee also directs that this proposal be sent to Code-Making Panel 3 for comment as to whether the Informational Note in 760.41(B) will still be applicable.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Panel Statement: The panel accepts the Correlating Committee direction to review the text in the Informational Note following the Exception to 5.

See Panel Action and Statement on Comment 2-16.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-16 Log #265 NEC-P02 **Final Action: Accept**

(210.8(A) Exception No. 5)

TCC Action: The Correlating Committee understands that this comment only rejects Proposal 2-36 and that the proposed revisions to 210.8(A) Exception 5 that are a part of the submitter's substantiation are not accepted.

Submitter: Code-Making Panel 3,

Comment on Proposal No: 2-36

Recommendation: Reject Proposal 2-36.

Substantiation: The Panel rejects the action of CMP 2. The exact wording that is found in 760.41(B) and 760.121(B) is provided below. This proposal should be an Accept. The allowance is that the power for fire alarm equipment not be supplied through either a ground-fault circuit interrupter or arc-fault circuit interrupters. The proposed text makes it clear that this is a requirement and not an option.

While burglar alarm systems are not addressed within Article 760, most if not all intrusion systems that are installed within single family dwellings do have at least one zone of protection connected to smoke detectors. The existing paragraph addressed both fire alarm and intrusion detection systems.

The existing language of 2108(A), Exception 5 should remain as follows:

760.41(B) This branch circuit shall not be supplied through ground-fault circuit interrupters or arc-fault circuit-interrupters.

760.121(B) This branch circuit shall not be supplied through ground-fault circuit interrupters or arc-fault circuit interrupters.

This comment was developed by a CMP-3 Task Group and balloted through the entire panel with the following ballot results:

15 Eligible to Vote
12 Affirmative
2 Ballots Not Returned (A.D. Corbin and D.T. Mills)
1 Negative (see comment below)

The following Negative Comment on Vote was received:

S.L. STENE: The action on Proposal 2-36 was the correct action to "accept in principle in part." The Panel 3 Comment should not have been a reject, since a total reject of the proposal would keep the text as previously stated in the 2011 NEC. The Panel 2 action on the proposal eliminated the fire alarm text and left burglar alarm panels to not require GFCI protection as a permissive statement. A burglar alarm without fire alarm function using Class 2 and 3 circuits is covered under Article 725. A dual function burglar/fire alarm is covered by 760.41(B) and 760.121(B). A burglar alarm panel with fire alarm capabilities is a combination fire and burglar alarm and could not be supplied by a GFCI protected circuit based on 760.41 and 760.121.

Panel Meeting Action: Accept

Panel Statement: The panel accepts this comment which Rejects Proposal 2-36.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-17 Log #1009 NEC-P02 **Final Action: Reject**

(210.8(A) Exception No. 5)

Submitter: Mike Holt, Mike Holt Enterprises

Comment on Proposal No: 2-36

Recommendation: Accept the proposal in principal by deleting the exception (and its informational note) altogether.

Substantiation: Over the last several Code cycles exceptions to GFCI protection have been removed due to the fact that equipment should not interfere with the operation of a GFCI device. A burglar alarm should work just fine with GFCI protection.

Panel Meeting Action: Reject

Panel Statement: See panel action and statement on Comment 2-16 which reverts the text back to the 2011 edition and reinstates the exception to correlate with Article 760.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-18 Log #773 NEC-P02 **Final Action: Reject**

(210.8(A)(2))

Submitter: Richard H. Murray, S. Easton, MA

Comment on Proposal No: 2-37

Recommendation: Revise the second sentence in 210.8 to read as follows:

The ground-fault circuit-interruptor <u>test equipment</u> shall be installed in a readily accessible location.

Substantiation: I believe this will help solve some of the issues that evolved when this change was added to the 2011 NEC.

Panel Meeting Action: Reject

Panel Statement: The panel requests the submitter to clarify what specifically is intended to be readily accessible. GFCI test equipment is undefined in the NEC. The panel notes that the comment is not related to the proposal referenced.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-89 Log #255 NEC-P02 **Final Action: Accept**

(210.8(A)(5))

Submitter: Code-Making Panel 17,

Comment on Proposal No: 2-10

Recommendation: Continue to reject this proposal.

Substantiation: Relocating this definition to Article 100 will grant it global authority over unfinished areas of all occupancies. Currently it is limited to dwellings as defined in article 100 (see title to 210.8 (A). The impact of such a move has not been considered nor justified in the proposal. The existing definition is specifically framed to the installation of GFCI protected receptacles in basement areas of dwellings that are not intended as habitable rooms. The use of the term "unfinished basement" in articles 334.15 (C) and 382.12 (1) apply to the installation and protection of the physical wiring methods. The definition as used in article 210.8 (A) (5) applies to protecting occupants via use of Ground Fault Circuit Interrupters in those areas of dwellings which present an elevated risk of shock. This is not true in all occupancies. The submitter has not provided historical evidence indicating a conflict in the application of the term "unfinished basement" as used in article 334.15 (C) nor 382.12 (1). The current location of this definition in 210.8 (A) (5) has a reasonable history of success and lacking empirical evidence of a problem it should not be relocated. It is important to note that in the application of the language in 334 and 382 the term unfinished and basement is easily defined by use of standard dictionaries whereas the definition located in article 210 is specific for the application of GFCIs.

This comment was developed by a CMP-7 Task Group and balloted through the entire panel with the following ballot results:

14 Eligible to vote
11 Affirmative
2 Negative (See voting Comments below)
1 Ballot Not Returned (C.J. Fahrenhold)

The following Comments on Vote were received:

NEGATIVE:

C.K. HUNTER: We disagree with the stated CMP-7 reasoning. In reviewing the uses of the term in 334.15(C) and 382.12(1), the definition fits with the language and requirements in both of these sections. The proposal submitter was correct in pointing out that when a term is used multiple times in the NEC that the definition should appear in Article 100. Leaving it in Article 210 begs the question- what differentiates an unfinished basement in Article 210 from the use in Articles 334 and 382?

S.R. LaDART: Relocating this definition to Article 100 will grant it global authority over unfinished areas of all occupancies. Currently, it is limited to dwellings as defined in Article 100. The importance of such a move has not been considered nor justified in the proposal. Continue to Reject.

Panel Meeting Action: Accept

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-19 Log #1094 NEC-P02 **Final Action: Reject**

(210.8(A)(6))

Submitter: Ron B. Chilton, Rep. NC Code Clearing Committee

Comment on Proposal No: 2-39

Recommendation: The Code Panel should have "Accepted" this proposal.

Substantiation: This omission still leaves a gap, which seems unintentional by the previous Code Making Panels, where the kitchen sink is within 2 ft., of the end of the countertop and a receptacle may be less than a foot from the edge, on the wall adjacent to the countertop, or more often, directly on the opposite wall of a pass-through opening, not serving the countertop. This allows appliances to be set on the ledge of a pass-through directly over the sink and plugged into a receptacle not provided with GPCI protection. The Proposal only closes the gap to clarify that all receptacles located near sinks as close as 6 ft be GFCI protected. Surely all countertop receptacles in the kitchen are required to have GPCI protection, this evolved from the original 6 ft. rule. In the last few Code cycles emphasis has been placed on deleting the exceptions to requirements for GFCI protection in loose proximity, 6 ft., of all sinks in a dwelling. The Proposal is identical to other past proposals for sinks in a dwelling addressing the need for GFCI protection for receptacles near sinks. When the requirement for GFCI protection in bathrooms became effective, there was no reference to the countertop only, and the emphasis was placed on the receptacle being located in the proximity of all those potential water hazards.

Panel Meeting Action: Reject

Panel Statement: The proposed text of the proposal is not clear and appears to limit the requirement for GFCI protection to within 6 ft of a sink. The panel reaffirms that all receptacles serving the counter top shall have GFCI protection.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-20 Log #769 NEC-P02 **Final Action: Accept**

(210.8(A)(7))

TCC Action: The Correlating Committee directs that the term "located" be changed to "installed" for correlation.

Submitter: James Dorsey, Douglas County Electrical Inspector

Comment on Proposal No: 2-40

Recommendation: Delete the words "located in areas other than kitchens"

In the 2011 NEC:

(7) Sinks - ~~Located in areas other than kitchens~~ where receptacles are located within 1.8 m (6 ft) of the outside edge of the sink.

Proposed text should read:

(7) Sinks - <u>**W**</u>here receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink.

Substantiation: Consistency; There is no difference in the ground-fault shock hazard between any appliances (especially with the trend of stainless steel) that are plugged into a 120v receptacle (refrigerators, dishwashers, trash compactors or garbage disposals) that is within 6' of a wet bar sink to the same type of appliance plugged into a 120v receptacle within 6' of the sink in a residential kitchen. The NEC has indicated that the presence of water and grounded or conductive surfaces can contribute to a hazardous environment. Since the NEC mandates that all receptacles within 6' of a wet bar sink must be gfci protected how can the panel not agree with the proposal to protect the same type of appliances in a residential kitchen where there is a ground-fault shock hazard because of the presence of water and grounded surfaces? The 6' rule with consistency would be a good start.

Many residences are built slab on grade so the kitchen is in contact with the earth just like wet bar sinks in basements. It is awkward, confusing and even embarrassing as an inspector (who must enforce the code by what is written in

the code) to tell a homeowner or contractor that one area must be gfci protected while the other area does not. Furthermore, it creates inconsistency among inspectors on how to enforce this article while also using common sense. Common sense would say, if it is ok not to require gfci protection in a kitchen for cord connected appliances within 6' of the sink than it should be ok not to enforce GFCI protection for the same type of appliances by a wet bar. Please reconsider your rejection or add an exception to the general 6' rule for consistency.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13
Comment on Affirmative:
HILBERT, M.: The action on Comment 2-20 was to accept however there are two recommendations in the comment. The submitter removes the reference to "other than kitchens" in the first recommendation and changes "location" to "installation" in the second recommendation under "The text should read." Changing "location" to "installation" would make 210.8(A)(7) consistent with the other subdivisions in 210.8(A).

2-21 Log #803 NEC-P02 **Final Action: Reject**
(210.8(A)(7))

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 2-44
Recommendation: Proposal 2-44 should be accepted.
Substantiation: The submitter is correct when he stated that the means of measurement needs to be defined and that it is not clearly understood. The shortest distance would be horizontal from the edge of the sink. We receive questions from the field pertaining to whether the measurement is horizontal or a combination of horizontal and vertical.
Panel Meeting Action: Reject
Panel Statement: See panel statement on Comment 2-22.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Negative: 1
Explanation of Negative:
HILBERT, M.: See my ballot comment on Comment 2-22.

2-22 Log #1544 NEC-P02 **Final Action: Reject**
(210.8(A)(7))

Submitter: Frederic P. Hartwell, Rep. Massachusetts Electrical Code Advisory Committee
Comment on Proposal No: 2-44
Recommendation: Accept the proposal in principle. Revise text to read as follows:
(7) Sinks — located in areas other than kitchens where receptacles are installed within <u>the zone</u> 1.8 m (6 ft) <u>measured horizontally from</u> ~~of~~ the outside edge of the sink <u>and extending from the floor to 1.8 m (6 ft) above the floor</u>.
Substantiation: The Advisory Committee agrees that the requirement should reach all receptacles within 6 ft of a sink. The proposal was always intended to do exactly that. If the rule is applied literally based on the current text, a receptacle at baseboard height and 6 ft 2 in. from the sink, measured in a straight line, is excluded because it would be over 6 ft from the outside edge of a sink that might well be perhaps two feet higher. This wording agrees with the proposal concept and more clearly conveys the intent. It is now apparent that both CMP 2 and the Advisory Committee are in agreement as to the intended scope of the requirement.
Panel Meeting Action: Reject
Panel Statement: The panel disagrees with the submitter and notes that it is the intent of the panel that the 6 ft measurement is taken from the outside edge of the sink using the shortest possible path to the receptacle. Adding the term "zone" could be misconstrued and lead to additional concerns or misinterpretations.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Negative: 1
Explanation of Negative:
HILBERT, M.: The action could have been to accept this comment in principle and clarify the how the measurement is made. The panel statement accurately reflects the meeting discussion with regard to how the measurement is made. It would be beneficial to readers of the Code to have that language in 210.8 as many readers of the Code never see an ROP or ROC.
The submitter clarified how he intended the "zone" to apply which is appreciated. However, any panel discussion I can recall was clear the measurement was to be the shortest path between the nearest edge of the sink and the receptacle as opposed to the zone concept.
The Panel came close to including a new last sentence in the opening paragraph of 210.8 to clarify how the measurements are made. However, due to the lengthy discussions on measuring the shortest path, that opportunity was lost for this cycle.
From an enforcement standpoint there is only one practical way to measure the shortest path. That is the shortest path the cord of an appliance could take. Similar wording to what is already time tested in 680.22(A)(5) could be incorporated into 210.8 as a new subsection. The following wording would provide readers of the Code with clear and practical guidance on how the shortest path is measured:
210.8(X) Measurements: When determining the dimensions in this section addressing distances from receptacles, the distance shall be measured as the shortest path the cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, doorway with hinged or sliding door, window opening or other effective barrier.

2-23 Log #865 NEC-P02 **Final Action: Reject**
(210.8(A)(9))

Submitter: C. Douglas White, Center Point Energy / Rep. Edison Electric Institute/Electric Light & Power Group
Comment on Proposal No: 2-47
Recommendation: Reject proposal 2-47.
Substantiation: The substantiation does not provide sufficient technical information to conclude that additional GFCI protection is required for all laundry area 125 volt, 15 and 20 ampere receptacles. The necessity of providing GFCI protection for the laundry area circuit was not quantified. There is no data provided in the substantiation regarding the number or frequency of electric shock incidents involving laundry area circuits. The substantiation is anecdotal at best. GFCI protection has been a requirement of the NEC for many years. The requirement has never existed for all laundry area circuits until proposal 2-47 was made for the 2014 NEC. If the proposal is an attempted resolution with a particular appliance problem, the manufacturers of the product have other avenues that may yield the desired result such as installing GFCI protection within their equipment.
Panel Meeting Action: Reject
Panel Statement: Laundry areas involve electrical appliances and water with a resulting increased risk of electric shock. The panel's action to require GFCI protection of receptacles in laundry areas addresses this increased risk and is consistent with the NEC requirements for GFCI protection of other receptacles in areas near water.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 11 Negative: 2
Explanation of Negative:
DUREN, R.: The substantiation offered by the original proposal 2-47 indicated the incidence of electrical shocks related to consumer products has declined over time. The submitter offered no evidence to support the statement and no evidence to indicate that additional GFCI protection is needed.
The panel statement supporting the panel action on comment 2-23 indicates that because there is water and electricity in a laundry room a GFCI for each 120 volt outlet should be required.
The outlets within six feet of the sink are already required to be GFCI protected. The water in the laundry room would have to make a significant trip to exceed the six foot area around the edge of the sink. A reasonable question to ask is what is the length of the any cord connected appliances typically utilized in a laundry room?
The washing machine outlet may or may not be within six feet of a sink. However, protection for the washing machine could easily be provided by a plug style GFCI device. If the concern of the submitter is with regard to the washing machine then he should petition the Consumer Products Safety Commission to require GFCI protection for all new washing machines sold in the United States.
ORLOWSKI, S.: NAHB urges the members of the panel to Accept this comment seeking to reject proposal 2-47. As we stated in the ROC meeting, there was no substantiation provided by the original proponent to expand GFCI protection to laundry areas. No statistics or data were provided to the panel showing any injuries or deaths associated to electrical shock from laundry appliances. No proof was provided to support the committees assumption that there is an increased risk of electrical shock with these appliances. As we stated previously, the NEC should not be used as a tool to negate the due diligence of appliance manufacturers in designing consumer safe products.
Comment on Affirmative:
HILBERT, M.: I agree with expanding the requirements for GFCI protection to the laundry area as portable appliances such as an iron will likely be used in that area. However, I disagree with expanding this requirement due to failure of fixed appliance. See my ballot comment on 2-29.

2-24 Log #1048 NEC-P02 **Final Action: Reject**
(210.8(A)(9))

Submitter: George M. Stolz, II, Quicksilver Electrical Training
Comment on Proposal No: 2-47
Recommendation: Reject the proposal.
Substantiation: There was no substantiation provided to require GFCI in Laundry Areas, at all. As written, the substantiation should have been to a proposal to add "(9) Everywhere Else"! If the submitter has evidence that GE appliances are failing and killing people I would invite them to offer up this data. Also, this proposal could conflict with the beneficial change accepted to change required circuits to refer to the equipment, rather than an undefined area, in 210.11 and 210.52. With the 2011 change to require GFCI protection around all sinks, and then the 2014 proposal to require GFCI protection on all bathtubs, that about covers every laundry area/equipment receptacles. It is

unnecessary, and in most cases will require an extra line-side GFCI receptacle to protect the washer receptacle, based on the "readily accessible" requirement added in 2011.
Panel Meeting Action: Reject
Panel Statement: See the panel statement on comment 2-23.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 11 Negative: 2
Explanation of Negative:
HILBERT, M.: The action should have been to accept this comment. Although I do not agree with all of the submitter's substantiation, Article 210 may not be the right location for GFCI or AFCI rules regarding fixed appliances. See my statement on Comment 2-29.
ORLOWSKI, S.: See my Explanation of Negative Vote on Comment 2-23.

1-109 Log #26 NEC-P01 **Final Action: Accept**
(210.8(B) Exception No. 1 to (3))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 2-52
Recommendation: The Correlating Committee directs that this proposal be referred to Code-Making Panel 1 for action as it relates to the action on Proposal 1-131.
This action will be considered as a public comment by Code-Making Panel 1.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: Refer to Comment 1-80 which deletes the proposed section in Article 110 and does not impact the actions taken by Panel 2 in Proposal 2-52.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

2-25 Log #804 NEC-P02 **Final Action: Reject**
(210.8(B)(5))

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 2-55
Recommendation: Proposal 2-55 should be accepted.
Substantiation: The submitter is correct when he stated that the means of measurement needs to be defined and that it is not clearly understood. The shortest distance would be horizontal from the edge of the sink. We receive questions from the field pertaining to whether the measurement is horizontal or a combination of horizontal and vertical.
Panel Meeting Action: Reject
Panel Statement: The panel disagrees with the submitter and notes that it is the intent of the panel that the 6 ft measurement is taken from the outside edge of the sink using the shortest possible path to the receptacle.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Negative: 1
Explanation of Negative:
HILBERT, M.: The action should have been to accept this comment in principle. See my ballot comment on Comment 2-22.

2-26 Log #1545 NEC-P02 **Final Action: Reject**
(210.8(B)(5))

Submitter: Frederic P. Hartwell, Rep. Massachusetts Electrical Code Advisory Committee
Comment on Proposal No: 2-55
Recommendation: Accept the proposal in principle. Revise text to read as follows:
(5) Sinks — where receptacles are installed within the zone 1.8 m (6 ft) <u>measured horizontally from</u> ~~of~~ the outside edge of the sink <u>and extending from the floor to 1.8 m (6 ft) above the floor.</u>
Substantiation: The Advisory Committee agrees that the requirement should reach all receptacles within 6 ft of a sink. The proposal was always intended to do exactly that. If the rule is applied literally based on the current text, a receptacle at baseboard height and 6 ft 2 in. from the sink, measured in a straight line, is excluded because it would be over 6 ft from the outside edge of a sink that might well be perhaps two feet higher. This wording agrees with the proposal concept and more clearly conveys the intent. It is now apparent that both CMP 2 and the Advisory Committee are in agreement as to the intended scope of the requirement.
Panel Meeting Action: Reject
Panel Statement: See panel statement on Comment 2-25.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Negative: 1
Explanation of Negative:
HILBERT, M.: The action should have been to accept this comment in principle. See my ballot comment on Comment 2-22.

2-27 Log #1 NEC-P02 **Final Action: Accept in Principle**
(210.8(B)(8))

Submitter: Mike Weaver, C&M Enterprises
Comment on Proposal No: 2-49
Recommendation: Do not accept Proposal 2-49.
Substantiation: While the proposal, in and of itself has significant merit (as noted in the submitter's substantiation), for application to commercial garages and similar areas and occupancies, this subsection item (8), which was new for the 2011 cycle, currently has the ability to impact a broader range of occupancy areas than the language of 210.8(B)(8) infers on the surface. Existing text, which will be removed by the acceptance of Proposals 2-49 or 2-50, affords effective limitation to expanded, potentially unintended, application of 210.8(B)(8).
The text of 210.8(B)(8) incorporates the word "garag"' which is a defined term in Article 100. Careful review of this "garage" definition language reveals that the auto dealer showroom floor area (as just one example) meets the Article 100 definition of a garage. Potentially, the riding mower dealer showroom floor area also falls under the definition of "garage" (a vehicle is defined in Merriam-Webster's dictionary as a piece of mechanized equipment, and is undefined in the NEC). If the language modifications (deleted text) in Proposal 2-49 (or Proposal 2-50) are accepted into210.8(B)(8), then GFCI protection will be mandated for the receptacles noted within 210.8(B) for an automobile dealership's showroom floor area (as one example). This is NOT what the submitter was addressing in the proposal substantiation provided. This mandate for the (previous) example area, as well as other unintended "garage" occupancy areas become locations which are enforceable to the requirements of Section 210.8(B)(8). Encompassing other "garage" areas (such as the commercial-industrial facilities' fork-lift charging area. If the vehicles are staged there for other than during their charging process, which is quite typical for such areas) may have merit, while others (the dealer showroom floor area) may not. While the submitter's (CMP accepted) proposal has sound merit, it incorporates GFCI protection for areas where such protection may not be considered as necessary. Current 210.8(B)(8) language provides some limitations for such areas of question.
Limiting the board application of 210.8(B)(8) for areas which GFCI protection may not be considered necessary, requires new language, or carefully worded exceptions, or a revision to the Article 100 definition of "garage". Revisions which broaden the application of 210.8(B)(8) to encompass the submitter's noted (and CMP confirmed) concerns requires additional input from others who also recognize the added collateral damage from deletion of text noted in the original proposal. This comment submission, in conjunction with your rejection of Proposals 2-49 and 2-50, will allow the submitter and others to craft adequate language which addresses the submitter's concerns without producing potentially unwanted consequences. If this requires an additional revision cycle, it will be better than accepting the revisions as originally proposed, which paint 210.8(B)(8)'s requirements to areas and occupancies with quite a broad brush.
Please see my companion comment to Proposal 2-50.
Panel Meeting Action: Accept in Principle
Add the following text to the end of sentence 210.8(B)(8):."...other than vehicle exhibition halls and showrooms."
Panel Statement: The panel agrees with the submitter and has added text to 210.8(B)(8) to address his concerns.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-28 Log #2 NEC-P02 **Final Action: Accept in Principle**
(210.8(B)(8))

Submitter: Mike Weaver, C&M Enterprises
Comment on Proposal No: 2-50
Recommendation: Do not accept Proposal 2-50.
Substantiation: Please see substantiation to my comment on Proposal 2-49.
This is a companion comment to a previous comment addressed to Proposal 2-49.
Panel Meeting Action: Accept in Principle
Panel Statement: See the panel action and statement on Comment 2-27.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-29 Log #566 NEC-P02 **Final Action: Accept**
(210.8(D))

Note: When the ballot result does not confirm the TC action on a Proposal by a two-thirds affirmative vote, the Report on Proposals shall be published with a specific request for public comment on that Proposal. The Proposal is now being reconsidered by the TC as a public comment.
Submitter: Jay A. Broniak, GE Appliances & Lighting
Comment on Proposal No: 2-58
Recommendation: Revise text to read as follows:
This form proposal is for requiring ground-fault circuit-interrupt (GFCI) protection on the dishwasher circuit.
Section 210.8

(D) Kitchen Dishwasher branch circuit. GFCI protection shall be provided for outlets that supply dishwashers installed in dwelling unit locations.
Substantiation: As the requirement for ground-fault circuit-interrupters (GFCIs) has been expanded throughout the NEC code, the amount of electrical shock incidents related to consumer products have continued to decline over time. Increased usage of GFCls within branch circuits of residential homes is a highly effective means of further reducing the potential for electrical shocks. CMP-2 should require GFCI protection on the dishwasher circuit.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 9 Negative: 4
Explanation of Negative:
HILBERT, M.: The action should have been to accept this comment in principle. See my ballot comment on Comment 2-22.
This comment should have been rejected as it does not address the root cause. Most of the substantiation to provide to GFCI protection for dishwashers was related to concerns with an appliance. The submitter indicated the vast majority of failures have been related to either end of life component use, unexplained electronic circuitry error, or poor quality control as indicated by chafed wiring. There is no question to the fact that either AFCI or GFCI protection may have prevented many of these unfortunate events from happening in the first place, but they should not be used to address an appliance problem. If the manufacturing process remains unchanged it does nothing in the terms of safety for the existing dwellings in this country when it becomes time to replace appliances.
Article 210 contains rules for receptacle placement and due to the unlimited possibilities of cord-and-plug connected equipment that can be supplied from those receptacles the existing rules in 210.8(A) and (B) are appropriate. Understanding it would be unrealistic to address the many different types of portable appliances individually, it makes perfect sense to require GFCI protection for the 15 and 20 ampere, 125 volt, receptacles in areas where they most likely to be used. However, fixed appliances such as dishwashers, washing machines and the GFCI protection requirements for them may be more appropriately covered in Chapter Four. The GFCI protection rules for cord-and-plug connected vending machines and electric drinking fountains already exist in Article 422 along with leakage-current detector-interrupter (LCDI) or arc-fault circuit-interrupter (AFCI) rules for window air conditioners in Article 440. Boat hoists are also specific equipment so the GFCI rules for them may be more appropriately located in Article 422 or Article 610.
It seems that locating the GFCI requirements for specific equipment to Chapter Four or Six as appropriate would promote greater consistency in the NEC. It may be appropriate for a task group with members from CMP 2 and CMP 17 for possible proposals for the 2017 NEC.
MITCHEM, J.: This comment should have been rejected. The substantiation was based on the lack of protective functions within the equipment. The concern about product safety should be addressed through relevant product safety standards instead of depending on external means for safety of the users.
ORLOWSKI, S.: NAHB urges the members of the panel to reject this comment. As we stated in the ROC meeting, other than providing the panel with a presentation on how products fail over a period of time, there was no substantiation provided by the original proponent to expand GFCI protection to dishwashers. No statistics or data were provided to the panel showing any injuries or deaths associated to electrical shock from these appliances. No proof was provided to support the committees assumption that there is an increased risk of electrical shock with these appliances. As we stated previously, the NEC should not be used as a tool to negate the due diligence of appliance manufacturers in designing consumer safe products.
WILKINSON, R.: If you read the submitter's substantiation, one must believe that if a little good, more protection is great. There is no technical support to warrant additional protection for a dishwasher.

2-30 Log #866 NEC-P02 **Final Action: Reject**
(210.8(D))

Submitter: C. Douglas White, Center Point Energy / Rep. Edison Electric Institute/Electric Light & Power Group
Comment on Proposal No: 2-58
Recommendation: Continue to reject proposal 2-58.
Substantiation: The substantiation does not provide sufficient technical information to conclude that additional GFCI protection is required for a dishwasher outlet. The necessity of providing GFCI protection for the dishwasher outlet was not quantified in the substantiation. There is no data provided in the substantiation regarding the number or frequency of electric shock incidents involving the dishwasher. Rather, the substantiation presented is anecdotal. Furthermore, manufacturers of dishwashers have the capability of installing added protection within the internal wiring of their equipment.
Panel Meeting Action: Reject
Panel Statement: The submitter of the original proposal substantiates concerns that are valid. Dishwashers are appliances that utilize electricity and water with a resulting increased risk of electric shock.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 9 Negative: 4
Explanation of Negative:
DUREN, R.: The substantiation offered by the original proposal 2-58 indicated the incidence of electrical shocks related to consumer products has declined over time. The submitter offered no evidence to support the statement and no evidence to indicate that additional GFCI protection is needed.
HILBERT, M.: See my ballot comment on 2-29.
ORLOWSKI, S.: Panel should have accepted this proposal, see reason statement on Comment 2-29.
WILKINSON, R.: See my Explanation of Negative Vote on Comment 2-29.

2-31 Log #27 NEC-P02 **Final Action: Accept**
(210.9 Exception No. 3 (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 2-60
Recommendation: The Correlating Committee directs that Panel 2 reconsider this proposal and consider breaking the text into more than one sentence for the purpose of clarity.
It was the action of the Correlating Committee that this proposal be referred to Code-Making Panels 5 and 9 for comment.
This action will be considered as a public comment.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the Correlating Committee direction to reconsider the proposal and has taken action on Comment 2-33. See the panel action on Comment 2-33.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-32 Log #275 NEC-P02 **Final Action: Reject**
(210.9 Exception No. 3 (New))

Submitter: Code-Making Panel 5,
Comment on Proposal No: 2-60
Recommendation: Code-Making Panel 5 recommends revising the text to read as follows:
The grounded conductor of a branch circuit supplied from a grounding autotransformer shall not be required to be connected to the grounded conductor of the system supplying the autotransformer if the autotransformer has less than 1.0% zero phase sequence on its load side and more than 30% zero phase sequence impedance on its line side.
Substantiation: The revised text is edited for clarity and compliance with the NEC Style Manual.
This comment was developed by a CMP-5 Task Group and balloted through the entire panel with the following ballot results:
16 Eligible to Vote
15 Affirmative
1 Ballot Note Returned (W.J. Helfrich)
The following AFFIRMATIVE comments on Vote were received:
T.N. BOWMER: I agree with the proposal to include the exemption and generally reword as suggested. However, it is unclear to me how an inspector can determine if the autotransformer meets the <1% zero phase sequence on its load side and > 30% zero phase sequence impedance on its load side. Should the 1st
"zero phase sequence" be "zero phase sequence impedance".
D. MOHLA: Add in Informational Note to 210.9, Exception 3 to read as follows:
"Informational Note: Inversion of the neutral may occur under abnormal conditions in Y-connected autotransformers with ungrounded neutrals resulting in high voltage on the neutral. Inversion of neutral can occur on power frequency voltage or on the transient voltage. Grounding the autotransformer neutral, use of a delta tertiary, and use of three-leg 3-phase cores all help to prevent inversion of neutral. See IEEE Standard 142-2007, IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems, for additional information."
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 2-33.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-33 Log #281 NEC-P02 **Final Action: Accept**
(210.9 Exception No. 3 (New))

Submitter: Code-Making Panel 9,
Comment on Proposal No: 2-60
Recommendation: This proposal should be Rejected to correlate with panel action on Proposal 9-142.
Substantiation: CMP 9 requested additional information to evaluate the technical merits of the proposal. If the submitter provides data as part of a public comment, CMP 9 committed to create a task group to further review the available information prior to the meeting on public comments. The panel is concerned that this requirement may create an opportunity for a proprietary product and the panel is concerned this may violate the NFPA Patent Policy. The submitter should provide information to NFPA that indicates that the NFPA Patent Policy is not violated.
This comment was developed by a CMP-9 Task Group and balloted through

the entire panel with the following ballot results:
12 Eligible to vote
11 Affirmative
1 Ballot Not Returned (J.M. Ferrara, Voting Alternate)
No Comments on Vote were received.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-34 Log #1275 NEC-P02 **Final Action: Accept**
(210.9 Exception No. 3)

Submitter: Elliot Rappaport, Electro Technology Consultants
Comment on Proposal No: 2-60
Recommendation: Reject the proposal.
Substantiation: Although the proposal may be appropriate, the substantiation is inadequate. The purpose of providing the grounded conductor from the grounded system supplying the autotransformer is to assure that the neutral point of the autotransformer will remain at (or near) ground potential during fault conditions. If that condition is not satisfied, then failure of equipment connected to the unfaulted phases can occur. The supporting material does not provide justification for why these specific phase sequence impedances provide for the desired voltage conditions during a fault.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-35 Log #1596 NEC-P02 **Final Action: Accept in Part**
(210.11(C)(1), (2), and (3))

Submitter: Scott Cline, Monterey Park, CA
Comment on Proposal No: 2-61
Recommendation: Add 120-volt, in front of “20-ampere” in (1), (2), and (3), -OR-
Add a reference to 210.52(D) in 210.11(C)(3).
Substantiation: 210.11, 220.10, and 210.11(C)(3), include circuits which are not 120-volt.
As now worded, a 20-amp, 240-volt circuit to a bathroom receptacle would satisfy the words of 210.11(C)(3), but this certainly is not the intent.
If adding “120-volt” to remove possible ambiguity seems inappropriate, then a reference in 210.11(C)(3) to 210.52(D) seem to be in order.
Panel Meeting Action: Accept in Part
In 210.11(C)(3), add “120-volt” between the words “one” and “20-ampere branch circuit.”
Reject the remainder of the recommendation.
Panel Statement: The revision addresses the submitters concern about 210.11(C)(3) not referencing the need for a 120V circuit. The remainder of the proposed changes is not needed because 210.52 already requires 120V branch circuits in those areas.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-36 Log #28 NEC-P02 **Final Action: Accept**
(210.11(C)(3) Exception, Informational Note)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 2-62b
Recommendation: The Correlating Committee directs that the panel reconsider the location of the Informational Note.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Delete the Informational Note in 210.11(C)(3).
Add a new Informational Note No. 1 after 220.1 that reads: “Informational Note 1: See Examples in Informative Annex D”
Renumber the current informational Note in 220.1 as “Informational Note No. 2”
Panel Statement: The informational note is not needed in Article 210 since the chapter does not cover calculations. The panel has relocated the note to Article 220 as a more appropriate place to reference Annex.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-37 Log #520 NEC-P02 **Final Action: Accept in Principle**
(210.12)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 2-78
Recommendation: Revise text to read as follows:
210.12 Arc-Fault Circuit-Interrupter Protection.
(A) Dwelling Units. All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in dwelling unit kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, laundry areas, or similar rooms or areas shall be protected as described by (1), (2), (3), or (4).**[ROP 2–80, ROP 2–82a, ROP 2–85]**
For the purpose of this section dormitory units shall be considered dwelling units.
Substantiation: The NFPA, Fire Marshals and the Electrical Industry are in a massive campaign to extend the protection of AFCIs to dwelling units. The last several editions of the *NEC* have expanded the usage of AFCIs to extend more protection in dwelling units.
The causes of fire in dwelling units and in dormitories are nearly the same. Compare the statistics in http://www.nfpa.org/itemDetail.asp?categoryID=953&itemID=23071&URL=Research/Fire%20statistics/The%20U.S.%20fire%20problem for dwelling units and http://www.nfpa.org/assets/files//MbrSecurePDF/OS.Campus.PDF for dormitories. Also note that the dormitory statistics under-represent the problem:
“Many students live at home or in off-campus housing not owned by the university or by any fraternal organization. These numbers are not reflected in the statistics in this analysis. Further complicating the picture is the change in dormitory properties themselves. In the past, dormitories did not have kitchens in the individual units. Many of today’s dormitories more closely resemble apartment buildings with suite style apartments that include kitchens. The distinction between apartments and dormitory properties is now quite blurred.”
Surely our young men and women who live in dormitory settings should be afforded the same protection the *NEC* provisions for their home afford. Please support the addition of AFCI protection to dormitories and other congregate housing.
Panel Meeting Action: Accept in Principle
Add new (C) to read as follows:
(C) Dormitory Units. All 120-Volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dormitory unit bedrooms, living rooms, hallways, closets, and similar rooms shall be protected by a listed arc-fault circuit interrupter meeting the requirements of 210.12(A)(1) through (6) as appropriate.
Panel Statement: The panel accepts the expansion of AFCI protection to dormitory units but chose to add the text as a new (C) to 210.12(A).
Number Eligible to Vote: 13
Ballot Results: Affirmative: 10 Negative: 2 Abstain: 1
Explanation of Negative:
MITCHEM, J.: This comment should have been rejected. The panel action requires AFCI protection of dormitories that are not dwelling units per Article 100. The panel action does not distinguish between rooms and dwelling units. The need for extending an AFCI requirement to non-dwelling unit dormitories has not been substantiated.
WILKINSON, R.: The only benefit to this addition of the code, Dormitory Units Shall Be Considered Dwelling Units, will be to add additional cost to student housing and place more hardship on students seeking higher education.
Explanation of Abstention:
ORLOWSKI, S.: See reason statement on Comment 2-43.
Comment on Affirmative:
KING, D.: The need for AFCI protection of branch circuits in dormitories is necessary. As the submitter pointed out in his substantiation these facilities serve as dwelling units to those who reside in them and the occupants should be afforded the same level of protection provided by AFCI Protection as those in dwelling units.

2-38 Log #526 NEC-P02 **Final Action: Reject**
(210.12)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 2-92
Recommendation: Revise text to read as follows:
210.12 Arc-Fault Circuit-Interrupter Protection.
(A) Dwelling Units.
(1) A listed combination type arc-fault circuit interrupter, installed to provide protection of the entire branch circuit.
(2) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit where all of the following conditions are met:
a. The branch circuit over current protection device shall be a listed circuit breaker having an instantaneous trip not exceeding {1}~~300~~ 20 amperes
b. The {2}branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.
c. The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the
first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor-.
~~d. The first outlet box in the branch circuit shall be~~ {3} ~~identified.~~
(3) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit where the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet is installed using RMC, IMC, EMT, Type MC, ~~or~~ steel armored Type AC cables meeting the requirements of 250.118 {4} , metal wireways, or metal auxiliary gutters and using metal outlet and junction boxes.
(4) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit where the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet is installed using a {5}

~~listed metal or~~ nonmetallic conduit or tubing encased in not less than 50 mm (2 in.) of concrete.

{6} ~~Exception No. 1: If RMC, IMC, EMT, Type MC, or steel armored Type AC cables meeting the requirements of 250.118, metal wireways, metal auxiliary gutters, and metal outlet and junction boxes are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install an outlet branch-circuit type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.~~

{7} ~~Exception No. 2: Where a listed metal or nonmetallic conduit or tubing or Type MC Cable is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install an outlet branch-circuit type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.~~

{8} Exception ~~No. 3~~:

Substantiation: The last "conductor-." in 210.12(A)c. has a dash as a typo and should be removed. Legislative deletion format fails for deleting a dash.

{1} 210.12(A) applies to 15- and 20-ampere outlets and devices. Receptacles and lighting circuits would be required to have OCPDs of 15 or 20 ampere ratings. Not even the most extreme motor circuit would allow a 300A OCPD for a 20A FLA. I understand the 300A comes from the theoretical calculation for protection based on the #14 and #12 wire lengths. 90.1(A) Purpose. talks about the practical safeguarding, not the theoretical.

{2} 210.12(A)(2)b. requires "branch circuit wiring shall be continuous". I presume, but do not know if that means that the circuit will be without splice. I also assume that *continuous* does allow pig tailing the grounding conductor in any metallic junction boxes the circuit passes through, but I'm not sure. Or it may mean that it must be in a *continuous* cable or even in a continuous raceway (ENT perhaps). This need to be clarified. Possible text could be "wiring shall be ~~continuous~~ unspliced from" or " wiring shall be in a continuous sheath or wiring method from" depending on the meaning intended.

{3} 210.12(A)(2)d. requires the first outlet box to be *identified*. This is the only box in the entire text for 210.12 that has that requirement. Is this box somehow special? Is *identified* missing from the other box references?

Since 210.12(A)(2) specifies no wiring methods, I presume that all wiring methods are allowed.

It is my understanding that an exception alters the rule to which it applies AND imposes some additional condition(s).

{4} 210.12(A)(3) requires the use of RMC, IMC, EMT, Type MC, or steel armored type AC meeting the requirements of 250.118. Exception 1 merely adds "metal wireways, metal auxiliary gutters," without imposing any additional requirements. Folding exception 1 into 210.12(A)(3) imposes the same rules without the added text.

{5} 210.12(A)(4) allows the use of nonmetallic conduit if encased in 2 in. of concrete. The listing "metallic or" is unnecessary since 210.12(A)(3) already allows that whether or not it is encased in concrete.

{6} With the addition of the phrase in {4} above Exception No. 1 is now completely redundant and can be eliminated.

{7} Exception No. 2: allows the use of metal or nonmetallic conduit or tubing encased in 2 in. of concrete. This is already allowed in 210.12(A)(3) and (A)(4), as amended. Exception No. 2: also allows MC cable to be used if encased in 2 in. of concrete, but 210.12(A)(3) already allows that. Thus Exception 2 is now completely redundant and can be eliminated.

{8} Exception No. 3: is now the only exception left standing and now can be renamed "Exception:"

The exception text appears to reflect the piling of ROPs on this section.

Panel Meeting Action: Reject

Panel Statement: Circuit breakers are not available with instantaneous trip ratings of 20 A or less. Technical substantiation is not given for deletion of the requirement to identify the first outlet box in the branch circuit in (2)d. A specific recommendation is not made in (3).

Number Eligible to Vote: 13

Ballot Results: Affirmative: 11 Negative: 1 Abstain: 1

Explanation of Negative:

WOOD, T.: The acceptance of this Comment would simplify the use of outlet branch circuit type arc-fault circuit interrupters. It would improve ease of use allowing for additional use and safety, especially in older dwellings.

Explanation of Abstention:

ORLOWSKI, S.: See reason statement on Comment 2-43.

2-39 Log #824 NEC-P02 **Final Action: Reject**
(210.12)

Submitter: Robert Huddleston, Jr., RLH Engineering Consulting

Comment on Proposal No: 2-76

Recommendation: Delete wording as shown in the original proposal.

Substantiation: This proposal should have been accepted by the Panel. It was shown in the CD video that was sent to all Panel 2 members that combination-type AFCls do not trip under series arc fault conditions (loose connections, broken wires, damaged cord, or splice failures - all of which can burn a house down, and all of which are advertised as being protected against by combination-type AFCIs by the manufacturers). The panel's rejection statement does not address the submitter's concern - that the NEC should not mandate and require devices that do not work as advertised (advertising by the manufacturers was provided to the Panel that conclusively demonstrated that the devices are sold to the general public under the guise of tripping on series arc faults). The proposal asks that the wording "combination-type" be struck from the Code language, as well as adding the words "parallel arc fault" to describe the protection that standard AFCls will indeed provide, generally because of differential ground fault detection techniques.

The panel statement of "Replication of the experiments shown in the video shows that there is minimal actual arcing occurring" implies that there was low energy in the arcs. However, as shown in the video, there was a 1500 Watt heater in series with the load, which would be typical of a large 120V load in a residence. How can the Panel accept the claim that combination-type AFCls will trip when experiencing a series arc fault, when a real, live series arc fault (series because the load of the circuit - 1500W heater is in series with the arcing fault) will NOT trip the AFCI?

Recently, a representative of Cutler Hammer came to the city of Kingsport, Tennessee and met with the city officials. They showed them a magic "box" that supposedly demonstrated how well AFCIs will trip and protect a structure when a series arc fault is generated using carbon-arc rods in series with a load. The city of Kingsport and their inspectors shook their heads up and down and said that this is really great technology...members of panel 2, there is a serious credibility problem here. Testing done by the submitter of the proposal clearly showed that combination-type AFCI devices will never trip on series arc faults.

How can this Code Panel continue to support requiring technology that does not work as claimed? I look forward to the panel finally seeing the light on this issue and responding in a responsible manner by eliminating the requirement for combination-type AFCI devices.

Note: Supporting material is available for review at NFPA Headquarters.

Panel Meeting Action: Reject

Panel Statement: See panel statement on Comment 2-45.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 12 Abstain: 1

Explanation of Abstention:

ORLOWSKI, S.: See reason statement on Comment 2-43.

2-40 Log #1160 NEC-P02 **Final Action: Accept in Principle**
(210.12)

Submitter: Thomas A. Domitrovich, American Circuit Breaker Manufacturers Association (ACBMA)

Comment on Proposal No: 2-92

Recommendation: Revise text to read as follows:

210.12 Arc-Fault Circuit-Interrupter Protection. Arc-fault circuit-interrupter protection shall be provided as required in 210.12(A) and (B). The arc-fault circuit interrupter shall be installed in a readily accessible location.

(A) Dwelling Units. All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in dwelling unit kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, laundry areas, or similar rooms or areas shall be protected by any of the means described in (1) through (6). ~~as described by (1), (2), (3), or (4).~~

(1) A listed combination type arc-fault circuit interrupter, installed to provide protection of the entire branch circuit.

~~(2) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit where all of the following conditions are met:~~

~~a. The branch circuit over current protection device shall be a listed circuit breaker having an instantaneous trip not exceeding 300 amperes.~~

~~b. The branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.~~

~~c. The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor~~

~~d. The first outlet box in the branch circuit shall be identified.~~

(2) A listed branch/feeder type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit. The first outlet box in the branch circuit shall be identified.

(3) A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit where all of the following conditions are met:

(a) The branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.

(b) The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor.

(c) The first outlet box in the branch circuit shall be identified.

(4) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit in combination with a listed branch circuit overcurrent protective device where all of the following conditions are met:

(a) The branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.

(b) The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor.

(c) The first outlet box in the branch circuit shall be identified.
(d) The combination of the branch circuit overcurrent device and the outlet branch circuit AFCI is identified and the combination meets the requirements for a "System Combination" type AFCI and is listed as such.

(NOTE: It is understood that the Correlating Committee has directed the CMP to correlate the added text and its location in Proposals 2-102, 2-103, and 2-109 with the panel action on Proposal 2-92. There are no comments on those items.)

Informational Note No. 1: For information on ~~types of~~ combination type and branch/ feeder type arc-fault circuit interrupters, see UL 1699-~~2011~~, Standard for Arc-Fault Circuit Interrupters. For information on outlet branch circuit type arc-fault circuit interrupters see UL 1699A Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters. For information on system combination arc fault circuit interrupters see UL 1699C Outline of Investigation for System Combination Arc-Fault Circuit Interrupters.
Informational Note No. 2: See 29.6(5) of NFPA 72- 2010, National Fire Alarm and Signaling Code, for information related to secondary power supply requirements for smoke alarms installed in dwelling units.
Informational Note No. 3: See 760.41(B) and 760.121(B) for power-supply requirements for fire alarm systems.

Substantiation: In the panel statement to Proposal 2-92 the panel agreed with the principle of a systems approach for providing arc fault protection to the branch circuit. The protection system accepted by the Panel consisted of an installation including a branch circuit breaker having a specific instantaneous trip current and a branch circuit where the length of the wiring from the overcurrent protection to the first outlet is limited and the installation of a listed outlet branch circuit AFCI at the first outlet on the circuit.

The specific instantaneous trip current for the branch circuit breaker in the ROP specifies a level of 300A or less based on work done by UL but further work by UL has shown that number to be in error and notes that the instantaneous trip level must be 195A or less.

In the latest UL work UL notes there are variations in the instantaneous trip levels in different lots and styles of circuit breakers. UL notes that only one style of breaker from the samples they have looked at appears to have an instantaneous trip level close to the 195 number. It has further been pointed out by circuit breaker manufacturers that while that number was in the breakers UL purchased that is not a maximum level in existing breaker production as this is not a controlled parameter in a standard circuit breaker.

Manufacturers have pointed out that instantaneous trip levels are not verified in submittals or follow up and that these numbers can and do vary tremendously on existing product styles and could vary on circuit breakers that have not been designed to meet the arc mitigation requirements of UL 1699. Circuit breakers are intended and Listed to protect the conductors from a short circuit or overload condition and the qualification of the circuit breaker includes testing to verify that. The necessary instantaneous trip level required to protect the conductor from a short circuit or overload conditions is very different than the level required for arc mitigation however and the circuit breaker is not tested for that.

Standard circuit breakers are not Listed, nor are the parameters controlled, to provide any type of arc-fault protection. Without such Listing the standard circuit breaker is being driven to provide protection outside the parameters for which it has been listed and outside the claims of the manufacturer. This drives a Listed product to be used in an unintended manner for which it is designed and Listed. The continued UL testing has demonstrated that without appropriate control of operational parameters of the circuit breake
in conjunction with the outlet device, the circuit can be at risk from arc-fault protection which may not be provided.

It is agreed that a systems approach could be used to add additional ways to provide AFCI protection but any change to the NEC for AFCI protection needs to provide protection equal to the current requirements in UL 1699 and must be verified in the product or system certification.

This comment is to address the latest UL work and to identify all the known possible solutions to provide AFCI protection. The comment modifies the final wording from the ROP and is summarized as follows:

(1) The first solution is the existing combination AFCI and there is no change to this item.

(2) The second solution identifies the combination of a branch/feeder AFCI along with an outlet branch circuit AFCI. This solution allows an outlet branch circuit AFCI to be used with no restrictions on wiring methods or available current or conductor length.

(3) The third solution is similar to the additional requirements accepted in Proposal 2-92. The issue of the instantaneous trip level is addressed by a supplemental arc protection circuit breaker (SAPCB) instead of a standard thermal magnetic circuit breaker. This solution will allow an outlet branch circuit AFCI to be used with a SAPCB with the same restrictions currently in the ROP – i.e. b) that the conductor be continuous between the circuit breaker and the first outlet; c) that the length of the conductor be no more than 50 feet for a 15A 14 AWG conductor circuit or 70 feet for a 20A 12 AWG conductor circuit; and d) that the first outlet be identified. The supplemental arc protection circuit breaker supplements the protection provided by the outlet branch circuit AFCI by providing the protection from UL 1699 that the outlet devices do not provide in a circuit breaker that has been tested and certified to the requirements in a new Outline of Investigation.

(4) The fourth solution is a modification of the CMP action on 2-92 and allows the combination of the overcurrent protective device and the outlet branch circuit AFCI to be tested as a system and certified as providing equivalent protection to a combination AFCI. This modification will address the issue of instantaneous trip levels of the circuit breaker and the verification of these levels. Informational Note 1 is corrected to delete dates for editions and to show the correct reference of UL 1699A for the outlet branch circuit type arc-fault circuit interrupter and add UL 1699C for the system combination AFCI.

Panel Meeting Action: Accept in Principle
Panel Statement: See panel action on Comment 2-52.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Abstain: 1
Explanation of Abstention:
ORLOWSKI, S.: See reason statement on Comment 2-43.
Comment on Affirmative:
WOOD, T.: While this is an improvement to the existing Code, it is cumbersome and restrictive. See my comment on 2-38.

2-41 Log #1226 NEC-P02 **Final Action: Accept in Principle**
(210.12)

Submitter: Tom Packard, Arc Fault Circuit Interrupter Joint Research and Development Consortium
Comment on Proposal No: 2-68
Recommendation: Proposal 2-68 should be ACCEPTED IN PRINCIPLE IN PART in place of the action taken on Proposal 2-92. Section 210.12(A) should be revised to read as follows:
210.12 Arc-Fault Circuit-Interrupter Protection.
(A) Dwelling Units. All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreational rooms, closets, hallways, or similar or areas shall be protected by a listed arc-fault circuit interrupter, combination-type, installed to provide protection of the branch circuit. It shall be permitted to install a listed outlet branch-circuit-type arc-fault circuit interrupter to provide protection of the branch circuit where the length of branch-circuit wiring from the branch-circuit overcurrent device to the first outlet does not exceed 15.2 m (50 ft) for 14 AWG conductors and 21.3 m (70 ft) for 12 AWG conductors.
Informational Note No. 1: For information on types of arc-fault circuit interrupters, see ANSI/UL 1699-1999 2011, Standard for Arc-Fault Circuit Interrupters.
Informational Note No. 2: See 11.6.3(5) 29.6.3(5) of NFPA 72-2010, National Fire Alarm and Signaling Code, for information related to secondary power supply requirements for smoke alarms installed in dwelling units.
Informational Note No. 3: See 760.41(B) and 760.121(B) for power-supply requirements for fire alarm systems.
Exception No. 1: If RMC, IMC, EMT, Type MC, or steel armored Type AC cables meeting the requirements of 250.118 and metal outlet and junction boxes are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install an outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.
Exception No. 2: Where a listed metal or nonmetallic conduit or tubing is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install an outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.
Exception No. 3: Where an individual branch circuit to a fire alarm system installed in accordance with 760.41(B) or 760.121(B) is installed in RMC, IMC, EMT, or steel-sheathed cable, Type AC or Type MC, meeting the requirements of 250.118, with metal outlet and junction boxes, AFCI protection shall be permitted to be omitted.

Substantiation: This comment is made on behalf of the Arc Fault Circuit Interrupter Wiring Device Joint Research and Development Consortium, the original submitter of Proposal 2-153 (Log #3485), Held along with associated Comment 2-68 (Log #1755) in the 2010 Annual Meeting National Electrical Code Committee Report. This Code Cycle's Proposal 2-68 (Log #22) was previously that Held Comment 2-68. The Consortium members are: Cooper Wiring Devices, Hubbell Incorporated (Delaware), Leviton Manufacturing Inc., Legrand/Pass & Seymour.

Accepting this comment here will promote increased installation of AFCI devices across the country thus increasing overall safety, as indicated in the original Parks study. The majority of CMP2 has indicated in previous votes that they are in favor of acceptance of an AFCI Receptacle without the home run metal conduit limitation. This new data from the Parks Associate Short Circuit Fault Current survey reinforces this majority opinion and specifically mitigates UL's concern about SCC availability. Some CMP2 members have asked for AFCI installation options. Acceptance of an OBC AFCI Receptacle will provide that option. As stated in proposal 2-68, "The Panel action on this Proposal allows for a more practical means of meeting the requirements of 210.12 and will extend this life saving technology to more branch circuit wiring than what is being protected by the present code text". Please consider all of the far reaching benefits of an AFCI Receptacle and accept this comment. Comment 2-68 from the 2011 Code Cycle (now Proposal 2-68 in the 2014 Code Cycle) is very effective in explaining the benefits of an AFCI Receptacle.

Arguments on upstream and downstream protection are also covered very well. Parallel arc faults upstream of the AFCI Receptacle on the home run from the panel has been the primary focus of concern, ignoring all of the other protection upstream and downstream provided by the AFCI receptacle. Proposal 2-68 again goes into all of this protection and added benefit. A primary argument has been the panel circuit breaker ability to trip in the presence of a parallel arc fault on the home run and the Short Circuit Current available at the panel. A recent UL report demonstrated that the higher the available short circuit current at the panel, the more effective the circuit breaker will be in clearing parallel arc faults. This relationship is reinforced by the equation that relates conductor length, available short circuit current and circuit breaker magnetic trip current found on page 3 of the UL report "Evaluation of Run Length and Available Current on Breaker Ability to Mitigate Parallel Arcing Faults". It has been argued in front of CMP2 that, in new construction, 500 amp SCC availability at the panel is prevalent. Attached is a Parks Associates Nationwide survey of SCC availability at the panel. This survey indicates there is a high probability that the current will be sufficient to trip a circuit breaker when a parallel arc fault occurs. This is a determining factor in accepting this comment on Proposal 2-68 and this comment provides the data that the panel requested during the proposal stage..

The equation in the UL report determines that the protection against parallel arcs in the home run provided by a circuit breaker is affected by a number of variables. However, the two most significant factors in establishing the level of parallel arc protection in the home run are the instantaneous trip of the circuit breaker and the available short circuit current at the panel. The information available in the UL report and the Parks study provide a basis for the distribution of these values. A statistical simulation of the equation in the UL report using the distribution of the circuit breaker instantaneous trip values and the available short circuit current values reveals that a high level of protection can be expected for a 50 ft (14 AWG), 70 ft (12AWG) length of home run. In fact, the statistical analysis indicates that under the least favorable conditions the confidence level for protection of a 50 ft/70 ft home run exceeds 97%. The conclusion of this statistical analysis closely correlates with the conclusion in the UL report for protection of the home run. Consequently the additional requirements introduced in Proposal 2-92 are unwarranted, and the Panel should ACCEPT IN PRINCIPLE IN PART Proposal 2-68 with the modification shown, in place of the action taken on Proposal 2-92.

The following items should be considered:

1. Available SCC is significantly greater than originally believed.
2. The UL report demonstrates a direct relationship of SCC availability to the ability of a circuit breaker to trip under a parallel arc fault condition.
3. The Parks study data supports parallel arc fault protection of a 50 ft home run as originally calculated by UL.

The revisions to the Informational Notes from what was presented in Proposal 2-68 are to reflect the 2011 NEC® changes from FPNs to Informational Notes and to reflect Panel action to ACCEPT Proposals 2-93, 2-94 and 2-95.

Background:

The Parts of this Code Cycle's Proposal 2-68 that are NOT carried forward for Acceptance In Principle are:

• The portion providing a definition for Arc-Fault Circuit Interrupter (AFCI) incorporated in Article 100 of the 2011 Code in accordance with panel action on Proposal 2-3 (Log #705) during the last Code Cycle

• The partial deletion of Exception No. 1, resulting from wording incorporated into the main portion of 210.12(A) above based upon new data explained below.

Proposal 2-68 appeared as Comment 2-68 (Log #1755) on Proposal 2-153 in the 2010 Annual Meeting National Electrical Code Committee Report on Proposals. This comment was held for further study during the processing of the 2011 NATIONAL ELECTRICAL CODE.

This present Comment on Proposal 2-68 from the 2014 Code Cycle Report on Proposals is to support this proposal as written and to support Proposal 2-153 from the 2011 Code Cycle as written.

Code Proposal 2-153 from the 2011 Code Cycle was written to remove the metal conduit restriction and allow for an Outlet Branch Circuit AFCI Receptacle in the first outlet. The Parks Associate Study demonstrated the increased safety benefits that would result in the widespread acceptance of an AFCI Receptacle. Code Making Panel 2 Accepted this proposal in Principle during the 2011 Code Cycle ROP meeting. CMP 2 put several Comments to this proposal on Hold during the 2011 Code Cycle ROC meeting.

Note: Supporting material is available for review at NFPA Headquarters.

Panel Meeting Action: Accept in Principle

Panel Statement: The panel accepts the concept of outlet branch circuit device and has incorporated its use in the action taken on Comment 2-52. The panel integrated the outlet branch circuit device into the listed system approach for AFCI protection.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 11 Negative: 1 Abstain: 1

Explanation of Negative:

KING, D.: This comment should have been accepted. The submitter adequately substantiated that practical safeguarding against parallel arcing faults within the homerun lengths as defined in the proposed text is provided by standard overcurrent devices. Accepting this comment would implement clear, prescriptive language for the inspection community to enforce and would provide a practical and affordable alternative for this life saving technology.

Explanation of Abstention:

ORLOWSKI, S.: See reason statement on Comment 2-43.

Comment on Affirmative:

LAROCCA, R.: See my affirmative comment on 2-42.

2-42 Log #1227 NEC-P02 **Final Action: Accept in Principle**
(210.12)

Submitter: Tom Packard, Arc Fault Circuit Interrupter Joint Research and Development Consortium

Comment on Proposal No: 2-92

Recommendation: Proposal 2-92 should be ACCEPTED IN PRINCIPLE IN PART. The wording of 210.12(A) should be revised to read as follows:

210.12 Arc-Fault Circuit-Interrupter Protection.

(A) Dwelling Units. All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreational rooms, closets, hallways, or similar or areas shall be protected as described by (1), (2), (3) or (4):

(1) ~~a~~ A listed combination-type arc-fault circuit interrupter~~, combination-type,~~ installed to provide protection of the entire branch circuit.

(2) A listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet on the branch circuit if all of the following conditions are met:

(a) The ungrounded and grounded conductors of branch-circuit wiring shall be installed in continuous lengths without a splice or joint from the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit interrupter.

(b) The length of branch-circuit wiring from the branch-circuit overcurrent device to the first outlet does not exceed 15.2 m (50 ft) for 14 AWG conductors and 21.3 m (70 ft) for 12 AWG conductors.

(c) The first outlet box in the branch circuit shall be identified.

(3) A listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet on the branch circuit where the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet is installed using RMC, IMC, EMT, Type MC, or steel armored Type AC cables meeting the requirements of 250.118 and using metal outlet and junction boxes.

(4) A listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet on the branch circuit where the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet is installed using listed metal or nonmetallic conduit or tubing encased in not less than 50 mm (2 in.) of concrete.

Informational Note No. 1: For information on types of arc-fault circuit interrupters, see ANSI/UL 1699-~~1999~~ 2011, *Standard for Arc-Fault Circuit Interrupters*.

Informational Note No. 2: See ~~11.6.3(5)~~ 29.6.3(5) of NFPA 72-2010, *National Fire Alarm and Signaling Code*, for information related to secondary power supply requirements for smoke alarms installed in dwelling units.

Informational Note No. 3: See 760.41(B) and 760.121(B) for power-supply requirements for fire alarm systems.

~~*Exception No. 1: If RMC, IMC, EMT, Type MC, or steel armored Type AC cables meeting the requirements of 250.118 and metal outlet and junction boxes are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install an outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.*~~

~~*Exception No. 2: Where a listed metal or nonmetallic conduit or tubing is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install an outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.*~~

Exception ~~No. 3~~: Where an individual branch circuit to a fire alarm system installed in accordance with 760.41(B) or 760.121(B) is installed in RMC, IMC, EMT, or steel-sheathed cable, Type AC or Type MC, meeting the requirements of 250.118, with metal outlet and junction boxes, AFCI protection shall be permitted to be omitted.

Substantiation: This comment is made on behalf of the Arc Fault Circuit Interrupter Wiring Device Joint Research and Development Consortium. The Consortium members are: Cooper Wiring Devices, Hubbell Incorporated (Delaware), Leviton Manufacturing Inc., Legrand/Pass & Seymour.

Accepting this comment here will promote increased installation of AFCI devices across the country thus increasing overall safety, as indicated in the original Parks study. The majority of CMP2 has indicated in previous votes that they are in favor of acceptance of an AFCI Receptacle without the home run metal conduit limitation. This new data from the Parks Associate Short Circuit Fault Current survey reinforces this majority opinion and specifically mitigates UL's concern about SCC availability. Some CMP2 members have asked for AFCI installation options. Acceptance of an OBC AFCI Receptacle will provide that option. As stated in proposal 2-68, "The Panel action on this Proposal allows for a more practical means of meeting the requirements of 210.12 and will extend this life saving technology to more branch circuit wiring than what is being protected by the present code text". Please consider all of the far reaching benefits of an AFCI Receptacle and accept this comment.

Comment 2-68 from the 2011 Code Cycle (now Proposal 2-68 in the 2014 Code Cycle) is very effective in explaining the benefits of an AFCI Receptacle. Arguments on upstream and downstream protection are also covered very well. Parallel arc faults upstream of the AFCI Receptacle on the home run from the panel has been the primary focus of concern, ignoring all of the other protection upstream and downstream provided by the AFCI receptacle. Proposal 2-68 again goes into all of this protection and added benefit. A primary argument has been the panel circuit breaker ability to trip in the presence of a parallel arc fault on the home run and the Short Circuit Current available at the panel. A recent UL report demonstrated that the higher the available short circuit current at the panel, the more effective the circuit breaker will be in clearing parallel arc faults. This relationship is reinforced by the equation that relates conductor length, available short circuit current and circuit breaker magnetic trip current found on page 3 of the UL report "Evaluation of Run Length and Available Current on Breaker Ability to Mitigate Parallel Arcing Faults". It has been argued in front of CMP2 that, in new construction, 500 amp SCC availability at the panel is prevalent. The Parks Associates Nationwide survey of SCC availability at the panel, shows this number to be incorrect. This information was requested by the panel. This survey indicates there is a high probability that the current will be significantly higher and sufficient to trip a circuit breaker when a parallel arc fault occurs. This is a determining factor in accepting this comment on Proposal 2-92.

The equation in the UL report determines that the protection against parallel arcs in the home run provided by a circuit breaker is affected by a number of variables. However, the two most significant factors in establishing the level of parallel arc protection in the home run are the instantaneous trip of the circuit breaker and the available short circuit current at the panel. The information available in the UL report and the Parks study provide a basis for the distribution of these values. A statistical simulation of the equation in the UL report using the distribution of the circuit breaker instantaneous trip values and the available short circuit current values reveals that a high level of protection can be expected for a 50 ft (14 AWG), 70 ft (12AWG) length of home run. In fact, the statistical analysis indicates that under the least favorable conditions the confidence level for protection of a 50 ft/70 ft home run exceeds 97%. The conclusion of this statistical analysis closely correlates with the conclusion in the UL report for protection of the home run. Consequently the additional instantaneous trip current requirements introduced in Proposal 2-92 are unwarranted, and the Panel should ACCEPT IN PRINCIPLE IN PART Proposal 2-92 with the modifications shown.

The following items should be considered:

1. Available SCC is significantly greater than originally believed.
2. The UL report demonstrates a direct relationship of SCC availability to the ability of a circuit breaker to trip under a parallel arc fault condition.
3. The Parks study data supports parallel arc fault protection of a 50 ft home run as originally calculated by UL.

The revisions to the Informational Notes from what was presented in Proposal 2-92 are to reflect the 2011 NEC® changes from FPNs to Informational Notes and to reflect Panel action to ACCEPT Proposals 2-93, 2-94 and 2-95.

Note: Supporting material is available for review at NFPA Headquarters.

Panel Meeting Action: Accept in Principle

Panel Statement: The panel accepts the concept of outlet branch circuit device and has incorporated its use in the action taken on Comment 2-52. The panel integrated the outlet branch circuit device into the listed system approach for AFCI protection.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 11 Negative: 1 Abstain: 1

Explanation of Negative:

KING, D.: See my explanation of negative on Comment 2-41.

Explanation of Abstention:

ORLOWSKI, S.: See reason statement on Comment 2-43.

Comment on Affirmative:

LAROCCA, R.: The report of the Short Circuit Fault Current Study from Parks Associates as cited in the substantiation for the comment provided valuable information. However, it failed to bridge the gap between the average available current at the service panel found today and the minimum values for anticipated available current specified in UL1699. It also failed to take into account that the mean instantaneous tripping currents of the branch circuit breaker appear to be higher than that used for the Monte Carlo simulation. Expansion of the Monte Carlo analysis to include this wider spread of parameters is needed to be able to understand whether the confidence level is appropriate and what risk would be accepted by accepting this comment.

2-43 Log #1244 NEC-P02 **Final Action: Reject**
(210.12)

Submitter: John Masarick, Independent Electrical Contractors, Inc.

Comment on Proposal No: 2-82a

Recommendation: I ask the panel to reject this proposal.

Substantiation: IEC believes the AFCI is a very important product and has the potential to save lives and property; however, in a recent survey of installers, approximately 50% of responders reported having some sort of difficulty with nuisance tripping during installation of AFCI's. One in seven reported replacing the AFCI with a standard circuit breaker because the installation problems could not be resolved. A taskforce has been formed consisting of manufacturers and distributors to gather more information and to better understand the reasons for the installation problems. At the present time, IEC believes there is a need for more training, better test equipment and possibly the AFCI needs more testing. Until more information can be gathered the panel is encouraged not to expand the use of AFCI's in the industry.

While IEC continues to believe the AFCI is an important product, more information needs to be gathered.

Panel Meeting Action: Reject

Panel Statement: The panel believes that the incremental expansion of AFCI protection will provide additional safety and also allow for additional experience in the application of AFCIs to be obtained.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 11 Negative: 1 Abstain: 1

Explanation of Negative:

WILKINSON, R.: The panel believes that the expansion of AFCI protection will provide additional safety. My belief is that the expansion of AFCI protection will provide additional cost to the public.

Explanation of Abstention:

ORLOWSKI, S.: NAHB is abstaining on this comment, and several others, that would expand the use of AFCI protection in dwelling units. Despite repeated attempts by NAHB and several other affected parties to show that there have been no decreases in the number of electrical arcing fires (see substantiation in Proposal 2-81a), the NEC code making panel continues to expand AFCI protection incrementally, without providing any concrete evidence or supporting data that AFCI protection has resulted in any diverted fires

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2-44 Log #1363 NEC-P02 **Final Action: Accept in Principle**
(210.12)

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)

Comment on Proposal No: 2-92

Recommendation: Revise text to read as follows:

210.12 Arc-Fault Circuit-Interrupter Protection. Arc-fault circuit-interrupter protection shall be provided as required in 210.12(A) and (B). The arc-fault circuit interrupter shall be installed in a readily accessible location.

(A) Dwelling Units. All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in dwelling unit kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, laundry areas, or similar rooms or areas shall be protected <u>by any of the means described in (1) through (6).</u> ~~as described by (1), (2), (3), or (4).~~

(1) A listed combination type arc-fault circuit interrupter, installed to provide protection of the entire branch circuit.

~~(2) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit where all of the following conditions are met:~~

~~a. The branch circuit over current protection device shall be a listed circuit breaker having an instantaneous trip not exceeding 300 amperes.~~

~~b. The branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.~~

~~c. The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor.~~

~~d. The first outlet box in the branch circuit shall be identified.~~

<u>(2) A listed branch/feeder type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit. The first outlet box in the branch circuit shall be identified.</u>

<u>(3) A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit where all of the following conditions are met:</u>

<u>(a) The branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.</u>

<u>(b) The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor.</u>

<u>(c) The first outlet box in the branch circuit shall be identified.</u>

<u>(4) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit in combination with a listed branch circuit overcurrent protective device where all of the following conditions are met:</u>

<u>(a) The branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.</u>

<u>(b) The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor.</u>

<u>(c) The first outlet box in the branch circuit shall be identified.</u>

<u>(d) The combination of the branch circuit overcurrent device and the outlet branch circuit AFCI is identified and the combination meets the requirements for a "System Combination" type AFCI and is listed as such.</u>

It is understood that the Correlating Committee has directed the CMP to correlate the added text and its location in Proposals 2-102, 2-103, and 2-109 with the panel action on Proposal 2-92. There are no comments on those items.

Informational Note No. 1: For information on types of <u>combination type and branch/ feeder type</u> arc-fault circuit interrupters, see UL 1699-2011, Standard

for Arc-Fault Circuit Interrupters. For information on outlet branch circuit type arc-fault circuit interrupters see UL 1699A Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters. For information on system combination arc fault circuit interrupters see UL 1699C Outline of Investigation for System Combination Arc-Fault Circuit Interrupters.
Informational Note No. 2: See 29.6(5) of NFPA 72- 2010, *National Fire Alarm and Signaling Code*, for information related to secondary power supply requirements for smoke alarms installed in dwelling units.
Informational Note No. 3: See 760.41(B) and 760.121(B) for power-supply requirements for fire alarm systems.
Substantiation: In the panel statement to Proposal 2-92 the panel agreed with the principle of a systems approach for providing arc fault protection to the branch circuit. The protection system accepted by the Panel consisted of an installation including a branch circuit breaker having a specific instantaneous trip current and a branch circuit where the length of the wiring from the overcurrent protection to the first outlet is limited and the installation of a listed outlet branch circuit AFCI at the first outlet on the circuit.

The specific instantaneous trip current for the branch circuit breaker in the ROP specifies a level of 300A or less based on work done by UL but further work by UL has shown that number to be in error and notes that the instantaneous trip level must be 195A or less.

In the latest UL work UL notes there are variations in the instantaneous trip levels in different lots and styles of circuit breakers. UL notes that only one style of breaker from the samples they have looked at appears to have an instantaneous trip level close to the 195 number. It has further been pointed out by circuit breaker manufacturers that while that number was in the breakers UL purchased that is not a maximum level in existing breaker production as this is not a controlled parameter in a standard circuit breaker.

Manufacturers have pointed out that instantaneous trip levels are not verified in submittals or follow up and that these numbers can and do vary tremendously on existing product styles and could vary on circuit breakers that have not been designed to meet the arc mitigation requirements of UL 1699. Circuit breakers are intended and Listed to protect the conductors from a short circuit or overload condition and the qualification of the circuit breaker includes testing to verify that. The necessary instantaneous trip level required to protect the conductor from a short circuit or overload conditions is very different than the level required for arc mitigation however and the circuit breaker is not tested for that.

Standard circuit breakers are not Listed, nor are the parameters controlled, to provide any type of arc-fault protection. Without such Listing the standard circuit breaker is being driven to provide protection outside the parameters for which it has been listed and outside the claims of the manufacturer. This drives a Listed product to be used in an unintended manner for which it is designed and Listed. The continued UL testing has demonstrated that without appropriate control of operational parameters of the circuit breaker in conjunction with the outlet device, the circuit can be at risk from arc-fault protection which may not be provided.

It is agreed that a systems approach could be used to add additional ways to provide AFCI protection but any change to the NEC for AFCI protection needs to provide protection equal to the current requirements in UL 1699 and must be verified in the product or system certification.

This comment is to address the latest UL work and to identify all the known possible solutions to provide AFCI protection. The comment modifies the final wording from the ROP and is summarized as follows:

(1) The first solution is the existing combination AFCI and there is no change to this item.

(2) The second solution identifies the combination of a branch/feeder AFCI along with an outlet branch circuit AFCI. This solution allows an outlet branch circuit AFCI to be used with no restrictions on wiring methods or available current or conductor length.

(3) The third solution is similar to the additional requirements accepted in Proposal 2-92. The issue of the instantaneous trip level is addressed by a supplemental arc protection circuit breaker (SAPCB) instead of a standard thermal magnetic circuit breaker. This solution will allow an outlet branch circuit AFCI to be used with a SAPCB with the same restrictions currently in the ROP – i.e. b) that the conductor be continuous between the circuit breaker and the fist outlet; c) that the length of the conductor be no more than 50 feet for a 15A 14 AWG conductor circuit or 70 feet for a 20A 12 AWG conductor circuit; and d) that the first outlet be identified.
The supplemental arc protection circuit breaker supplements the protection provided by the outlet branch circuit AFCI by providing the protection from UL 1699 that the outlet devices do not provide in a circuit breaker that has been tested and certified to the requirements in a new Outline of Investigation.

(4) The fourth solution is a modification of the CMP action on 2-92 and allows the combination of the overcurrent protective device and the outlet branch circuit AFCI to be tested as a system and certified as providing equivalent protection to a combination AFCI. This modification will address the issue of instantaneous trip levels of the circuit breaker and the verification of these levels.

Informational Note 1 is corrected to delete dates for editions and to show the correct reference of UL 1699A for the outlet branch circuit type arc-fault circuit interrupter and add UL 1699C for the system combination AFCI.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action on Comment 2-52.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Abstain: 1
Explanation of Abstention:
ORLOWSKI, S.: See reason statement on Comment 2-43.

2-45 Log #1389 NEC-P02 **Final Action: Reject**
(210.12.Arc-Fault Circuit-Interrupter Protection)

Submitter: Joseph C. Engel, Monroeville, PA
Comment on Proposal No: 2-88
Recommendation: Revise text to read as follows:
210.12 Are-Fault Circuit-Interrupter Protection.
(A) Dwelling Units: All 125-volt, single-phase, 15- and 20- ampere branch circuits supplying outlets installed in dwelling unit family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, or similar rooms or areas shall be protected by a listed arc fault circuit interrupter combination-type, installed to provide protection of the branch circuit.
Substantiation: I believe the Panel MUST vote to Accept my proposal to remove the words “combination-type” from 210.12. A vote to Reject would force a consumer to purchase a more expensive product whose key performance claims the Panel argues are false. People could thus consider a vote to Reject to be unethical or worse (fraudulent?).

My reasoning is as follows.

The Panel now seems to agree that the claims made concerning the Combination AFCI are FALSE. Namely that 1) series arcing across a break in a cord’s conductor is a fire hazard and 2) a Combination AFCI will respond to such an event and trip. The Panel apparently conducted a test that proved claims false. From the Panel’s own Rejection Statement of my proposal:

“Replication of the experiments shown in the video shows that there is minimal actual arcing occurring. When arcing does occur, causing the sparking seen in the video, its duration is very short and the energy is three orders of magnitude below what is required to ignite the NM cable or surrounding materials. The waveform looks the same as when a wall switch is switched on and off. If the AFCI responded to this waveform it would increase the incidence of unwanted tripping while not contributing significantly to mitigating fire hazards.”
Panel Meeting Action: Reject
Panel Statement: Although no actual revision is shown, the panel understands that it is the submitter’s intent to delete the words “combination type” from 210.12A. A Combination Type AFCI is defined in UL1699 as an AFCI which complies with the requirements for both branch/feeder and outlet circuit AFCIs. It is intended to protect downstream branch circuit wiring and cord sets and power-supply cords.

Note also the following definitions from UL1699:

BRANCH/FEEDER ARC-FAULT CIRCUIT-INTERRUPTER – A device intended to be installed at the origin of a branch circuit or feeder, such as at a panelboard. It is intended to provide protection of the branch circuit wiring, feeder wiring, or both, against unwanted effects of arcing. This device also provides limited protection to branch circuit extension wiring. It may be a circuit-breaker type device or a device in its own enclosure mounted at or near a panelboard.

OUTLET CIRCUIT ARC-FAULT CIRCUIT-INTERRUPTER – A device intended to be installed at a branch circuit outlet, such as at an outlet box. It is intended to provide protection of cord sets and power-supply cords connected to it (when provided with receptacle outlets) against the unwanted effects of arcing. This device may provide feed-through protection of the cord sets and power-supply cords connected to downstream receptacles.

In the context of these definitions, and the required arcing tests for these types of AFCIs, the UL1699 Standard does not use the terms “series arc” or “parallel arc.” The standard, which is an ANSI standard, does include performance requirements to establish the required protection. The submitter of this proposal has not demonstrated that the AFCI devices which he has tested do not meet the performance requirements for combination type AFCIs as contained in the UL1699 standard.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Abstain: 1
Explanation of Abstention:
ORLOWSKI, S.: See reason statement on Comment 2-43.

2-46 Log #29 NEC-P02 **Final Action: Accept**
(210.12(A))

TCC Action: The Correlating Committee clarifies that Informational Note 4 will be removed from 210.12(A) since companion proposals and comments to add 410.9, 411.8 and 422.5 were not accepted.
Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 2-92
Recommendation: The Correlating Committee understands that the term “over current” should be the term “overcurrent” in 210.12(A)(2)(a).

The Correlating Committee directs that the panel correlate the actions on Proposals 2-96, 2-102, 2-103, 2-109, and 2-116, and clarify the use of the Exceptions.

In addition, the Correlating Committee understands that the panel actions on Proposals 2-79, 2-80, 2-82a, 2-85, 2-93, 2-94 and 2-95 modify the accepted text in Proposal 2-92, per their respective panel statements.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: 2-96: The panel accepts the addition of Informational Note 4 as accepted in Proposal 2-96. The panel understands that Informational Note 4 will modify the accepted text in 210.12.
2-102: The panel accepted the addition of “metal wireways” and “metal auxilary gutters” The panel understands the two additional wiring methods above will modify the accepted text of 210.12 (A)(3) as follows: If RMC, IMC, EMT, Type MC, or steel armored Type AC cables meeting the requirements of 250.118, metal wireways, metal auxiliary gutters and metal outlet and junction boxes are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install an outlet branch-circuit type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.
2-103: The panel accepted the addition of “Type MC Cable.” The panel understands the additional wiring method above will modify the accepted text of 210.12(A)(4) as follows: Where a listed metal or nonmetallic conduit or tubing or Type MC Cable is encased in not less than 50mm (2 in.) of concrete for the portion of the branch circuit between the branch circuit overcurrent device and the first outlet, it shall be permitted to install an outlet branch circuit type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.
2-109: The panel notes that due to the action on Proposal 2-92 “Exception No. 3” of 210.12 needs to be modified to “Exception.”
2-116: See panel action and Comment on 2-60. The panel notes that Exceptions 1 and 2 have been moved to positive language with the panel action on Proposal 2-92. The panel understands that the deletion of Exceptions 1 and 2 and the change of Exception 3 to exception will modify the accepted text of 210.12.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Abstain: 1
Explanation of Abstention:
ORLOWSKI, S.: See reason statement on Comment 2-43.

2-47 Log #452 NEC-P02 **Final Action: Reject**
(210.12(A))

Submitter: Robert G. Fahey, City of Janesville
Comment on Proposal No: 2-80
Recommendation: Revise text to read:
210.12(A) Dwelling Units. All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in dwelling units, with <u>the exception of unfinished basements, garages and bathrooms</u> ~~kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, laundry areas, or similar rooms or areas~~ shall be protected as described by (1), (2), (3), or (4).
Substantiation: The proposed language eliminates the laundry list provided in this Code section, therefore providing more clarity. This comment is not intended to change or eliminate the present or proposed locations where AFCI protection is required; this comment is meant only to make the Code language more concise.
Panel Meeting Action: Reject
Panel Statement: The submitter’s recommendation adds AFCI protection for outside circuits, attics and crawl spaces which were not areas contemplated at the ROP stage.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Abstain: 1
Explanation of Abstention:
ORLOWSKI, S.: See reason statement on Comment 2-43.
Comment on Affirmative:
HILBERT, M.: I support the expansion of the GFCI requirements to the laundry area due to the likely use of portable appliances such as an iron. However I agree with the submitter with regard to requiring GFCI protection for a branch circuit due to concerns with the appliance. See my comment of Comment 2-29

2-48 Log #867 NEC-P02 **Final Action: Reject**
(210.12(A))

Submitter: C. Douglas White, Center Point Energy / Rep. Edison Electric Institute/Electric Light & Power Group
Comment on Proposal No: 2-80
Recommendation: Reject proposal 2-80.
Substantiation: No substantiation has been provided to indicate that arcing faults within the wiring of laundry areas have caused the fires noted in the proposal. NFPA statistics provided in the report discussed in the substantiation are not specific to the segment of the wiring within a dwelling unit responsible for the fire.
Panel Meeting Action: Reject
Panel Statement: Data submitted to the panel over many previous code cycles indicated that there were arcing incidents occurring in residential branch circuits. The panel has taken an approach of incrementally expanding arc fault protection over several code cycles to provide increased safety by reducing the number of arcing events in dwellings. The panel action on this proposal continues with this approach.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 11 Negative: 1 Abstain: 1
Explanation of Negative:
DUREN, R.: The submitter of proposal 2-80 sites the data from the NFPA annual fire study as evidence of the need for additional AFCI protection within the laundry area. One item unaccounted for in the NFPA annual fire study is the vintage of the dwellings in which the reported fires occurred.
The submitter failed to establish a link between the fires reported and the number of those fires caused by laundry area circuits.
Explanation of Abstention:
ORLOWSKI, S.: See reason statement on Comment 2-43.

2-49 Log #868 NEC-P02 **Final Action: Reject**
(210.12(A))

Submitter: C. Douglas White, Center Point Energy / Rep. Edison Electric Institute/Electric Light & Power Group
Comment on Proposal No: 2-85
Recommendation: Reject proposal 2-85.
Substantiation: The addition of “or devices” following “outlets” in the list found in 210.12(A) has greatly expanded the requirements for AFCI protection to all areas of a dwelling unit, but the substantiation only refers to bedroom areas. The substantiation supporting the proposed change is lacking technical merit and is anecdotal. It does not present any data indicating a problem exists with hard wired devices.
Panel Meeting Action: Reject
Panel Statement: Data submitted to the panel over many previous code cycles indicated that there were arcing incidents occurring in residential branch circuits. Including devices in the requirement ensures increased arc fault protection for the branch circuits that serve devices in the specified areas.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 11 Negative: 1 Abstain: 1
Explanation of Negative:
DUREN, R.: The code change proposed in ROP 2-85 expands the requirements of AFCI protection without sufficient justification or substantiation.
Explanation of Abstention:
ORLOWSKI, S.: See reason statement on Comment 2-43.

2-50 Log #869 NEC-P02 **Final Action: Reject**
(210.12(A))

Submitter: C. Douglas White, Center Point Energy / Rep. Edison Electric Institute/Electric Light & Power Group
Comment on Proposal No: 2-90
Recommendation: Reject proposal 2-90.
Substantiation: The substantiation for this proposal does not cite any reference that validates an issue exists for dishwashers or the dishwasher circuit. A subsequent NFPA document [Hall, John R. Jr., Home Electrical Fires, National Fire Protection Association, January 2012] to the one cited in the substantiation does not list dishwashers as a cause of home electrical fires and there is no data listed that indicates the wiring of the dishwasher circuit is a cause of home fires.
Panel Meeting Action: Reject
Panel Statement: The panel has added kitchens to the locations that must have AFCI protection. Data submitted to the panel over many previous code cycles indicated that there were arcing incidents occurring in residential branch circuits. The panel has taken an approach of incrementally expanding arc fault protection over several code cycles to provide increased safety by reducing the number of arcing events in dwellings.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 11 Negative: 1 Abstain: 1
Explanation of Negative:
DUREN, R.: The data referenced in the original proposal ROP 2-90 does not substantiate the request to include the dishwasher circuit in the list of AFCI protected circuits.
Explanation of Abstention:
ORLOWSKI, S.: See reason statement on Comment 2-43.

2-51 Log #1245 NEC-P02 **Final Action: Reject**
(210.12(A))

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 2-89
Recommendation: This comment recommends the panel approve proposal 2-89 with the change shown below. The requested change would allow any <u>listed AFCI</u> to be used at the origin of the branch circuit and for the outlet AFCI.
(A) Dwelling Units. All 120-voIt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit family rooms, dining rooms. living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, or similar rooms or areas shall be protected by a listed

arcfault circuit interrupter, combination-type, installed to provide protection of the branch circuit.

Informational Note No. I: For information on types of arc-fault circuit interrupters, see UL 1699-1999, Standard for Arc-Fault Circuit Interrupters.

Informational Note No.2: See 11.6.3(5) of NFPA 72-2010, National Fire Alarm and Signaling Code, for information related to secondary power supply requirements for smoke alarms installed in dwelling units.

Informational Note No.3: Sec 760.41 (8) and 760.121 (8) for power-supply requirements for lire alarm systems.

Exception No. I: If RMC, [MC, EMT, Type MC, or steel armored Type AC cables meeting the requirements of 250.118 and metal outlet and junction boxes are installed for the portion of the branch circuit between the branchcircuit overcurrent device and the first outlet, it shall be permitted to install an outlet branch-circuit type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit. <u>Home run circuits shall be clearly identified at all points of termination, connection, and splices. The means of identification shall be permitted by separate color coding. marking: tape, tagging, or other approved means.</u>

Exception No. 2: Where a listed metal or nonmetallic conduit or tubing is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to be installed an outlet branch-circuit type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit. <u>Home run circuits shall be clearly identified at all points of termination. connection. and splices. The means of identification shall be permitted by separate color coding:. marking tape. tagging. or other approved means.</u>

Exception No. 3: Where an individual branch circuit to a fire alarm system installed in accordance with 760.41 (B) or 760.121 (B) is installed in RMC, IMC, EMT, or steel-sheathed cable, Type AC or Type MC, meeting the requirements of 250.118, with metal outlet and junction boxes, AFCI protection shall be permitted to be omitted.

(B) Branch Circuit Extensions or Modifications - Dwelling Units. In any of the areas specified in 21 0.12(A), where branch-circuit wiring is modified, replaced, or extended the branch circuit shall be protected by one of the following:

(I) A listed ~~combination type~~ AFCI located at the origin of the branch circuit

(2) A listed outlet branch-circuit type AFC[located at the first receptacle

Substantiation: IEC believes the AFCI is a very important product and has the potential to save lives and property; however, in a recent survey of installers, approximately 50% of responders reported having some sort of difficulty with nuisance tripping after installing AFCI's. One in seven reported replacing the AFCI with a standard circuit breaker because the installation problems could not be resolved. A taskforce has been formed consisting of manufacturers and distributors to gather more information and to better understand the reasons for the installation problems. At the present time, IEC believes there is a need for more training, better test equipment and possibly the AFCI needs more testing. Until more information can be gathered the panel is encouraged to allow the non combination type AFCI to be installed because it gives the contractor more flexibility to eliminate nuisance tripping during installation.

While IEC continues to believe the AFCI is an important product, more information needs to be gathered.

Panel Meeting Action: Reject

Panel Statement: The panel reaffirms that the substantiation for the original proposal recommended identifying the first outlet but did not provide technical substantiation for identifying the points of termination, connection, and splices. The comment has not provided the additional technical substantiation needed to accept the original proposal.

The panel reaffirms the intent to require the use of a Listed Combination Type AFCI at the origin of the branch circuit.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 12 Abstain: 1

Explanation of Abstention:

ORLOWSKI, S.: See reason statement on Comment 2-43.

2-52 Log #1411 NEC-P02 **Final Action: Accept**

(210.12(A))

TCC Action: The Correlating Committee understands that 210.12(A)(5) and 210.12(A)(6) were accepted in two forms by Panel 2 through their actions on Comment 2-46 and 2-52. The Correlating Committee directs that 210.12(A)(5) and 210.12(A)(6) be modified by the panel action taken on Comment 2-46. In 210.12(A)(5) and 210.12(A)(6), the word "listed" is added in front of "outlet branch circuit type AFCI" by the Correlating Committee for correlation.

To correlate with the actions taken on Proposal 2-116, Comments 2-37, Proposal 2-85, Proposal 2-82a, Proposal 2-80, Comment 2-52, Comment 2-59, Comment 2-46, Proposal 2-102, Proposal 2-103, Proposal 2-93, Proposal 2-79, Proposal 2-94, Proposal 115, and the Correlating Committee Action on Comment 46, the Correlating Committee directs that the final text to read as follows:

210.12 Arc-Fault Circuit-Interrupter Protection. Arc-fault circuit-interrupter protection shall be provided as required in 210.12(A), (B) and (C). The arc-fault circuit interrupter shall be installed in a readily accessible location. [P2-116] [C2-37]

(A) Dwelling Units. All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in dwelling unit kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, laundry areas, or similar rooms or areas shall be protected by any of the means described in (1) through (6) [P2-85], [P2-82a], [P2-80] [C2-52]

(1) A listed combination type arc-fault circuit interrupter, installed to provide protection of the entire branch circuit.

(2) A listed branch/feeder type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit. The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit. [C2-59]

(3) A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit where all of the following conditions are met:

(a) The branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.

(b) The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor.

(c) The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit. [C2-59]

(4) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit in combination with a listed branch circuit overcurrent protective device where all of the following conditions are met:

(a) The branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.

(b) The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor.

(c) The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit. [C2-59]

(d) The combination of the branch circuit overcurrent device and outlet branch circuit AFCI is identified as meeting the requirements for a "System Combination" type AFCI and is listed as such.

(5) If RMC, IMC, EMT, Type MC, or steel armored Type AC cables meeting the requirements of 250.118, metal wireways, metal auxiliary gutters and metal outlet and junction boxes are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

[C2-52] [C2-46] [P2-102]

(6) Where a listed metal or nonmetallic conduit or tubing or Type MC Cable is encased in not less than 50mm (2 in.) of concrete for the portion of the branch circuit between the branch circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch circuit type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit [C2-46][P2-103]

Exception. Where an individual branch circuit to a fire alarm system installed in accordance with 760.41(B) or 760.121(B) is installed in RMC, IMC, EMT, or steel-sheathed cable, Type AC or Type MC, meeting the requirements of 250.118, with metal outlet and junction boxes, AFCI protection shall be permitted to be omitted.

Informational Note No. 1: For information on combination type and branch/feeder type arc-fault circuit interrupters, see ANSI/UL 1699-2011, Standard for Arc-Fault Circuit Interrupters. For information on outlet branch circuit type arc-fault circuit interrupters see UL Subject 1699A Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters. For information on System Combination AFCIs see UL Subject 1699C Outline of Investigation for System Combination Arc Fault Circuit Interrupters. [P2-93]

Informational Note No. 2: See 29.6.3(5) of NFPA 72- 2010, National Fire Alarm and Signaling Code, for information related to secondary power supply requirements for smoke alarms installed in dwelling units. [P2-79] [P2-94]

Informational Note No. 3: See 760.41(B) and 760.121(B) for power-supply requirements for fire alarm systems.

(B) Branch Circuit Extensions or Modifications-Dwelling Units

In any of the areas specified in 210.12(A), where branch-circuit wiring is modified, replaced, or extended, the branch circuit shall be protected by one of the following:

(1) A listed combination-type AFCI located at the origin of the branch circuit

(2) A listed outlet branch-circuit type AFCI located at the first receptacle outlet of the existing branch-circuit

Exception: AFCI protection shall not be required where the extension of the existing conductors is not more than 1.8 m (6 ft.) and does not include any additional outlets or devices. [P2-115]

(C) Dormitory Units. All 120-Volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dormitory unit bedrooms, living rooms, hallways, closets, and similar rooms shall be protected by a

listed arc-fault circuit interrupter meeting the requirements of 210.12(A)(1) through (6) as appropriate. [C2-37]
Submitter: Robert L. LaRocca, UL LLC
Comment on Proposal No: 2-92
Recommendation: Continue to accept 2-92 in principle but revise the CMP 2's action as follows:

210.12 Arc-Fault Circuit-Interrupter Protection.

(A) Dwelling Units. All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, or similar rooms or areas shall be protected ~~as described by (1), (2), (3) or (4)~~ by any of the means described in (1) through (6):

(1) A listed combination type arc-fault circuit interrupter, installed to provide protection of the entire branch circuit.

~~(2) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit where all of the following conditions are met:~~
~~(a) The branch circuit over current protection device shall be a listed circuit breaker having an instantaneous trip not exceeding 300 amperes.~~
~~(b) The branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.~~
~~(c) The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor.~~
~~(d) The first outlet box in the branch circuit shall be identified.~~

(2) A listed branch/feeder type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit. The first outlet box in the branch circuit shall be identified.

(3) A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit where all of the following conditions are met:
(a) The branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.
(b) The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor.
(c) The first outlet box in the branch circuit shall be identified.

(4) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit in combination with a listed branch circuit over current protective device where all of the following conditions are met:
(a) The branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.
(b) The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor.z
(c) The first outlet box in the branch circuit shall be identified.
(d) The combination of the branch circuit overcurrent device and outlet branch circuit AFCI is identified as meeting the requirements for a "System Combination" type AFCI and is listed as such.

~~(3)~~(5) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit where the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet is installed using RMC, IMC, EMT, Type MC, or steel armored Type AC cables meeting the requirements of 250.118 and using metal outlet and junction boxes.

~~(4)~~(6) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit where the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet is installed using a listed metal or nonmetallic conduit or tubing encased in not less than 50 mm (2 in.) of concrete.

Delete Exceptions 1 and 2 of the existing text

~~Exception 3~~ Exception: Where an individual branch circuit to a fire alarm system installed in accordance with 760.41(B) or 760.121(B) is installed in RMC, IMC, EMT, or steel-sheathed cable, Type AC or Type MC, meeting the requirements of 250.118, with metal outlet and junction boxes, AFCI protection shall be permitted to be omitted.

Informational Note No. 1: For information on ~~types of~~ combination type and branch/feeder type arc-fault circuit interrupters, see UL 1699~~-1999~~, Standard for Arc-Fault Circuit-Interrupters. For information on outlet branch circuit type arc-fault circuit interrupters see UL Subject 1699A Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters. For information on System Combination AFCIs see UL Subject 1699C Outline of Investigation for System Combination Arc Fault Circuit Interrupters.

Informational Note No. 2: See 11.6.3(5) of NFPA 72- 2010, National Fire Alarm and Signaling Code, for information related to secondary power supply requirements for smoke alarms installed in dwelling units.

Informational Note No. 3: See 760.41(B) and 760.121(B) for power-supply requirements for fire alarm systems.

Substantiation: This comment was developed in conjunction with the manufacturers of circuit breakers and outlet branch circuit AFCIs.

The level of protection of the branch circuit against the effects of arcing faults needs to be equivalent to that currently defined for Combination Type AFCIs meeting the requirements of UL 1699. Both the proposal 2-92 and CMP 2's action on it at the ROP were based on information in the UL Report - *Effectiveness of Circuit Breakers in Mitigating Parallel Faults in the Home Run*. This report was issued on September 30, 2011 and revised on January 11, 2012. Since that time, UL has continued with additional research testing. Continued testing conducted by UL shows that the effectiveness of the protection of the home run afforded by a branch circuit breaker is affected by the current available at the panel, the instantaneous trip setting of the branch circuit breaker, and the length and size of the branch circuit conductors. The current available at the panel can vary from installation to installation based on the local distribution system, distance from the supply transformer and size of the service entrance conductors. The branch circuit lengths cited in the original report and accepted by CMP 2 are valid only if the current available at the panel is relatively high and the circuit breaker instantaneous trip rating is controlled to a known value. UL 1699, however, assumes that the current at the panel can be as low as 500A based on previous research work. Discussions with some utilities confirm that a value this low is a possibility for some installations. The instantaneous trip performance of the circuit breaker is not defined by UL requirements and recent testing shows that there can be variations of this parameter from batch to batch.

The results of testing reported in a new UL report - *Evaluation of Run Length and Available Current on Breaker Ability to Mitigate Parallel Arcing Faults*, Part 1 dated July, 2012, and Part 2 dated October, 2012, show that for an installation with 500 A available at the panel, the lengths of home run conductors cited in the panel action require a branch circuit breaker having an instantaneous trip current of less than 200A rather than the 300 A accepted in the panel action. Only some residential breakers currently available in the market place have demonstrated instantaneous trip levels this low and variations from batch to batch have been noted in testing by UL. Additionally, the instantaneous trip response may vary with the ambient temperature of the installation.

The Report mentioned above is available from the UL.Com website using this link to the appropriate page: http://lms.ulknowledgeservices.com/common/ncsresponse.aspx?rendertext=randdthoughtleadership

The revisions to the CMP's action on 2-92 in the comment above are intended to give the installer choices among systems of protection devices that provide protection of the branch circuit that is equivalent to the protection currently provide by a combination type AFCI meeting the requirements of UL 1699. A number of viable options for systems providing this protection have been suggested by the testing conducted by UL and collaborative work with the involved industries.

Option 1 is the current requirement for a listed combination type AFCI installed at the origin of the branch circuit and is unchanged.

Option 2 combines a listed branch feeder type AFCI installed at the origin of the branch circuit with a listed outlet branch circuit AFCI installed at the first outlet. The branch feeder type device provides protection against faults in parallel with the supply for the home run up to the terminals of the outlet branch circuit device. The outlet branch circuit device provides protection against arcing faults in series with the load for the upstream and downstream circuit conductors. Both devices can mitigate the effects arcing faults in parallel with the supply on the load side of the outlet branch circuit device. Since both devices are listed and in compliance with UL 1699, they have been tested assuming only 500 A available short circuit current at the panel, and there is no restriction on the length or size of the branch circuit conductors in the home run.

Option 3 introduces a special supplemental arc protection circuit breaker to be used in combination with an outlet branch circuit AFCI. The supplemental arc protection circuit breaker concept is being developed by the circuit breaker industry specifically for this application. An outline containing certification requirements is being developed jointly by the industry and UL. This type of circuit breaker will be investigated to provide the required arc fault protection of the home run when installed in a systems with an outlet branch circuit device and a home run of the specified length and AWG. Investigation of the circuit breaker will be based on selected requirements from UL 1699 and will assume a 500A current capability at the panel. UL's certification of this breaker will include specific surveillance components to verify the effectiveness of the arc mitigation of production samples.

Option 4 modifies option 2 of the CMP's action based on the additional research testing performed by UL. It introduces the concept of certifying a branch circuit overcurrent device and outlet branch circuit AFCI in specific system combinations that have been tested and certified to comply with the requirements of UL 1699 using a new outline of investigation. This outline will be published as UL Subject 1699C after being developed jointly by UL and the circuit breaker and wiring device industries. UL's certification of the combination will include specific surveillance components to verify the effectiveness of the arc mitigation of production samples in combination.

Options 5 and 6 are options 3 and 4 from the panel's action, renumbered.

Exceptions 1 and 2 of the existing code text should have been deleted by the CMP since the exceptions were turned into positive language in options 3 and 4 of the panel's action.

Informational Note 1 is revised to delete references to specific issue dates for the referenced documents and also adds references to the outlines of investigation for the outlet branch circuit device and for the system combination.

Each of the options above provides protection of the entire branch circuit in a manner that is equivalent to the current UL 1699 protection levels and controls the important parameters of the arc fault protection. Since testing is conducted in accordance with UL 1699 or requirements derived from UL 1699, the effect

of temperature variations on performance is addressed as well.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Abstain: 1
Explanation of Abstention:
ORLOWSKI, S.: See reason statement on Comment 2-43.
Comment on Affirmative:
KING, D.: Although I support Comment 2-41, I support an affirmative vote on this comment as it will allow for the expanded use of listed outlet branch circuit arc fault circuit interrupter devices and will provide a practical alternative for many installations.
WOOD, T.: See my comment on 2-40.

2-53 Log #1502 NEC-P02 **Final Action: Reject**
(210.12(A))

Submitter: Alan Manche, Schneider Electric
Comment on Proposal No: 2-92
Recommendation: Revise the proposed language in 210.12(A)(2) to include a minimum available fault current value.
(e)The available fault current at the branch circuit overcurrent device shall not be less than 500A.
Substantiation: The available fault current at the branch circuit overcurrent device plays a significant role in the operation parameters for protection. We often think of single family residence and concerns in rural areas where the fault current is known to be below this value. Even more significant concerns are found in multi-family dwellings where the Transformer sits in a central location of a multi-building complex, the Multi-meter equipment serves as the service disconnect on the end of each building may be 100ft of conductor from the transformer to the meter main and then the feeder conductor from the service meter main may be 200 ft long in a three or four story complex and those conductors are feeding a panel in the far end of the multi-family building. A quick point-to-point calculation will demonstrate that you easily drop below 500A at the panel where the branch circuit devices are located, creating an issue for this protection system of standard breaker and AFCI receptacle. This comment seeks to ensure we have the appropriate parameters in place to ensure the configuration is providing protection.
Panel Meeting Action: Reject
Panel Statement: Information regarding the magnitude of the available fault current at the branch circuit over current protective device is not readily available for most installations where AFCI protection is required, making enforcement impossible. The evaluation of listed AFCI's to UL1699 will take into account the effect of the available short circuit current on the capability of the AFCI to mitigate faults
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Abstain: 1
Explanation of Abstention:
ORLOWSKI, S.: See reason statement on Comment 2-43.

2-54 Log #944 NEC-P02 **Final Action: Reject**
(210.12(A), Informational Note 4)

TCC Action: Based on the action taken on Proposals 17-20, 18-62, 18-88 and Comments 17-8, the Correlating Committee directs that this comment be reported as "Reject" since the companion proposals and comments were not accepted.
Submitter: Ed Larsen, Schneider Electric USA
Comment on Proposal No: 2-96
Recommendation: Accept the revised proposal to add text to read as follows:
Informational Note No. 4: See 410.9, 411.8 and 422.5 for FCC Part 15 Class B Digital Device ~~or~~ and FCC Part 18 ~~limits for~~ Consumer ISM Equipment ~~compliance~~ marking requirements for fluorescent and high intensity discharge luminaires, LED and low voltage lighting power supplies, self ballasted lamps and appliances installed in dwelling units.
Substantiation: CMP2 accepted this proposal, but it was rejected by the TCC because the proposals to add sections 410.9, 411.8 and 422.5 were rejected by CMP17 and CMP18. Comments have been submitted regarding ROP 17-20, 18-62 and 18-88 to revise the proposed text in response to the panel statements. The text for Informational Note No. 4 has been revised to correlate with the revised text for 410.9, 411.8 and 422.5. This comment should be accepted contingent on acceptance of the submitter's comments on 17-20, 18-62 and 18-88.
Panel Meeting Action: Accept
Panel Statement: The panel notes that if the action on this comment passes ballot it will modify the action taken on Comment 2-46.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Abstain: 1
Explanation of Abstention:
ORLOWSKI, S.: See reason statement on Comment 2-43.

2-55 Log #30 NEC-P02 **Final Action: Accept**
(210.12(A) Exception No. 1)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 2-102
Recommendation: The Correlating Committee directs that the panel correlate the added text and its location in Proposals 2-102, 2-103, and 2-109 with the panel action on Proposal 2-92.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: See panel action and statement on Comment 2-46.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Abstain: 1
Explanation of Abstention:
ORLOWSKI, S.: See reason statement on Comment 2-43.

2-56 Log #431 NEC-P02 **Final Action: Reject**
(210.12(A) Exception No. 1)

Submitter: Robert G. Wilkinson, IEC Texas Gulf Coast
Comment on Proposal No: 2-101
Recommendation: Accept proposal 2-101.
Substantiation: CMP2 rejected my proposal 2-101 with the panel statement "Section 90.4 permits new products that may not be available at the time the Code is adopted". This provision was added to the 90.4 in the 1984 NEC and it was never intended to be applied to products that don't exist. The first electronic GFCI was developed in 1961 and the first requirement for GFCI protection in the NEC was in the 1968 edition and it was limited to protection of underwater lighting in swimming pools. Imagine what would have happened if the 1959 NEC required GFCI protection in light of the fact that the first circuit breaker type GFCI was not introduced until 1968 and the first receptacle type GFCI was not introduced until 1972. It is a disservice to the public to require a product that is not available to fulfill a requirement in the NEC. To continue to go down this path is to put the NEC in jeopardy of not being adopted. The credibility of the NEC is compromised by requiring products that do now exist. To take this matter to be ridiculous, I propose for the NEC to require a receptacle that I plan to develop that will provide AFCI, GFCI, ALCI, ELCI, IDCI, and LCDI protection. This receptacle will also be tamper resistant, weather resistant, and have the ability to change color to match the wall color. Since 90.4 permits requiring new products that may not be available at the time the Code is adopted, I'm sure my proposed magic receptacle will be accepted.
Panel Meeting Action: Reject
Panel Statement: The panel reaffirms that 90.4 permits requiring new products that may not be available at the time the code is adopted. The panel notes that one manufacturer has announced the availability of the Outlet Branch Circuit device as of the end of October.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Abstain: 1
Explanation of Abstention:
ORLOWSKI, S.: See reason statement on Comment 2-43.

2-57 Log #430 NEC-P02 **Final Action: Reject**
(210.12(A) Exception No. 2)

Submitter: Robert G. Wilkinson, IEC Texas Gulf Coast
Comment on Proposal No: 2-104
Recommendation: Accept proposal 2-104.
Substantiation: CMP2 rejected my proposal 2-104 with the panel statement "Section 90.4 permits requiring new products that may not be available at the time the Code is adopted". This provision was added to 90.4 in the 1984 NEC and it was never intended to be applied to products that don't exist. The first GFCI was developed in 1961 and the first requirement for GFCI protection in the NEC was in the 1968 edition and it was limited to protection of underwater lighting in swimming pools. Imagine what would have happened if the 1959 NEC required GFCI protection in light of the fact that the first circuit breaker type GFCI was not introduced until 1968 and the first receptacle type GFCI was not introduced until 1972. It is a disservice to the public to require a product that not available to fulfill a requirement in the NEC. To continue to go down this path is to put the NEC in jeopardy of not being adopted. The credibility of the NEC is compromised by requiring products that do not exist. To take this matter to the ridiculous, I propose for the 2017 NEC to require a receptacle that I plan to develop that will provide AFCI, GFCI, ALCI, ELCI, IDCI, and LCDI protection. This receptacle will also be tamper resistant, weather resistant, and have the ability to change color to match the wall color. Since 90.4 permits requiring new products that may not be available at the time the Code is adopted, I'm sure my proposed magic receptacle will be accepted.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 2-56.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Abstain: 1
Explanation of Abstention:
ORLOWSKI, S.: See reason statement on Comment 2-43.

2-58 Log #1521 NEC-P02 **Final Action: Reject**
(210.12(A) Exception No. 2)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 2-105
Recommendation: Revise text to read as follows:
210.12 Arc-Fault Circuit-Interrupter Protection. (A) Dwelling Units.
Exception No. 2: Where a listed ~~metal or~~ nonmetallic conduit (PVC or RTRC) or tubing (ENT) ~~or Type MC Cable~~ is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install an outlet branch-circuit type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.
Substantiation: Exception No 1. allows listed metallic conduit and tubing to be used. It is not necessary to list it again "encased in concrete".
Exception No 1. allows MC cable.. It is not necessary to list it again "encased in concrete".
The objection to limiting the non-metallic conduits to PVC is addressed by the changes.
HDPE and NUCC were omitted from the list since they are not to be used in a building. I understand that encased in concrete places them "outside" the building.
Panel Meeting Action: Reject
Panel Statement: The use of wiring methods in Exception No. 1 includes additional requirements not included in Exception No. 2. There is insufficient substantiation to limit the nonmetallic conduit or tubing as recommended in the comment.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Abstain: 1
Explanation of Abstention:
ORLOWSKI, S.: See reason statement on Comment 2-43.

2-59 Log #1010 NEC-P02 **Final Action: Accept**
(210.12(A)(2)(d))

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 2-92
Recommendation: Revise Section 210.12(A)(2)(d) of the proposal as follows (or with similar, better language):
(d) The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit ~~identified~~.
Substantiation: The term "identified" is defined in Article 100. It seems that the definition is not what the submitter intended.
Panel Meeting Action: Accept
Panel Statement: The panel understands that the action on this comment will modify the text in Comment 2-52.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Abstain: 1
Explanation of Abstention:
ORLOWSKI, S.: See reason statement on Comment 2-43.

2-60 Log #31 NEC-P02 **Final Action: Accept**
(210.12(B) (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 2-116
Recommendation: The Correlating Committee directs the panel to reconsider and correlate the action on this proposal with the action taken on Proposal 1-131.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel 2 rejects Proposal 1-131.
Panel Statement: The panel accepts the Correlating Committee direction to act on Proposal 1-131. The general rule accepted by Panel 1 in Proposal 1-131 is applicable to receptacle AFCIs only whereas the wording accepted by Panel 2 in Proposal 2-116 applies to all AFCI types. Therefore, the action on Proposal 2-116 needs to remain unchanged.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Abstain: 1
Explanation of Abstention:
ORLOWSKI, S.: See reason statement on Comment 2-43.

2-61 Log #980 NEC-P02 **Final Action: Reject**
(210.12(B))

Submitter: Charles J. Palmieri, Town of Norwell
Comment on Proposal No: 2-116
Recommendation: Revise text to read as follows:
Arc-fault circuit-interrupter protection shall be provided as required in 210.12(A) and (B). The arc-fault circuit interrupter shall be installed in ~~a readily accessible location~~ accordance with 110.25.
Substantiation: I am providing suggested text for the panel to consider on this proposal if Code Panel 1 continues to accept P 1-131 70-A2013-ROP and create a new section 110.25. The recommended modification to panel action on P-2-116 should be considered. The TCC has directed the panel to coordinate its actions on P 2-3. The same consideration should be afforded to the panel action on P 2-116.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 2-60.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Abstain: 1
Explanation of Abstention:
ORLOWSKI, S.: See reason statement on Comment 2-43.

2-62 Log #429 NEC-P02 **Final Action: Reject**
(210.12(B)(2))

Submitter: Robert G. Wilkinson, IEC Texas Gulf Coast
Comment on Proposal No: 2-123
Recommendation: Accept proposal 2- 123.
Substantiation: CMP2 rejected my proposal 2-123 with the panel statement "Section 90.4 permits requiring new products that may not be available at the time the code is adopted". This provision was added to the 90.4 in the 1984 NEC and it was never intended to be applied to products that don't exist. The first electronic GFCI was developed in 1961 and the first requirement for GFCI protection in the NEC was in the 1968 edition and it was limited to protection of underwater lighting in swimming pools. Imagine what would have happened if the 1959 NEC required GFCI protection in light of the fact that the first circuit breaker type GFCI was not introduced until 1968 and the first receptacle type GFCI was not introduced until 1972. It is a disservice to the public to require a product that is not available to fulfill a requirement in the NEC. To continue to go down this path is to put the NEC in jeopardy of not being adopted. The credibility of the NEC is compromised by requiring products that do not exist. To take this matter to the ridiculous, I propose for the 2017 NEC to require a receptacle that I plan to develop that will provide AFCI, GFC I, ALCI, ELCI, IDCI, and LCDI protection. This receptacle will also be tamper resistant, weather resistant, and have the ability to change color to match the wall color. Since 90.4 permits requiring new products that may not be available at the time the Code is adopted, I'm sure my proposed magic receptacle will be accepted.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 2-56.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Abstain: 1
Explanation of Abstention:
ORLOWSKI, S.: See reason statement on Comment 2-43.

2-63 Log #1246 NEC-P02 **Final Action: Reject**
(210.12(B)(2))

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 2-123
Recommendation: I recommend the panel accept proposal 2-123.
Substantiation: CMP 2 rejected proposal 2-123 with the panel statement "Section 90.4 permits requiring new products that may not be available at the time the Code is adopted". This provision was added to 90.4 in the 1984 NEC and it was never intended to be applied to products that don't exist. The first electronic GFCI was developed in 1961 and the first requirement for GFCI protection in the NEC was in the 1968 edition and it was limited to protection of underwater lighting in swimming pools. Imagine what would have happened if the 1959 NEC required GFCI protection in light of the fact that the first circuit breaker type GFCI was not introduced until 1968 and the first receptacle type GFCI was not introduced until 1972. It is a disservice to the public to require a product that is not available to fulfill a requirement in the NEC. To continue to go down this path is to put the NEC in jeopardy of not being adopted. The credibility of the NEC is compromised by requiring products that do not exist.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 2-56.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Abstain: 1
Explanation of Abstention:
ORLOWSKI, S.: See reason statement on Comment 2-43.

2-64 Log #1547 NEC-P02 **Final Action: Reject**
(210.13 (New))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 2-125
Recommendation: Reject the proposal.
Substantiation: It is unlikely that the circuit described in the substantiation would actually have the status of a branch circuit. The secondary conductors from the transformer would be classified as a tap in Section 240.21(C) and require overcurrent protection at some point on the supply side of the transformer. If of sufficient size the GFPE rules in Section 215.10 would apply. The Code does not require a change to address this.
Panel Meeting Action: Reject

Panel Statement: The panel disagrees with the submitter in that there are applications where this can be applied and avoid confusion where the overcurrent protection is functioning as a branch circuit overcurrent device directly supplying a load.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13
Comment on Affirmative:
HILBERT, M.: The submitter is correct the conductors described in the proposal are transformer secondary conductors and by definition in Article 100 they are feeder conductors. Although the cases where the conductors would be defined as branch circuit conductors are likely to be few and far between, it is not impossible. An example would be where GFPE was not included for the distribution equipment due to a continuous industrial process and a large branch circuit was run to equipment where an orderly shutdown was not a concern.

2-65 Log #1011 NEC-P02 **Final Action: Reject**
(210.17)

Submitter: Ryan Jackson, West Valley City, UT
Comment on Proposal No: 2-128a
Recommendation: Please substantiate the change.
Substantiation: The "substantiation" proved by the panel wasn't substantiation at all. Perhaps the substantiation was supposed to be the panel statement? I don't mind this change, but those of us who teach and/or write books about the Code need to know why this change occurred. Is it based on the typical load of this type of equipment? Was there a task group involved? Thank you.
Panel Meeting Action: Reject
Panel Statement: The comment does not make a recommendation relative to specific code text as is required by section 4.3.3(c) of the NFPA Regulations Governing Committee Projects.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-66 Log #1049 NEC-P02 **Final Action: Reject**
(210.17)

Submitter: George M. Stolz, II, Quicksilver Electrical Training
Comment on Proposal No: 2-128a
Recommendation: Reject the proposal.
Substantiation: Panel 2 is once again venturing into design considerations without minding the impositions of vague and unenforceable language on both installers and inspectors trying to comply with the Code, and without evidence of a problem relating to safety or fire hazard. The panel is creating a problem where the installer may claim a receptacle is for a blender and the inspector claims it looks like an EV-charging location. This is a design consideration based on equipment that may not have even been invented yet. See the panel's more appropriate responses to proposals 2-63 and 2-64. There may be instances where the designer finds it beneficial to group an EV receptacle with other loads for other purposes. Barring a fire or a death to prohibit that, it should remain in the hands of the designer.
Panel Meeting Action: Reject
Panel Statement: The panel notes that there is no requirement to install an EV charging receptacle, but it is important that where one is installed that no other outlets be installed on that circuit. The requirement will help to ensure that EV charging can be completed safely.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-67 Log #6 NEC-P02 **Final Action: Reject**
(210.19, Informational Note 5)

Submitter: Peter Skweres, Minnesota Department of Transportation
Comment on Proposal No: 2-132
Recommendation: Add text as follows:
Informational Note 5. On dedicated lighting circuits that only employ LED luminaires the acceptable maximum voltage drop on both feeders and branch circuits shall not exceed 10 percent.
Substantiation: Voltage drop requirements for exclusive lighting circuits that employ LED luminaires are too stringent. New LED luminaires have power supplies that operate on an input voltage range from 277 - 105 V AC (nns). RehL'(ing the voltage drop requirement when LED luminaires are used will not reduce the efficiency of this type of luminaire. LED luminaires are specifically designed to operate over this very wide input voltage range. There is a linear relationship between the stated power consumed and the current required and the voltage applied.
Panel Meeting Action: Reject
Panel Statement: The proposed informational note states a requirement which is prohibited in Informational notes. The panel notes that a specific voltage drop is not required in Article 210. The existing Informational notes are not requirements of the code.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-68 Log #32 NEC-P02 **Final Action: Accept**
(210.19(A)(1))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 2-131
Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the actions taken on Proposals 2-201 and 2-202.
The Correlating Committee directs that the panel clarify whether the 125 percent is applied before or after the correction factors for consistency.
The Correlating Committee also directs that this proposal be submitted to Code-Making Panel 6 for comment.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel continues to accept the text as revised in the Report on Proposals. The text accepted by CMP-2 at the ROP stage is accurate. By splitting the requirement a condition is created where the conductor must be the larger of (a) or (b). Condition (a) requires that the conductor have an allowable ampacity of 125% of the continuous load plus the non continuous load. Condition (b) requires that the conductor have an allowable ampacity to carry the maximum load served after the conductor ampacity has had any correction or adjustment factors applied. Once the two calculations are completed, the larger of the two must be used.
There is no correlation issues with 215.2 since Exceptions 2 and 3 have been proposed for feeders only.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-69 Log #257 NEC-P02 **Final Action: Reject**
(210.19(A)(1))

Submitter: Code-Making Panel 6,
Comment on Proposal No: 2-131
Recommendation: Edit the wording of 210.19(A)(1), 2011 Code version, as follows:
(1) General. After the application of any ampacity adjustment or correction factors, branch-circuit conductors shall have an ampacity not less than the maximum combined load to be served. Within 1.22 m (4 ft) of termination equipment, the combined load of each connected conductor shall be 100 percent of the noncontinuous load plus 125 percent of the continuous load, unless the termination equipment is listed for operation at 100 percent of its rating. ~~Where a branch circuit supplies continuous loads or any combination of continuous and noncontinuous loads, the minimum branch-circuit conductor size, before the application of any adjustment or correction factors, shall have an allowable ampacity not less than the noncontinuous load plus 125 percent of the continuous load.~~
Delete the Exception and add new Informational Note:
Informational Note No. 5: Not all conductors of a circuit are necessarily connected tot he same termination equipment (circuit breaker, bus-bar lug, device, etc.). For instance, grounded conductors might not need the extra 25 percent of the continuous load added tot he combined load, where ungrounded conductors connected to a circuit breaker might.
Substantiation: The submitter is correctly concerned that the needed information to size the conductors is not clear. The part which is certain is that the ampacity must be at least the size of the load. However, the conductors within the 4 foot test length for equipment must have continuous loads considered (also noted in 2014 Proposal 2-202). If the equipment is 100% rated, then there is no adjustment needed, but if it is not 100% rated, then an additional 25% of the continuous load must be added.
Further Discussion:
The determination of conductor ampacity already includes any required adjustment or correction factors, but the added opening phrase reminding users that ampacity adjustment or correction factors may change the ampacity of a conductor might be worthwhile.
Phrasing the requirement in positive language allows the Exception to be deleted, as per Style Manual preference. The added Info Note clarifies that there might be different requirements for each end of each conductor of a circuit due the equipment it is terminated to.
The first sentence establishes the basic rule, including a reminder regarding ampacity factors. A second sentence to establish that at least four feet of each individual conductor connected to a standard non-100% rated equipment must have the possibility of an extra 25 percent continuous load considered. An information note to help clarify the concept of evaluating each conductor separately based on the equipment's listed rating. This then establishes the minimum load ampacity for the conductors. The conductor ampacity is then determined by 110.14(C) and any other applicable ampacity sections, usually those in Article 310.
The term "equipment" is a Code defined term which covers all the various types of termination methods.
We do not consider that the language inclusive of the 4 foot limitation is a new subject since it correlates to the necessary considerations for the conductor

ampacity for non-!00% rated equipment situations. Should your panel consider it new, then you could consider this alternate for the second sentence:

"The combined load of each connected conductor shall be 100 percent of the noncontinuous load plus 125 percent of the continuous load, unless the termination equipment is listed for operation at 100 percent of its rating." This wording still separates one conductor from another.

It appears to be true that the current 2011 wording of 210.19(A)(1) is a problem due to the syntax of the word "before." It appears that a #12 THHN copper could be allowed a rating of 20 for its 210.19(A)(1) based ("before the application of any adjustment or correction factors,") load ampacity, even though it might have correction factors which then limit it to an inadequate level.

Similar general logic will apply to Proposal 2-201 and 2-202 regarding feeders.

This Comment was developed before the results of the ROP were published, and therefore, could not reflect or consider any changes approved during the ROP process.

This comment was developed by a CMP-6 Task Group and balloted through the entire panel with the following ballot results:

10 Eligible to Vote

7 Affirmative (See voting comments below)

3 Negative (See voting comments below)

The following Comments on Vote were received:

AFFIRMATIVE:

S. CLINE: For the Informational Notes only, of 210.19(A)(1) [P2-131], and 215.2(A)(1) [P2-201 and P2-202], the words "a circuit breaker" might better be "an overcurrent device" for equal treatment.

P.R. PICARD: The use of a 4 foot length requires more substantiation than Mr. Hartwell's statement in ROP 2-202 that "the four-foot limit is based on prior conversations with UL personnel relative to how much conductor length is actually effective in performing that function."

NEGATIVE:

S. B. FRIEDMAN: The proposed language changes do not add clarity, and in fact adds confusion to the requirements when trying to incorporate the 4 ft. exception into existing text in proposal 2-131 and 2-201. Additionally, adding the 4 foot rule in the manner proposed for Proposal 2-202 goes beyond that indicated and substantiated in proposal and accepted by CMP-2.

NEMA should support the actions taken by CMP-2 with no further changes.

NEMA recommends an affirmative vote on panel 6 comments 6-4 and 6-5 on code proposals 8-191 and 8-192 respectively.

R.L. HUDDLESTON, Jr.: The comment as submitted by Panel 6 as written on the "Form for Comment" contains language that would leave the reader with the impression that the installation described is "typical", does not add clarity to the Code, but rather adds confusion, and is also technically unsubstantiated. The 4 ft. length of conductors came from Mr. Hartwell's proposal (2-202) and apparently was something that was based on some undocumented conversation with UL personnel.

Code requirements should never be based on hearsay, but on technical substantiation. The comments suggests that typically within 4' of terminations that are not listed for 100% rating, a cable will be sized one way, and then outside of the 4' length it will be sized another way. I contend that this will be very much the exception to the way branch circuit installations will normally take place. I, for one, would much prefer to run a longer length of copper conductor of a certain size than to splice on both ends and run a smaller size in the middle, as splices are an obvious and proven weak point in the conductive path. If it can be technically demonstrated that 4' is the proper length to use, then this wording should appear as an exception rather than the rule. Also, Mr. Hartwell proposed the 4' rule for feeders in Article 215, and this comment from Panel 6 has merged that thinking into branch circuits in Article 210, where it was never intended to be utilized.

The substantiation (further discussion) page of Comment 6-1 gives alternate text for the 2nd sentence: "The combined load of each connected conductor shall be 100 percent of the noncontinuous load plus 125 percent of the continuous load, unless the termination equipment is listed for operation at 100 percent of its rating." If this wording was used instead of that shown on the "Form for Comment", I would support it.

M. XERRI: The proposed language changes do not add clarity to the proposals. By adding the 4 ft. exception into the proposals it is actually making the statement confusing. Additionally, adding the 4 foot rule in the manner proposed for proposal 2-202 goes beyond that indicated and substantiated in proposal and accepted by CMP-2.

Panel Meeting Action: Reject

Panel Statement: The wording provided in the proposal would apply the adjustment factors on top of the 125% sizing for continuous loads which is exactly the situation that CMP-2 intends to avoid. The wording as accepted by CMP-2 more clearly states the separation of the two calculations.

The panel does not agree with integrating the language regarding 4 feet of conductor into the text as it is unclear whether it will be acceptable in all cases.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-70 Log #1477 NEC-P02 **Final Action: Accept**
(210.19(A)(1))

Submitter: Charles R. Miller, Charles R. Miller Electrical Education and Training

Comment on Proposal No: 2-131

Recommendation: Accept the following text as revised by Code-Making Panel 2:

(1) General. Branch-circuit conductors shall have an ampacity not less than the maximum load to be served. Conductors shall be sized to carry not less than the larger of (a) or (b).

(a) Where a branch circuit supplies continuous loads or any combination of continuous and noncontinuous loads, the minimum branch-circuit conductor size shall have an allowable ampacity not less than the noncontinuous load plus 125 percent of the continuous load.

(b) The minimum branch-circuit conductor size shall have an allowable ampacity not less than the maximum load to be served after the application of any adjustment or correction factors.

Substantiation: Because of the new wording, this section is now easy to understand.

Panel Meeting Action: Accept

Panel Statement: The panel notes that there are no changes to the ROP text by accepting this comment.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-71 Log #852 NEC-P02 **Final Action: Reject**
(210.19(A)(2))

Submitter: Travis Lindsey, Travis Lindsey Consulting Services

Comment on Proposal No: 2-133

Recommendation: Add new text to read as follows:

<u>Conductors for branch circuits as defined in Article 100 shall be sized to prevent a voltage drop exceeding 3 percent at the farthest outlet, and where the maximum total voltage drop on both feeders and branch circuits to the farthest outlet does not exceed 5 percent. Voltage drop for a branch circuit is to be calculated or measured by utilizing a resistive load that represents 80% of the ampacity rating of the branch circuit.</u>

<u>Informational Note: See 215.2(A)(5) for voltage drop on feeder conductors.</u>

Substantiation: The code panel has chosen not accept this proposal citing prior consensus. Prior surveys of inspectors, contractors and electricians have shown an overwhelming majority of these professionals consider excessive voltage drop to be a safety issue as well as an economic issue. Failures of fire alarm systems and smoke evacuation systems can be attributed to failure to adjust for circuit losses yet these circuits are not required to be adjusted for voltage drop. Circuit operating voltages have been responsible for many equipment losses. A number of these equipment losses have in the past caused large monetary losses especially in process systems such as factories. Cost should not be a factor when this conflicts with increasing safety.

Panel Meeting Action: Reject

Panel Statement: It is not substantiated that voltage drop is a safety issue. According to the submitter's comment, there may be special cases where voltage drop is a safety issue. The voltage drop limitation should not apply to all installations.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-72 Log #974 NEC-P02 **Final Action: Reject**
(210.19(A)(2) (New))

Submitter: David Brender, Copper Development Assn. Inc.

Comment on Proposal No: 2-133

Recommendation: Add text to read as follows:

<u>(2) Voltage Drop. Conductors for branch circuits as defined in Article 100, shall be sized to prevent a voltage drop exceeding 3 percent at the farthest outlet, and where the maximum total voltage drop on both feeders and branch circuits to the farthest outlet does not exceed 5 percent. Voltage drop for a branch circuit is to be calculated or measured by utilizing a resistive load that represents 80% of the ampacity rating of the branch circuit.</u>

<u>Informational Note: See 215.2(A)(5) for voltage drop on feeder conductors.</u>

Substantiation: Voltage drop on critical circuits (such as fire stairwell pressurization) has been identified as a safety concern, not just a convenience concern, or "reasonable efficiency of operation" concern 210.19(A) Informational Note 4 is not enforceable, and the above change would move the voltage drop requirement to enforceable language.

Panel Meeting Action: Reject

Panel Statement: See panel statement on Comment 2-71.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-73 Log #1548 NEC-P02 **Final Action: Reject**
(210.21(B)(1))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 2-121
Recommendation: Accept the proposal in principle. Reformat the recommended text as a separate numbered paragraph as follows:
(5) Receptacles on Individual Branch Circuits. A receptacle outlet installed to comply with a requirement for an individual branch circuit shall contain a single receptacle, or a multiple receptacle if, and then only to the extent that, the supplied equipment includes multiple supply cord connections.
Substantiation: CMP 2 objected to this proposal on the grounds that it was placed in a paragraph now reserved to the rating of the receptacle. Fair enough. This comment addresses that problem. The substantiation regarding field controversies and the IAEI Section Meeting discussions remain valid.
Panel Meeting Action: Reject
Panel Statement: The panel continues to maintain its position that a circuit can be limited to a single piece of utilization equipment through means other than a single receptacle such as the restricted location of the receptacle.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Negative: 1
Explanation of Negative:
HILBERT, M.: The panel agreed that more than one receptacle is permitted where a single piece of utilization equipment had multiple supply cords. This comment could have been accepted in principle and revised to clarify that more than one receptacle is permitted in certain applications. The additional clarity would benefit readers of the NEC.
The proposed text could have modified to read:
(5) Receptacles on Individual Branch Circuits. A receptacle outlet installed to comply with a requirement for an individual branch circuit shall be permitted to contain a single receptacle or multiple receptacles when the supplied equipment includes multiple supply cord connections.

2-74 Log #243 NEC-P02 **Final Action: Reject**
(210.23)

Submitter: Jim Lally, Detailed Inspection Service, Inc.
Comment on Proposal No: N/A
Recommendation: Add new text to read as follows:
New 210.23(E) In other than dwellings there should be no more than a maximum of (13) duplex receptacles installed on a 20 amp. branch circuit.
Substantiation: This would compliment and clarify the reasoning in 220.14(l) and 220.14(L).
180va X 13= 2340va so since 120volts X 20 amps = 2400va
This would be the maximum allowed on a 20 amp. branch circuit.
Panel Meeting Action: Reject
Panel Statement: Section 210.23 refers to branch circuit permissible loads and not he number of receptacles on a circuit. This requirement is contained in existing 220.14(I).
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-75 Log #1549 NEC-P02 **Final Action: Reject**
(210.52(A))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 2-148
Recommendation: Accept the proposal.
Substantiation: The panel statement is not responsive. What the panel intends should never have been intended. Kitchen counter receptacles are not now, never have been, and can never be reserved for appliance use. In a space adjacent to a counter, the NEC now allows a receptacle 5½ ft above the floor to count as a perimeter receptacle in that space; it is frankly absurd to disallow a receptacle at the end of the counter some 4 ft above the floor to count for the same purpose. It is absurd to begin requiring 210.52(A) receptacle placements in stove and refrigerator cutouts because the adjacent countertop receptacles no longer count. And it greatly diminishes safety to reduce, in some cases to the vanishing point, receptacles in other rooms designed with built-in cabinetry. It also diminishes safety to, however inadvertently, effectively allow peninsular countertops of indefinite length with only a single receptacle outlet placement. The proposal that started us down this road to unintended consequences was never adequately substantiated. CMP 2 should revisit the exhaustive substantiation provided with the proposal, which need not be repeated here, and step on this before it gets any worse.
Panel Meeting Action: Reject
Panel Statement: The panel disagrees with the submitter and reiterates that it is intended that countertop receptacles serve the countertop and not adjacent wall space.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13
Comment on Affirmative:
HILBERT, M.: I agree with the submitter the kitchen counter receptacles can never be reserved completely for the countertop. I have often used the kitchen counter receptacles when vacuuming the kitchen area. On the other hand, limiting the intended coverage of countertop receptacles to only the countertop areas does have merit when you think of all that actually does get plugged in on the countertop these days.
If there is no requirement for a receptacle to be in the 36 inch wall space between the end of the kitchen countertop and the entrance to the room because of a receptacle located over the countertop, it is more likely the cord from the floor lamp or the desk lamp will be using one of the countertop receptacles.
I have not run into this situation in the past but, as an enforcer, I would not want to have to approve an installation that had a 30 inch wide countertop between the floor model gas range and the refrigerator with only one duplex receptacle that qualified for the countertop and the wall spaces for the refrigerator and the floor model gas range (the economy package).

2-76 Log #560 NEC-P02 **Final Action: Reject**
(210.52(A)(1))

Note: When the ballot result does not confirm the TC action on a Proposal by a two-thirds affirmative vote, the Report on Proposals shall be published with a specific request for public comment on that Proposal. The Proposal is now being reconsidered by the TC as a public comment.
Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 2-149
Recommendation: Revise text to read as follows:
210.52(A)(1)
(1) Spacing. Receptacles shall be installed such that no point measured horizontally along the floor line in any wall space is more than ~~1.8 m (6 ft)~~ 1.2m (4 ft) from a receptacle outlet.
Substantiation: Current Requirement: In previous editions of the NEC Handbook (e.g. 1981) it has been stated, "Receptacles are to be located so that no point in any wall space is more than 6 ft from a receptacle. This rule intends that an appliance or lamp with a flexible cord attached may be placed anywhere in the room and be within 6 ft of a receptacle, thus eliminating the need for extension cords."
Problem: Since **most cord connected equipment will have cords that are less than 6 ft long**, based on the UL standards requirements for these products, it is unlikely that the receptacle spacing requirement now in the NEC will allow the cord on any single product to reach a receptacle from any point on the wall without the use of an extension cord, even if the cord attached product is sitting at the same height as the receptacle. **Should the cord connected equipment (a Lamp for instance) be elevated beyond the height of the receptacle, even a cord length of 6 ft would no longer accommodate the need**. Generally, receptacles are mounted at approximately 18" above floor height. The average height of a bedside table is approximately 28". By triangulating the cord requirement based on the difference in heights and the distance travel, the lamp cord would now have to be greater than 6 ft **,** if the cord remains flush to the wall. If the cord is angled away from the wall by 8 inches, e.g., a lamp on a table, a cord of more than 6 ft in length would be stretched taught to reach the receptacle. Often location of furniture precludes the relocation of the appliance closer to the outlet.
Need for More Receptacles: Additionally, this requirement did not anticipate the **extraordinary increase in the availability and use of cord connected equipment** in the home, ie, Televisions, DVD Players, Stereo Systems, Lamps, Cordless Phones, Cell Phone Chargers, Video Gaming Systems, Computers, Printers, Fax Machines, Cameras, Cell Phone Chargers, I-Pods, I-Pads, Electronic Readers (Kindle, Nook), Electric Toys, Chargers for Battery Powered Tools, etc. All of which are generally available in multiples throughout the average home, and few of which were available when this code was originally developed. Due to this ever expanding list of cord connected products that may be used in any room of a home, all available receptacles within reach of a cord can easily be in use. This results in increased usage of extension cords to reach available receptacles, remotely located in other areas of the household. The increased use of cord connected equipment results in the same condition that the 6 ft spacing rule was intended to prevent, and it is evident that **the number of receptacles required 50 years ago is no longer adequate for today's home**. Reducing the required spacing will have the effect of making more receptacles available for the increased number of cord connected products now in the home.
Should the spacing requirement between receptacles not be reduced to accommodate the aforementioned increase in demand, improper use of **extension cords ~~use~~ will continue to proliferate ~~and the~~ with hazardous results ~~of their use will multiply~~**. Electrical cord fires are one of the **leading causes of the total number of residential fires in the United States**. The U.S. Consumer Product Safety Commission (CPSC) estimates that 3300 residential fires originate in extension cords each year, killing 50 persons.
Additionally, recent CPSC statistics (CPSC Document # 16 - http://www.cpsc.gov/cpscpub/pubs/16.html) also indicate that there are over 4,000 injuries associated with electrical extension cords that result in treatment in hospital emergency rooms annually. Half of these injuries involve fractures, lacerations, contusions or strains from people tripping over extension cords. Thirteen percent of the injuries involve children under the age of 5.
Increasing the number of available receptacles will reduced the improper use of extension cords that lead to the incidents described in the CPSC reports. When more receptacles are available, the improper use of extension cords installed

under carpets and rugs, run though doorways and in walkways will be reduced.
Summary: As the number of cord connected household electrical / electronic products continues to grow, the lack of a sufficient number of available receptacle outlets leads the homeowner to the use of extension cords. The NEC has long recognized the hazards presented by the use of extension cords, ~~especially~~ where they are used in place of permanent wiring. Reducing the spacing between receptacles as recommended in this proposal will help to ensure that there are an adequate number of receptacles available for connection of the growing number of cord connected appliances being used in the typical dwelling. Since 1956, the receptacle spacing requirements in 210.52 (A) (1), and the resulting number of receptacles installed has remained unchanged.
Panel Meeting Action: Reject
Panel Statement: The panel reiterates its previous panel statement that a dramatic move from twelve foot wall spacing to eight foot wall spacing has not been substantiated.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 9 Negative: 4
Explanation of Negative:
KING, D.: The UL product standards list many cord connected pieces of equipment with shorter than 6' cords Therefore the 6' receptacle spacing is inadequate and leads to the use of extension cords.
The CPSC statistics indicate over 4,000 injuries and 3300 fires resulting in 50 fatalities each year are associated with the use of extension cords. Changing the spacing to the suggested 4' will significantly reduce the numbers of these incidents.
LAROCCA, R.: The current receptacle spacing requirements have not been changed since the 1950s. In that time the number of electrical utilization appliances proliferated, without an increase in the receptacles available to power them. The length of the power supply cords of these products has also been reduced to less than 6 feet. This has led to the use of relocatable power taps and extension cords to serve these products. Relocatable power taps may be hidden under or behind furniture leading to damage and overheating. Extension cords may be run under carpets and rugs and may be damaged creating a potential fire or shock hazard, or create a tripping hazard if left exposed. Requiring additional wall receptacles would help prevent these potentially hazardous conditions.
PAULEY, J.: NEMA supports the revision to the receptacle spacing in residential locations. It has been decades since this rule has been written and it is currently out of date with the significant numbers of electronic equipment that are in use in dwellings. The revision would better address this increased need to access a receptacle for plug-in devices.
WOOD, T.: This revision should be accepted. The submitters substantiation is valid.

2-77 Log #805 NEC-P02 **Final Action: Reject**
(210.52(A)(1))

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 2-149
Recommendation: Proposal 2-149 should be accepted.
Substantiation: The panel did not have the required 2/3 votes to reject this proposal during the ROP. In addition, the Panel Statement for rejection did not address the NEMA substantiation supplied with the proposal.
Panel Meeting Action: Reject
Panel Statement: See panel statement on Comment 2-76.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 10 Negative: 3
Explanation of Negative:
KING, D.: See my explanation of negative on comment 2-76.
LAROCCA, R.: See my statement of negative on 2-76.
WOOD, T.: See my comment on Comment 2-76.

2-78 Log #1550 NEC-P02 **Final Action: Accept**
(210.52(A)(1))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 2-149
Recommendation: Continue to reject the proposal.
Substantiation: The most disturbing thing about the panel action on this proposal is that it actually received more than one or two affirmative votes. The proposal is extremely disturbing in that it would overturn NEC provisions that have served us well for many decades in order to ratify multiple product standards that somehow allow listed cord- and plug-connected appliances in 210.52(A) (residential) environments to be equipped with cords that are too short. This submitter has now decided to submit a proposal (public input? – new procedures) to CMP 17 (Article 422) in the 2017 cycle to require a minimum cord length of 6 ft for such equipment. If the NEC Committee doesn't get a handle on this soon, the tail will surely wag the dog. Where will this trend end? If the rule drops to four feet, will we see appliance cords drop to 4 feet? Perhaps one meter? An important reason NEMA and UL have representatives on all code making panels is supposed to be to assure that the equipment they manufacture and list will perform properly in locations governed by NEC provisions. It was never supposed to be the case that the installation code would instead do the reverse, and bow to the product standard.
CMP 2 members might be interested to know that they are not the only panel subjected to this sort of proposal. CMP 9 just overwhelmingly rejected a proposal (9-97, vote 10-2) to unravel settled NEC provisions in 402.8(C) going back two cycles because the NEC is inconsistent with the product standard. And so it is; it was put in the NEC expressly to compel a change in the product standard because of field installation issues. Now it seems that in order to avoid a file review the manufacturers involved are attempting to undo the prior change. Enough is enough. Proposals such as these must be resoundingly rejected. At best, the proposal substantiation provides some arguments for making changes in product standards that increase the length of cords supplied with appliances, floor lamps, etc. This electrician, when installing new cords on such equipment, always makes them even a little longer than 6 ft for the same reasons.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 11 Negative: 2
Explanation of Negative:
KING, D.: See my explanation of negative on comment 2-76.
LAROCCA, R.: See my statement of negative on 2-76.

2-79 Log #408 NEC-P02 **Final Action: Accept in Principle**
(210.52(A)(3))

Submitter: Russel LeBlanc, The Peterson School of Engineering
Comment on Proposal No: 2-154
Recommendation: This proposal should have been accepted.
Substantiation: The panel's statement is incorrect. The present "literal" wording does not address a receptacle outlet mounted ON the floor. While the INTENT of the present wording may be to include it, the LITERAL wording does not. There is a difference between an outlet box installed IN a floor and one installed ON a floor. The proposed wording makes it clear that either location is acceptable. If this difference is not clear then let us use this funny analogy. The next time you need to use the toilet, will you be sitting ON the bowl or IN the bowl? You'll probably notice that there is quite a difference!
Panel Meeting Action: Accept in Principle
Revise text to read as follows: "Receptacle outlets in or on floors shall not be counted...".
Panel Statement: The panel has accepted the text but without parenthesis being used.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-90 Log #772 NEC-P02 **Final Action: Reject**
(210.52(C)(2))

Submitter: Eric Bunce, Rmh Group Inc.
Comment on Proposal No: 2-161
Recommendation: Revise text to read as follows:
Island Counter Spaces. At least one receptacle shall be installed at each island countertop space with a long dimension of 600 mm (24 in.) or greater and a short dimension of 300 mm (12 in.) or greater. <u>Island counter tops that exceed 1200 mm (48 in.) in length shall have one additional receptacle outlet installed for each 1200 mm (48 in.) of counter top or fraction thereof.</u> ~~Additional receptacle outlets required by this section shall be equally spaced along the length of the counter top measured in the long dimension.~~
Substantiation: The submitter of this idea has presented a valid solution for a real problem in the NEC. Insufficient receptacles on counter top islands result in the dangerous use of extension cords. This problem would be avoided if the panel would accept the proposed solution with the exception of removing the restrictive requirement for equally spacing receptacles. The code making panel's response that "...it is likely that additional receptacles a installed by the installer for the convenience of the owner." is very presumptive by the code making panel. Everyone's naturally inclined to do as little work as possible and home builders and owners do not want to incur additional costs if they can avoid it. I recommend that the code making panel add the proposed text above which mirrors the intent of article 210.62 for showroom windows and gives the installer a clear direction instead of assuming good will or common sense will prevail. Alternatively 210.62 could be modified to require one receptacle to mirror 210.52(C)(2) and we could depend on the contractor to just do the right thing.
Panel Meeting Action: Reject
Panel Statement: The configurations of various islands can make it impossible to install receptacles using the submitter's recommendation. The panel notes that this was similar to the rule that existed a number of code cycles ago and after much consideration of proposals and comments, the panel arrived at the consensus that a single receptacle to cover the designated island space is sufficient.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-80 Log #33 NEC-P02 **Final Action: Accept**
(210.52(E))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 2-169
Recommendation: The Correlating Committee understands that the first sentence of 210.52(E) is revised by the panel action taken on Proposal 2-168.
The Correlating Committee directs that the panel clarify the action on this proposal with respect to the text that was accepted in the panel action on Proposal 2-176.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise 210.52(E)(3) to read as follows: (3) Balconies, Decks and Porches. Balconies, decks and porches that are attached to the dwelling unit and are accessible from inside the dwelling unit shall have at least one receptacle outlet accessible from the balcony, deck or porch. The receptacle outlet shall not be located more than 2.0 m (6 1/2 ft) above the balcony, deck, or porch walking surface.
Panel Statement: This action clarifies that the panel intended to combine the language from Proposals 2-169 and 2-176 to read as now shown.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-81 Log #34 NEC-P02 **Final Action: Accept**
(210.52(E)(3))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 2-176
Recommendation: The Correlating Committee directs that the panel correlate the action on Proposal 2-169 with this proposal.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: See panel action on Comment 2-80, which addresses the concern of the Correlating Committee.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-82 Log #1480 NEC-P02 **Final Action: Accept in Principle in Part**
(210.52(G))

TCC Action: The Correlating Committee understands that the Panel Statement to Comment 2-67 was intended to state: "The proposed informational note states a requirement which is not permitted in Informational notes."
Submitter: Donald R. Offerdahl, Bismarck, ND
Comment on Proposal No: 2-179
Recommendation: Revise text to read as follows:
(G) Basements, Garages, and Accessory Buildings. For a one-family dwelling, the following provisions shall apply:
(1) At least one receptacle outlet, in addition to those for specific equipment, shall be installed in each basement.
(2) At least one receptacle outlet shall be installed for each car space in each attached garage and in each detached garage.
(3) At least one receptacle outlet shall be installed in each accessory building with electric power.
Substantiation: The panel statement states "The submitter has not substantiated requiring that the number of receptacles." The substantiation that the panel wants has been witnessed by myself and if the panel asks any electrical inspectors if there is a misuse of extension cords when inspecting the residential homes, the panel will have the substantiation they are asking for by the information obtained from electrical inspectors throughout the United States.
Panel Meeting Action: Accept in Principle in Part
Revise 210.52(G)(1) as revised in Proposal 2-178a of the ROP as follows:
(1) Garages. In each attached garage and in each detached garage with electric power. The branch circuit supplying this receptacle(s) shall not supply outlets outside of the garage. <u>At least one receptacle outlet shall be installed for each car space.</u>
Panel Statement: The panel revises (G)(1) only which affects garages and maintains the ROP requirements for basements and accessory buildings. The panel rejects the remainder of the proposal. The submitter's substantiation dealt only with receptacles for garages and did not substantiate the changes proposed for basements or accessory buildings.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 11 Negative: 2
Explanation of Negative:
ORLOWSKI, S.: NAHB urges the members of the code making panel to reject this proposal. As NAHB stated at the meeting, no hazard was identified to justify the requirement of an electrical outlet being required for each car space. The submitter has failed, again, to justify the need for an additional outlet based on the number of car spaces in the garage and how adding a receptacle for each car space will reduce the unknown hazard that the submitter alluded too. In addition, as long as homeowners have the ability to purchase extensions cords, they will continue to be used and possibly misused. Misuse of extensions cords can only be addressed through the proper education of the use by the end user.
WILKINSON, R.: Two duplex receptacles could furnish this requirement for a four car garage and you would still not solve the problem. The NEC is not a design manual.
Comment on Affirmative:
HILBERT, M.: Continue to accept the comment. Expanding the number of receptacles in garages will go a long way with reducing the use of extension cords in general while supporting the move to EVs. However, in looking at the action it may have been better to use the term "vehicle space" as opposed to "car space." This question is bound to surface so the term "car space" is intended to include other types of vehicles such as a pickup truck.

2-83 Log #806 NEC-P02 **Final Action: Accept in Principle**
(210.52(G)(1))

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 2-181
Recommendation: Proposal 2-181 should be accepted.
Substantiation: Builders do not always locate the receptacle in a "convenient" location in the garage. Many larger garages have extra bays for lawn equipment and other supplies. These extra bays are in placed because detached barns are not always allowed in all housing developments. In addition, it is not always "convenient" to move a car with a dead battery to receptacle so that a battery charger can be connected. Garage floors can have standing water on the floor from rain and melted snow. This could become a safety hazard when extension cords used.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action on Comment 2-82. The revision in Comment 2-82 will require a receptacle for each garage space, which addresses the submitter's concern.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 11 Negative: 2
Explanation of Negative:
ORLOWSKI, S.: See reason statement on Comment 2-82.
WILKINSON, R.: See my Explanation of Negative Vote on Comment 2-82.

2-84 Log #1000 NEC-P02 **Final Action: Accept**
(210.52(G)(1))

Submitter: David Clements, International Association of Electrical Inspectors
Comment on Proposal No: 2-180
Recommendation: Reject the proposal and restore to the 2011 NEC language.
(G) ~~Outlets in~~ Basements, Garages, and Accessory Buildings. For a one-family dwelling, the following provisions shall apply:
(1) At least one receptacle outlet, in addition to those for specific equipment, shall be installed in each basement, in each attached garage, and in each detached garage or accessory building with electric power. ~~For receptacles outlets inside of attached and detached garages, branch circuits(s) supplying receptacle outlets not installed for specific equipment shall have no other outlets.~~
Substantiation: The correct substantiation to reject proposal 2-180 should be NEC **90.1 Purpose. (B) Adequacy.** "but not necessarily efficient, convenient, or adequate for good service or **future expansion** of electrical use." This proposal is in conflict with NEC 90.1(B).
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 11 Negative: 2
Explanation of Negative:
KING, D.: The Panel should continue to support the original Proposal. The increased usage of these circuits warrants them being confined to the garage.
PAULEY, J.: NEMA disagrees with the panel action on this comment. With the advent of plug-in electric vehicles, the change to limit the garage outlets to their own circuit is a very simple way to
accommodate a Level 1 EV charger within the basic electrical infrastructure. The panel action at the ROP stage to limit the branch circuit to the garage was a positive change and
should be maintained.

2-85 Log #1050 NEC-P02 **Final Action: Reject**
(210.64)

Submitter: George M. Stolz, II, Quicksilver Electrical Training
Comment on Proposal No: 2-191
Recommendation: Reject the proposal.
Substantiation: Considering that possibly 1% of all services installed on the planet have data recording equipment attached to them once in their lives for a temporary period of time, this proposal is woefully under-substantiated. There are cord-set GFCI protection devices to protect against half of the submitter's concern. Many services can even be temporarily modified to service a 120V

receptacle for the task at hand as well.
Panel Meeting Action: Reject
Panel Statement: The panel maintains its position from the proposal stage that the requirement for a receptacles in the vicinity of the service equipment has been substantiated and will enhance safety.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-86 Log #1247 NEC-P02 **Final Action: Accept**
(210.64)

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 2-191
Recommendation: I recommend the panel continue to accept in Principal proposal 2-191 as stated in the panel's statement below.
"210.64 Electrical Service Areas. At least one 125 volt single phase 15 or 20 ampere rated receptacle outlet shall be installed within 15 m (50 ft) of the electrical service equipment.
Exception: The receptacle outlet shall not be required to be installed in one and two family dwellings.
Substantiation: Test equipment is frequently needed for monitoring and servicing electrical equipment in service areas. If a receptacle is not available near the service equipment, an extension cord is often used. The extension cord often must travel down hallways and across rooms. The extension cord will present a slip, trip, or fall hazard.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-11 Log #511 NEC-P02 **Final Action: Reject**
(210.70(C))

Submitter: Russel LeBlanc, The Peterson School of Engineering
Comment on Proposal No: 2-198
Recommendation: This proposal should have been accepted.
Substantiation: Presently illumination is not required for equipment in a dark utility room. That is simply not safe. The proposal will make it safer to service equipment needing servicing. While I agree with the panel statement "The determination of whether a space in buildings or structures other than a dwelling unit is used for a utility room or basement must be decided by the AHJ on a case-by-case basis", that statement does not explain why the panel feels the equipment in those spaces does not need illumination. Yes the AHJ needs to make the decision on what name to call the space (e.g. utility room or basement etc.), but no matter what name you give the space, the hazards at the equipment remain the same if there is no illumination provided. Dark is dark not matter whether it is in an attic, underfloor space, utility room or basement of a dwelling or a non-dwelling. Lighting is needed in all of these locations, regardless of what the name of the space is if there is equipment that needs servicing.
Panel Meeting Action: Reject
Panel Statement: The panel reiterates its previous panel statement that the determination of whether a space in buildings or structures other than a dwelling unit is used as a utility room or basement must be decided by the AHJ on a case-by-case basis.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Negative: 1
Explanation of Negative:
KING, D.: This Comment should be accepted. I agree with the submitter's substantiation. The added safety benefit afforded by adequate illumination in all areas where equipment is located that may require servicing should be given further consideration by the Panel.

2-87 Log #352 NEC-P02 **Final Action: Reject**
(210.71 (New))

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 2-198a
Recommendation: Add text to read as follows:
<u>210.71 Meeting Rooms.</u>
<u>In other than dwelling units, portions of buildings or structures of up to 70 m2 (760 ft2) that are designed or intended for the gathering of seated occupants for such purposes as conferences, deliberations, or similar purposes, where electronic equipment such as computers, projectors, or similar equipment is likely to be used, shall have 125-volt, 15- and 20-ampere receptacle outlets installed as specified in 210.71(A) and (B).</u>
<u>(A) Receptacles in Walls. In meeting rooms having a floor area of 70 m2 (760 ft2) or less, receptacles shall be installed such that no point measured horizontally along the floor line of any fixed wall is more than 1.2m (4 ft) from a receptacle.</u>
<u>(B) Floor Receptacles. A meeting room that is at least 3.6 m (12 ft) wide and has a floor area of at least 21 m2 (225 ft2) and not more than 70 m2 (760 ft2) shall have at least one duplex receptacle located in the floor at a distance not less than 1.8 m (6 ft) from any fixed wall.</u>
<u>Informational Note 1: See Section 314.27 for floor boxes used for receptacles located in the floor.</u>
<u>Informational note 2: See Article 518 for Assembly Occupancies designed for 100 or more persons.</u>
Substantiation: NEMA respectfully requests the code panel reconsider its action on the subject proposal.
The panel considers the installation of receptacles in meeting rooms to be a design consideration. It is readily apparent by observation of the receptacle installation in meetings rooms that the current design practice for providing receptacles in these rooms results in a shortage of available receptacles. A typical meeting room is significantly underserved by the limited number of receptacles available for cord and plug connected products. This leads to the conditions described in the proposal substantiation of daisy chained temporary power strips and the potentially hazardous use of extension cords.
The panel statement that the proposal would require receptacle outlets in moveable walls is incorrect. The proposal requires wall receptacle outlets only in fixed walls.
The panel also expressed concern with the varying configurations of meeting rooms. The proposal clearly defines the function and dimensions of the meeting rooms that will be affected. The size of the meeting room described in the proposal is very unlikely to be of a configuration that would make compliance with the requirement difficult. Meetings rooms of this size are typically rectangular in shape.
Panel Meeting Action: Reject
Panel Statement: The panel reiterates its previous panel statement that there are too many variations in meeting room configurations to create a specific rule. Requiring a receptacle for each 760 sq ft of meeting room space will not necessarily eliminate or shorten any extension cords depending on the configuration.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 10 Negative: 3
Explanation of Negative:
KING, D.: The Comment should be accepted. I agree with the submitter that there is a shortage of available receptacles to serve areas for which these rooms are designed for. The excessive use of extension cords across traffic areas to provide power to the center floor space has been noted over several code cycles. The Panel should reconsider this comment.
LAROCCA, R.: In meeting rooms such as found in office buildings, hotels, and motels it has become common practice to run multiple extension cords from the limited receptacle outlets in the perimeter of the room to the center of the room to accommodate the wide spread use of projectors, PCs, and other information technology equipment. Cords used in such a manner are often run under carpets and rugs or are taped to the floor. The cords used in this way may run hotter due to restricted air flow, may be damaged creating a potential fire or shock hazard, or may result in a tripping hazard if left exposed and loose. Requiring additional wall receptacles and a listed floor box and receptacle in these rooms would help prevent these potentially hazardous conditions.
PAULEY, J.: NEMA continues to support the need for additional outlets in meeting rooms. At every business meeting in these rooms, the evidence of additional outlets is shown through the extensive use of extension cords and the misuse of relocatable power taps.

2-88 Log #807 NEC-P02 **Final Action: Reject**
(210.71 (New))

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 2-198a
Recommendation: Proposal 2-198a should be accepted.
Substantiation: There is not an adequate number of receptacles in meeting rooms for powering computers, projectors and other devices. The proposal defines and identifies requirements for the meeting room.
Panel Meeting Action: Reject
Panel Statement: See panel statement on Comment 2-87.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 11 Negative: 2
Explanation of Negative:
KING, D.: See my explanation of negative on comment 2-87.
LAROCCA, R.: See my statement of negative on 2-87.

ARTICLE 215 — FEEDERS

2-91 Log #258 NEC-P02 **Final Action: Reject**
(215.2(A)(1))

Submitter: Code-Making Panel 6,
Comment on Proposal No: 2-201
Recommendation: The wording proposed in the action needs to be changed. Edit the wording of 210.19(A)(1), 2011 Code version, as follows:
(1) General. <u>After the application of any ampacity adjustment or correction</u>

factors, feeder conductors shall have an ampacity not less than required to supply the combined load as calculated in Parts III, IV, and V of Article 220. Within 1.22 m (4 ft) of termination equipment, the combined load of each connected conductor shall be 100 percent of the noncontinuous load plus 125 percent of the continuous load, unless the termination equipment is listed for operation at 100 percent of its rating. ~~The minimum feeder-circuit conductor size, before the application of any adjustment or correction factors, shall have an allowable ampacity not less than the noncontinuous load plus 125 percent of the continuous load.~~

(Delete Exceptions #1 and #2, add new Info note.)

Informational Note: Not all conductors of a circuit are necessarily connected to the same termination equipment (circuit breaker, bus-bar lug, device, etc). For instance, grounded conductors might not need the extra 25 percent of the continuous load added to the combined load, where ungrounded conductors connected to a circuit breaker might.

215.2(A)(1) 2014 NEC Proposal 2-201

Further discussion:

The determination of conductor ampacity already includes any required adjustment or correction factors, but the added opening phrase reminding users that ampacity adjustment or correction factors may change the ampacity of a conductor might be worthwhile.

The two exceptions are deleted. The sub-section would then read:

(1) General. After the application of any ampacity adjustment or correction factors, feeder conductors shall have an ampacity not less than required to supply the combined load as calculated in Parts III, IV, and V of Article 220. Within 1.22 m (4 ft) of termination equipment, the combined load of each connected conductor shall be 100 percent of the noncontinuous load plus 125 percent of the continuous load, unless the termination equipment is listed for operation at 100 percent of its rating.

Informational Note: Not all conductors of a circuit are necessarily connected to the same termination equipment (circuit breaker, bus-bar lug, device, etc). For instance, grounded conductors might not need the extra 25 percent of the continuous load added to the combined load, where ungrounded conductors connected to a circuit breaker might.

Phrasing the requirements in positive language allows the Exceptions to be deleted, as per Style Manual preference. The added Info Note clarifies that there might be different requirements for the different conductors of a circuit due to the equipment they are terminated to.

The first sentence establishes the basic rule, including a reminder regarding ampacity factors. A second sentence to establish that at least four feet of each individual conductor connected to a standard non-100% rated equipment must have the possibility of an extra 25 percent continuous load considered. An information note to help clarify the concept of evaluating each conductor separately based on the equipment's listed rating. This then establishes the minimum load ampacity for the conductors. The conductor ampacity is then determined by 110.14(C) and any other applicable ampacity sections, usually those in Article 310.

The term "equipment" is a Code defined term which covers all the various types of termination methods.

It appears to be true that the current 2011 wording of 215.2(A)(1) is a problem. It appears that a #3/0 THHN copper could be allowed a rating of 225 for its 215.2(A)(1) based ("before the application of any adjustment or correction factors,") load ampacity, even though it might have correction factors which then limit it to an inadequate level.

As an example, if the load consists of 100 amps of non-continuous, and 70 amps of continuous load, the "before the application" of any adjustment or correction factors allowable ampacity must be 187.5. By 215.2(A)(1), a typical #3/0 THHN copper is satisfactory. However, if that #3/0 is required by conditions of installation to be derated by 50% (for any of a variety of reasons), its Section 310 ampacity is only 113. The suggested wording of this comment would simply require the circuit conductors to have an installed minimum ampacity of 187.5.

The addition of the words " Within 1.22 m (4 ft) of equipment,... " addresses the concerns of Mr. Hartwell's Proposal 2-202.

The suggested wording is identical to the Comment for Proposal 202.

This Comment was developed before the results of the ROP were published, and therefore could not reflect or consider any changes approved during the ROP process.

Substantiation: The submitter is correctly concerned that the needed information to size the conductors is not clear. The fact that any required adjustment or correction factors for the conductor ampacity must result in a conductor ampacity at least as large as the load is not clear. However, the conductors within the 4 foot conductor test length for equipment must have continuous loads considered. If the equipment is 100% rated, then there is no load adjustment needed, but if it is not 100% rated, then an additional 25% of the continuous load must be added. Please see further discussion on page 2.

This comment was developed by a CMP-6 Task Group and balloted through the entire panel with the following ballot results:

10 Eligible to Vote

7 Affirmative (See voting comments below)

3 Negative (See voting comments below)

The following Comments on Vote were received:

AFFIRMATIVE:

S. CLINE: For the Informational Notes only, of 210.19(A)(1) [P2-131], and 215.2(A)(1) [P2-201 and P2-202], the words "a circuit breaker" might better be "an overcurrent device" for equal treatment.

P.R. PICARD: The use of a 4 foot length requires more substantiation than Mr. Hartwell's statement in ROP 2-202 that "the four-foot limit is based on prior conversations with UL personnel relative to how much conductor length is actually effective in performing that function."

NEGATIVE:

S. B. FRIEDMAN: The proposed language changes do not add clarity, and in fact adds confusion to the requirements when trying to incorporate the 4 ft. exception into existing text in proposal 2-131 and 2-201. Additionally, adding the 4 foot rule in the manner proposed for Proposal 2-202 goes beyond that indicated and substantiated in proposal and accepted by CMP-2.

NEMA should support the actions taken by CMP-2 with no further changes.

NEMA recommends an affirmative vote on panel 6 comments 6-4 and 6-5 on code proposals 8-191 and 8-192 respectively.

R.L. HUDDLESTON, Jr.: The comment as submitted by Panel 6 as written on the "Form for comment" contains language that would leave the reader with the impression that the installation described is "typical", does not add clarity to the Code but rather adds confusion, and is also technically unsubstantiated. The 4 ft. length of conductors came from Mr. Hartwell's proposal (2-202) and apparently was something that was based on some undocumented conversation with UL personnel. Code requirements should never be based on hearsay, but on technical substantiation. The Comment suggests that typically within 4' of terminations that are not listed for 100% rating, a cable will be sized one way, and then outside of the 4' length it will be sized another way. I contend that this will be very much the exception to the way feeder installations will normally take place. I, for one, would much prefer to run a longer length of copper conductor of a certain size than to splice on both ends and run a smaller size in the middle, as splices are an obvious and proven weak point in the conductive path. If it can be technically demonstrated that 4' is the proper length to use, then this wording should appear as an exception rather than the rule.

M. XERRI: The proposed language changes do not add clarity to the proposals. By adding the 4 ft. exception into the proposals it is actually making the statement confusing. Additionally, adding the 4 foot rule in the manner proposed for proposal 2-202 goes beyond that indicated and substantiated in proposal and accepted by CMP-2.

Panel Meeting Action: Reject

Panel Statement: The wording provided in the proposal would apply the adjustment factors on top of the 125% sizing for continuous loads which is exactly the situation that CMP-2 intends to avoid. The wording as accepted by CMP-2 more clearly states the separation of the two calculations.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-92 Log #259 NEC-P02 **Final Action: Reject**
(215.2(A)(1))

Submitter: Code-Making Panel 6,

Comment on Proposal No: 2-202

Recommendation: The effective action on proposal 2-202 needs to be: Accept in Principle in Part. The wording proposed in the action needs to be changed. Edit the wording of 210.19(A)(1), 2011 Code version, as follows:

(1) General. After the application of any ampacity adjustment or correction factors, feeder conductors shall have an ampacity not less than required to supply the combined load as calculated in Parts III, IV, and V of Article 220. Within 1.22 m (4 ft) of termination equipment, the combined load of each connected conductor shall be 100 percent of the noncontinuous load plus 125 percent of the continuous load, unless the termination equipment is listed for operation at 100 percent of its rating. ~~The minimum feeder-circuit conductor size, before the application of any adjustment or correction factors, shall have an allowable ampacity not less than the noncontinuous load plus 125 percent of the continuous load.~~

(Delete Ex #1 and 2, and add new Info note.)

Informational Note: Not all conductors of a circuit are necessarily connected to the same termination equipment (circuit breaker, bus-bar lug, device, etc). For instance, grounded conductors might not need the extra 25 percent of the continuous load added to the combined load, where ungrounded conductors connected to a circuit breaker might.

Substantiation: Proposal 2-202 correctly points out that the conductor within 4 feet of a non-100% rated piece of equipment might need to be a larger size than one further away in order to achieve its tested heat-sink effect. The provisions of ampacity evaluation allow for different sections of a circuit to be arrived at independently, with the lowest ampacity being the final determinate. This wording would allow the conductor within 4 feet to be one size, and the rest of the circuit to be another size.

Further discussion:

However, it is critical that conductors connected to terminals which are not 100 percent rated must have the 25% added to their load value. Hartwell's wording seems to bypass this requirement (this is the Part not Accepted), this suggested wording would not. The balance of the wording changes are to correlate with the Comment on Proposal 2-201.

The two exceptions are deleted. The sub-section would then read:

(1) General. After the application of any ampacity adjustment or correction factors, feeder conductors shall have an ampacity not less than required to supply the combined load as calculated in Parts III, IV, and V of Article 220. Within 1.22 m (4 ft) of termination equipment, the combined load of each

connected conductor shall be 100 percent of the noncontinuous load plus 125 percent of the continuous load, unless the termination equipment is listed for operation at 100 percent of its rating.

Informational Note: Not all conductors of a circuit are necessarily connected to the same termination equipment (circuit breaker, bus-bar lug, device, etc). For instance, grounded conductors might not need the extra 25 percent of the continuous load added to the combined load, where ungrounded conductors connected to a circuit breaker might.

This portion of the edited wording addresses the concerns of this Proposal: "Within 1.22 m (4 ft) of termination equipment, ..."

The term "equipment" is a Code defined term which covers all the various types of termination methods.

The balance of the wording changes are to correlate with the Comment on Proposal 2-201.

The suggested wording is identical to the Comment for Proposal 201.

This Comment was developed before the results of the ROP were published, and therefore could not reflect or consider any changes approved during the ROP process.

This comment was developed by a CMP-6 Task Group and balloted through the entire panel with the following ballot results:

10 Eligible to Vote

7 Affirmative (See voting comments below)

3 Negative (See voting comments below)

The following Comments on Vote were received:

AFFIRMATIVE:

S. CLINE: For the Informational Notes only, of 210.19(A)(1) [P2-131], and 215.2(A)(1) [P2-201 and P2-202], the words "a circuit breaker" might better be "an overcurrent device" for equal treatment.

P.R. PICARD: The use of a 4 foot length requires more substantiation than Mr. Hartwell's statement in ROP 2-202 that "the four-foot limit is based on prior conversations with UL personnel relative to how much conductor length is actually effective in performing that function."

NEGATIVE:

S. B. FRIEDMAN: The proposed language changes do not add clarity, and in fact adds confusion to the requirements when trying to incorporate the 4 ft. exception into existing text in proposal 2-131 and 2-201. Additionally, adding the 4 foot rule in the manner proposed for Proposal 2-202 goes beyond that indicated and substantiated in proposal and accepted by CMP-2.

NEMA should support the actions taken by CMP-2 with no further changes.

NEMA recommends an affirmative vote on panel 6 comments 6-4 and 6-5 on code proposals 8-191 and 8-192 respectively.

R.L. HUDDLESTON, Jr.: The comment as submitted by Panel 6 as written on the "Form for comment" contains language that would leave the reader with the impression that the installation described is "typical", does not add clarity to the Code but rather adds confusion, and is also technically unsubstantiated. The 4 ft. length of conductors came from Mr. Hartwell's proposal (2-202) and apparently was something that was based on some undocumented conversation with UL personnel. Code requirements should never be based on hearsay, but on technical substantiation. The Comment suggests that typically within 4' of terminations that are not listed for 100% rating, a cable will be sized one way, and then outside of the 4' length it will be sized another way. I contend that this will be very much the exception to the way feeder installations will normally take place. I, for one, would much prefer to run a longer length of copper conductor of a certain size than to splice on both ends and run a smaller size in the middle, as splices are an obvious and proven weak point in the conductive path. If it can be technically demonstrated that 4' is the proper length to use, then this wording should appear as an exception rather than the rule.

M. XERRI: The proposed language changes do not add clarity to the proposals. By adding the 4 ft. exception into the proposals it is actually making the statement confusing. Additionally, adding the 4 foot rule in the manner proposed for proposal 2-202 goes beyond that indicated and substantiated in proposal and accepted by CMP-2.

Panel Meeting Action: Reject

Panel Statement: See panel statement on Comment 2-91.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-93 Log #35 NEC-P02 **Final Action: Accept**

(215.2(A)(1) Exception No. 2 (New))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 2-202

Recommendation: The Correlating Committee requests that this proposal be reconsidered.

The phrase "that are not terminated at either end" and its use in the sentence are unclear.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Panel Statement: See panel action on Comment 2-94.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-94 Log #1431 NEC-P02 **Final Action: Accept**

(215.2(A)(1) Exception No. 2 (New))

Submitter: Christel K. Hunter, Alcan Cable, a General Cable Company

Comment on Proposal No: 2-202

Recommendation: Reject this proposed new Exception.

Substantiation: The first part of this exception is already allowed by code. The installation of smaller conductors that are then spliced to larger conductors in order to comply with the temperature limitations of equipment is certainly allowed by code as long as each section of the circuit complies with the applicable ampacity and connection requirements. There is no need to give further specific allowance for this installation method.

Additionally, there was no technical substantiation submitted for the four foot length. Although the submitter states that he has had conversations with UL, there was no submission of testing or research that would support that four feet is required or that even four feet is enough. Until valid technical substantiation is submitted, this proposal should be rejected.

Panel Meeting Action: Accept

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-95 Log #1551 NEC-P02 **Final Action: Reject**

(215.2(A)(1) Exception No. 2 (New))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.

Comment on Proposal No: 2-202

Recommendation: Accept the proposal in principle. Revise text to read as follows:

Exception No. 2: Feeder conductors that are connected at both their supply and load ends to separately installed pressure connectors as covered in 110.14(C)(2) shall be permitted to have an allowable ampacity, after the application of any required adjustment or correction factors, not less than the sum of the continuous load plus the noncontinuous load. This exception shall not apply within 1.2 m (4 ft), as measured along the length of the conductors, of an overcurrent device.

Substantiation: This editorial revision of the accepted proposal recasts the exception in affirmative text and addresses the concerns of the Correlating Committee. It also clarifies how the 4-ft distance is to be measured. The point is to assure adequate heat sinking capabilities of the portion of the feeder that actually lands on an overcurrent device.

Panel Meeting Action: Reject

Panel Statement: See panel statement on Comment 2-94.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-96 Log #853 NEC-P02 **Final Action: Reject**

(215.2(A)(5))

Submitter: Travis Lindsey, Travis Lindsey Consulting Services

Comment on Proposal No: 2-213

Recommendation: Add new text to read as follows:

Conductors for branch circuits as defined in Article 100 shall be sized to prevent a voltage drop exceeding 3 percent at the farthest outlet, and where the maximum total voltage drop on both feeders and branch circuits to the farthest outlet does not exceed 5 percent. Voltage drop for a branch circuit is to be calculated or measured by utilizing a resistive load that represents 80% of the ampacity rating of the branch circuit.

Informational Note: See 215.2(A)(5) for voltage drop on feeder conductors.

Substantiation: The code panel has chosen not accept this proposal citing prior consensus. Prior surveys of inspectors, contractors and electricians have shown an overwhelming majority of these professionals consider excessive voltage drop to be a safety issue as well as an economic issue. Failures of fire alarm systems and smoke evacuation systems can be attributed to failure to adjust for circuit losses yet these circuits are not required to be adjusted for voltage drop. Circuit operating voltages have been responsible for many equipment losses. A number of these equipment losses have in the past caused large monetary losses especially in process systems such as factories. Cost should not be a factor when this conflicts with increasing safety.

Panel Meeting Action: Reject

Panel Statement: It is not substantiated that voltage drop is a safety issue. According to the submitter's comment, there may be special cases where voltage drop is a safety issue. The voltage drop limitation should not apply to all installations.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-97 Log #975 NEC-P02 **Final Action: Reject**
(215.2(A)(5))

Submitter: David Brender, Copper Development Assn. Inc.
Comment on Proposal No: 2-213
Recommendation: Add text to read as follows:
<u>(5) Voltage Drop. Conductors for feeder circuits as defined in Article 100, shall be sized to prevent a voltage drop exceeding 3 percent at the farthest outlet, and where the maximum total voltage drop on both feeders and branch circuits to the farthest outlet does not exceed 5 percent. Voltage drop for a feeder circuit is to be calculated or measured by utilizing a resistive load that represents 80% of the ampacity rating of the branch circuit.</u>
<u>Informational Note: See 215.2(A)(5) for voltage drop on feeder conductors.</u>
Substantiation: Voltage drop on critical circuits (such as fire stairwell pressurization) has been identified as a safety concern, not just a convenience concern, or "reasonable efficiency of operation" concern. 215.(A)(4) Informational Note 2 is not enforceable, and under a section that applies to dwelling units. The above change would move the voltage drop requirement to enforceable language for all occupancies.
Panel Meeting Action: Reject
Panel Statement: See panel statement on Comment 2-96.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-98 Log #1578 NEC-P02 **Final Action: Accept**
(215.3 Exception)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 10-16
Recommendation: Revise text to read as follows:
215.3 Overcurrent Protection.
Exception No. 2: Overcurrent protection for <u>feeders between 600 to 1000 volts shall comply with Parts I through VII of Article 240. Feeders</u> over ~~600~~ <u>1000</u> volts, nominal, shall comply with Part IX of Article 240.
Substantiation: The voltage boundary in 215 is 60 volts. The voltage boundary in 240 (changed by ROP 10-16) is 1000 volts. 215.3 Exception 2 is now split.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-99 Log #527 NEC-P02 **Final Action: Reject**
(215.12)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 2-127
Recommendation: Revise text to read as follows:
215.12 Identification for Feeders.
(C) Ungrounded Conductors.
(2) Feeders Supplied From Direct Current Systems. Where a feeder is supplied from a dc system operating at more than 60 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means; each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with ~~215.12~~<u>210.5</u>(C)(2)(a) and (b). The identification methods utilized for conductors originating within each feeder panelboard or similar feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each feeder panelboard or similar feeder distribution equipment
~~(a) *Positive Polarity, Sizes 6 AWG or smaller.* Where the positive polarity of a dc system does not serve as the connection for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:~~
~~(1) A continuous red outer finish.~~
~~(2) A continuous red stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or black.~~
~~(3) Imprinted plus signs "+" or the word "POSITIVE" or "POS" durably marked on insulation of a color other than green, white, gray, or black, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B).~~
~~(b) *Negative Polarity, Sizes 6 AWG or smaller.* Where the negative polarity of a dc system does not serve as the connection for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:~~
~~(1) A continuous black outer finish.~~
~~(2) A continuous black stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or red.~~
~~(3) Imprinted minus signs "–" or the word "NEGATIVE" or "NEG" durably marked on insulation of a color other than green, white, gray, or red, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B).~~
Substantiation: Define the marking requirements for ungrounded DC conductors in a single place just as the marking for grounded and grounding conductors is handled. There is no reason to replicate that complex text.
Panel Meeting Action: Reject
Panel Statement: Proposal 2-217 was developed by a dc task group which also developed Proposal 2-23. The repetition causes no confusion and may be useful.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-100 Log #36 NEC-P02 **Final Action: Accept**
(215.12(C))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 2-217
Recommendation: The Correlating Committee directs that this proposal be reconsidered and correlated with the actions taken on Proposals 2-23, 4-234, 4-262, 4-375, 5-220, 5-221 and 13-33 with regard to the 50 volt/60 volt nominal level.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise 215.12(C) as follows:
Identification of Ungrounded Conductors. Ungrounded conductors shall be identified in accordance with 215.12(C)(1) ~~and~~ <u>or</u> (2) as applicable.
In proposed 215.12(C)(2) replace 60 volts with 50 volts.
Panel Statement: The panel has reviewed 215.12(C) and agrees that changing the word "and" in 215.12(C) to "or" is more appropriate.
The change from 60 volts to 50 volts is to correlate with the CMP 13 action on Proposal 13-33.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

ARTICLE 220 — BRANCH-CIRCUIT, FEEDER, AND SERVICE CALCULATIONS

2-101 Log #844 NEC-P02 **Final Action: Reject**
(220.6)

Submitter: Joe Goodwater, University of Nebraska Lincoln
Comment on Proposal No: 2-220
Recommendation: Modify the original proposal as shown below:
<u>**220.6 Expert agencies**. Information about the historical electrical demand of an occupancy class that is provided by an ANSI-accredited standards developer and approved by the Authority Having Jurisdiction, shall be permitted to be used as a basis for all load calculation methods in this Article.</u>
<u>Informational Note: An example of an ANSI accredited standards developer is the Institute of Electrical and Electronic Engineers whose recommended practices such as ANSI/IEEE Std. 241, *Recommended Practice for Electric Power Systems in Commercial Buildings,*</u>
Substantiation: For the convenience of the committee, the substantiation for the original rejection of our proposal is reproduced below:
"Panel Statement: The proposal does not define the requirements of the "third party agency" in any detail. 90.4 allows the AHJ to waive specific requirements by establishing and maintaining effective safety."
Our response:
Rather than use the term, "third party" or "expert agency" it might be better to simply identify the IEEE since electrical engineers are more likely to be closer to load data than fire protection professionals. There is precedent for this already in Section 430.26: It is unlikely that most AHJs will approve any reduction of the requirements. Referring to the IEEE would make the AHJ job easier as they would not have to make the final decision on whether to allow the reduced requirements.
430.26 Feeder Demand Factor. Where reduced heating of the conductors results from motors operating on duty-cycle, intermittently, or from all motors not operating at one time, the authority having jurisdiction may grant permission for feeder conductors to have an ampacity less than specified in <u>430.24</u>, provided the conductors have sufficient ampacity for the maximum load determined in accordance with the sizes and number of motors supplied and the character of their loads and duties.
Informational Note: Demand factors determined in the design of new facilities can often be validated against actual historical experience from similar installations. Refer to ANSI/IEEE Std. 141, *IEEE Recommended Practice for Electric Power Distribution for Industrial Plants,* and ANSI/IEEE Std. 241, *Recommended Practice for Electric Power Systems in Commercial Buildings,* for information on the calculation of loads and demand factor.
The energy conservation space continues to move quickly and NEC committees do not need to be perceived as being too slow to adapt to rapidly falling load densities. Moving too slowly is also unsafe as we have argued that over-sized transformers pose more of a flash hazard risk than overload fire risk. It is best to start reaching out to solid organizations such as the IEEE to revisit the prescriptive requirements of this article.
As for Section 90.4: that is "general purpose" language that is unhelpful for Authorities Having Jurisdiction who fear becoming a large target for lawsuits when they take exception to any part of the NEC. Clear, bright-line language

preferred – especially when the changes we seek are relatively easy and backed up by convincing data.
Panel Meeting Action: Reject
Panel Statement: The suggestion to allow ANSI accredited agencies to size loads is too broad for all of the situations involved in Article 220. The panel recognizes that in buildings designed to comply with energy codes, the lighting load can be calculated and monitored as defined in Proposal 2-228.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-102 Log #838 NEC-P02 **Final Action: Accept**
(Table 220.12)

Submitter: Brent Baumer, Ball State University
Comment on Proposal No: 2-228
Recommendation: Ball State University supports the acceptance of Proposal 2-228 that permits an exception to the prescriptive unit load lighting requirements of Table 220.12 and urge the technical committee to continue its acceptance in principle.
Substantiation: In my experience at Ball State University calculating lighting load per the tables in Art. 220 contributes to greatly over sizing services, feeders and transformers. This unnecessarily adds costs increasing the financial burden on the student and the taxpayer and increases the amount of available fault current and arc flash energy thereby decreasing safety. Many states adopt ASHRAE 90.1 which requires lighting load be much less than is required by Art. 220. In our buildings constructed under the rules of 90.1 I have not seen a great increase in the use of task lighting, desk lamps, table lamps, under cabinet lighting etc. to supplement the general room lighting. In fact, very few persons request or utilize supplemental lighting. With LED lighting rapidly replacing traditional fluorescent lighting, I see this gap between Art. 220 and reality only widening and the use of supplemental lighting becoming closer to negligible than it already is.
Panel Meeting Action: Accept
Panel Statement: The panel understands that this comment supports the action on Proposal 2-228.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-103 Log #842 NEC-P02 **Final Action: Reject**
(220.12 and Table 220.12)

Submitter: Jared Friesen, Morrissey Engineering
Comment on Proposal No: 2-228
Recommendation: Reword the exception to 220.12 approved in Proposal 2-228 and revise to provide three separate positive language paths for lighting load calculation as shown below:
220.12 Lighting Load ~~for Specified Occupancies~~. A unit load of not less than that calculated in 220.12 (A), (B) or (C) ~~specified in~~ Table 220.12 ~~for occupancies specified therein~~ shall constitute the minimum lighting load. The floor area for each floor, where used in the minimum lighting load calculation, shall be calculated from the outside dimensions of the building, dwelling unit, or other area involved. For dwelling units, the calculated floor area shall not include open porches, garages, or unused or unfinished spaces not adaptable for future use of dwelling units.
(A) **For Specified Occupancies**. A unit load of not less than that specified in Table 220.12 for occupancies specified therein shall constitute the minimum lighting load.
Informational Note: *The unit values herein are based on minimum load conditions and 100 percent power factor and may not provide sufficient capacity for the installation contemplated.*
(B) **Energy Restricted Occupancies**. Where the building is required to comply with the prescriptive lighting power requirements of an energy code adopted by the local authority, the maximum lighting power density values specified in that energy code may be used.
(C) **Monitored Lighting Loads In Non-Dwelling Units**. Where monitoring of the volt-amp or amp load dedicated to and including all permanently connected lighting is available to personnel who are qualified to maintain or modify the lighting system, the load may be calculated based on the maximum volt-ampere rating of the equipment and lamps for which the luminaire(s) is rated.
Substantiation: The modification to the accepted Proposal 2-228 incorporates the concerns of Morrissey Engineering and the specifying-engineer community at large who will be tasked with interpreting and applying the accepted proposal. Morrissey Engineering is involved in all phases of design, construction, and remodel/modification of each type of occupancy who's lighting density, and therefore load, is to be calculated by use of section 220.12 and table 220.12.

First, the re-formatted text repeats the same intent of accepted Proposal 2-228 but phrases with positive language over exceptions as the NFPA Manual of Style encourages.

Second, the new text clarifies that the calculation using the adopted energy code should be based on the more conservative maximum lighting power density, and not the connected (as defined by the applicable energy code) lighting power. The maximum lighting power density represents the maximum lighting power that is allowed to be used, not the lighting power that is designed for. Furthermore, the text now allows use of this energy code maximum lighting power density to stand alone from use of a power monitoring system. This change should be approved because it recognizes the legally mandated limits placed on the lighting system by other code writing panels when an energy code is adopted. Note that application of the energy code maximum power density calculation is essentially the same as application of table 220.12, but with values that are legal limits and are provided by other code writing panels who are engaged in the collection and interpretation of lighting power data by recognized authorities in the lighting industry.

Finally, the revised text provides for a third lighting load calculation method with the same intent of accepted Proposal 2-228. This method has been revised to 1) use the volt-ampere rating of the connected luminaire(s) that is to be monitored and 2) Be restricted to branch circuits serving only lighting in non-dwelling units and 3) ensure that data needed to monitor the system is available to those who are expected to need it and not be inaccessible. Based on the experience of many professional engineers in the consulting-specify industry, these revisions are expected to be sufficiently restrictive to be safe. They both require circuits to be sufficiently sized for a load with a definable demand when the branch circuit is dedicated to lighting, and allow for future expansion based on operational peak demand information accessible to the personnel who would need it.
Panel Meeting Action: Reject
Panel Statement: The panel allows the use of energy codes for lighting loads with the restrictions in Proposal 2-228. The allowance and restrictions are exceptions to the basic lighting loads by occupancy in Table 220-12.
The submitter's revisions modify the limitations placed on applying the values from the adopted energy code. These restrictions are required if a variance is allowed from the values in Table 220.12
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-104 Log #843 NEC-P02 **Final Action: Accept**
(Table 220.12)

Submitter: Joe Goodwater, University of Nebraska Lincoln
Comment on Proposal No: 2-228
Recommendation: The University of Nebraska supports the acceptance of Proposal 2-228 that permits an exception to the prescriptive unit load lighting requirements of Table 220.12 and urge the technical committee to approve it for inclusion into the 2014 National Electrical Code
Substantiation: Over the last 33 years UNL has tracked the demand on our building transformers. Our average demand is less than 40% of transformer rating and average load is well below that. I can only think of two instances in those 33 years that a transformer was fully loaded. In both of those cases, energy management systems have reduced the load to well under the original demand. On Love Library demand went from over 1000 kw to less than 500 Kw.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Negative: 1
Explanation of Negative:
ORLOWSKI, S.: See reason statement on Comment 2-108.

2-105 Log #845 NEC-P02 **Final Action: Reject**
(Table 220.12)

Submitter: Jerry Jimenez, University of California Berkeley
Comment on Proposal No: 2-228
Recommendation: The University of California Berkeley supports the acceptance of Proposal 2-228 that permits an exception to the prescriptive unit load lighting requirements of Table 220.12 and urge the technical committee to approve it for inclusion into the 2014 National Electrical Code but with the following modifications:
Exception: **In other than residential single-family and multifamily dwelling units**, where the building is designed and constructed to comply with an energy code adopted by the local authority, the lighting load shall be permitted to be calculated at the values specified in the energy code where the following conditions are met
a. A power monitoring system is installed that will provide ~~continuous~~ **historical** information regarding the total ~~general lighting~~ load of the building.
b. The power monitoring system will be set with alarm values **to** alert the building owner or manager if the ~~lighting~~ **total** load exceeds **the capacity of the service equipment** ~~values set by the energy code.~~
c. The demand factors specified in 220.42 are not applied to the general lighting load.
Substantiation: This is how we would like the new language to appear in the 2014 NEC:
Exception: In other than residential single-family and multi-family dwelling units, where the building is designed and constructed to comply with an energy code adopted by the local authority, the lighting load shall be permitted to be calculated at the values specified in the energy code where the following conditions are met
a. A power monitoring system is installed that will provide historical information regarding the total load of the building.
b. The power monitoring system will be set with alarm values to alert the building owner or manager if the total load exceeds the capacity of the service

equipment
c. The demand factors specified in 220.42 are not applied to the general lighting load.
This modification will permit the "power monitoring system" to be more basic in function and it will eliminate the need to install such equipment in single-family and multi-family dwelling units.
In the spirit of producing evidence that most distribution transformers are over-sized, we present the following:
At UC Berkeley, twelve transformers representative of typical building use (labs, classrooms, offices) were monitored with permanently installed real time meters for one year. The transformers are all 12 kV primary and either 480/277 v or 208/120 v secondary. They range in size from 500 kVA to 3,000 kVA. The average load over a period of one year was in the range of 7.5% to 38.7%. The peak load over that same period ranged from 17.8 % to 58.1 %. This means that in all cases, the transformers are too large by at least 50%. This causes several problems:
1) The no load losses over time are much higher than needed. This wastes energy and money.
2) The downstream switchgear is of higher ampacity than it needs to be. This wastes money.
3) The downstream switchgear is of higher short circuit rating than it needs to be. This wastes money.
4) The upstream infrastructure, which is based on connected kVA, is not loaded as heavily as it could be. This causes additional circuits to be constructed when perhaps they are not really required. This wastes money.
5) The fault currents downstream from these transformers is larger than it would be if the transformers were properly sized. This poses risk to electricians and others who might be in the vicinity of switchgear when a fault occurs. This presents a larger hazard than what would exist if the transformers were properly sized.
Panel Meeting Action: Reject
Panel Statement: Proposal 2-228 applies to the lighting load of a building as defined in Table 220-12 with an exception for monitoring the lighting load if it is designed according to an energy code. Comment 2-105 concerns the total load of the building which is not addressed in Proposal 2-228.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Negative: 1
Explanation of Negative:
ORLOWSKI, S.: See reason statement on Comment 2-108.

2-106 Log #846 NEC-P02 **Final Action: Accept**
(Table 220.12)

Submitter: Glenn T. Keates, Dymax Engineering
Comment on Proposal No: 2-228
Recommendation: Dymax Engineering supports the acceptance of Proposal 2-228 that permits an exception to the prescriptive unit load lighting requirements of Table 220.12 and urge the technical committee to approve it for inclusion into the 2014 National Electrical Code.
Substantiation: With lighting becoming more efficient and moving toward high efficiency ballasts, LED's, etc., it is time to recognize the importance of intelligently engineering a lighting system. This provision would allow that to occur, lowering the wasted "kVA" that exists in our present day electrical systems. It has been our experience and I'm sure others, as consulting engineers for a variety of campuses, to typically find that these facilities are, for lack of a better term, "over-transformered" to the extent that power factors are adversely affected, the units are underutilized and that the capital dollars are not be wisely used, as these more efficient systems come into reality.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Negative: 1
Explanation of Negative:
ORLOWSKI, S.: See reason statement on Comment 2-108.

2-107 Log #847 NEC-P02 **Final Action: Accept**
(Table 220.12)

Submitter: Paul A. Kempf, University of Notre Dame
Comment on Proposal No: 2-228
Recommendation: The University of Notre Dame supports the acceptance of Proposal 2-228 that permits an exception to the prescriptive unit load lighting requirements of Table 220.12 and urges the technical committee to approve it for inclusion into the 2014 National Electrical Code.
Substantiation: The University of Notre Dame has vast experience with the design and operation of campus facilities as well as its own electrical distribution network system. Our experience includes the loading of service transformers across a wide array of building types including residential, research, office, large assembly and food service to name a few.
Our considerable historical data of service demands indicates that under-loaded transformers are the norm for our facilities. We attribute this under loading to the service load calculations which overestimate the true load demands.
We support this proposal as we seek to reduce incident energy levels, gain sustainability through the conservation of energy and natural resources and lower the capital expense of purchasing equipment through more appropriately sized transformers. As safety and sustainability are key drivers for our industry and we believe this proposal supports these efforts in a responsible manner.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Negative: 1
Explanation of Negative:
ORLOWSKI, S.: See reason statement on Comment 2-108.

2-108 Log #848 NEC-P02 **Final Action: Reject**
(Table 220.12)

Submitter: Jose Meijer, Peter Basso Associates, Inc.
Comment on Proposal No: 2-228
Recommendation: We support the acceptance of Proposal 2-228 that permits an exception to the prescriptive unit load lighting requirements of Table 220.12 and urge the technical committee to continue its acceptance but with the following modification:
Exception: <u>**In other than dwelling units**</u>, where the building is designed and constructed to comply with an energy code adopted by the local authority, the lighting load shall be permitted to be calculated at the values specified in the energy code ~~where the following conditions are met~~
~~a. A power monitoring system is installed that will provide continuous information regarding the total general lighting load of the building.~~
~~b. A power monitoring system will be set with alarm values~~ <u>**to**</u> ~~alert the building owner or manager if the lighting load exceeds values set by the energy code.~~
~~c. The demand factors specified in 220.42 are not applied to the general lighting load.~~
Substantiation: There is a widening gap between the unit load requirements of Table 220.12 and energy codes (such as <u>ASHRAE 90.1</u> and the <u>International Energy Conservation Code</u>) both of which reference *Illuminating Engineering Society* lighting power densities.
A power monitoring system is not necessary because if there are overloads – even in continuously energized mixed outlet and lighting supply circuits – overcurrent devices will safely de-energize the circuit.
We recommend removal of dwelling from the scope of this exception because such circuits are covered under local residential building and energy codes which are also driving down permissible lighting power densities.
Panel Meeting Action: Reject
Panel Statement: The submitter recommends that the monitoring provision of Proposal 2-228 be deleted. It is the intent of the panel that the lighting load be monitored to prevent overloads or alarm the building manager if an overload occurs.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Negative: 1
Explanation of Negative:
ORLOWSKI, S.: NAHB recognizes the legitimacy in allowing for a reduction in the lighting load, based on proponents substantiation. However, NAHB does not support the requirements for continuous monitoring in dwelling units, as it does not add any improvement on the practical safeguarding of people or property under the provisions of NEC. The proponent is correct that this is being addressed at the state and local level through energy conservation codes. Monitor and alarm devices are not required anywhere else in the NEC on any other branch circuit suppling electricity and should not be a requirement for the lighting load in dwelling units.

2-109 Log #850 NEC-P02 **Final Action: Reject**
(Table 220.12)

Submitter: Kathy Richards, Northern Michigan University
Comment on Proposal No: 2-228
Recommendation: Continue to accept this proposal but revise the description of the "power monitoring system" so that the system is more generic and does not necessarily require a new capital expenditure but can use an existing building control system.:
Exception: Where the building is designed and constructed to comply with an energy code adopted by the local authority, the lighting load shall be permitted to be calculated at the values specified in the energy code where the following conditions are met:
a. A ~~power monitoring~~ system is installed that will provide ~~continuous~~ information regarding the ~~total~~ general lighting load of the building.
b. The ~~power monitoring~~ system will be set with alarm values to alert the building owner or manager if the lighting load exceeds the values set by the energy code.
~~c. The demand factors specified in 220.42 are not applied to the general lighting load.~~
Substantiation: The lighting load for alteration and new buildings is being driven downward so aggressively by energy codes that it may not even be necessary to require a power monitoring system; an existing facility management system may be sufficient. The majority of the buildings on Northern Michigan University's campus are fed from a main switchboard in the central steam plant through an underground power distribution system. Each building has a dedicated electric meter that is connected to the building's facility management system which is centrally monitored by Facilities Department staff. The facility management system has trending and alarm capabilities that could be utilized for monitoring the building electrical load.

Lighting load is usually only about 25% of a building's electrical load. Overloads due to lighting are extremely unlikely and when they are present they will be taken out by overcurrent devices therefore Condition (c) may be deleted.
Panel Meeting Action: Reject
Panel Statement: The submitter does not justify changing the "power monitoring system" required in Proposal 2-228 to a more general monitoring system. The purpose of the power monitoring system is to provide continuous information about the lighting load of the building.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-110 Log #910 NEC-P02 **Final Action: Accept**
(Table 220.12)

Submitter: Brooks H. Baker, III, University of Alabama at Birmingham
Comment on Proposal No: 2-228
Recommendation: The University of Alabama at Birmingham supports the acceptance of Proposal 2-228 that permits an exception to the prescriptive unit load lighting requirements of Table 220.12 and urge the technical committee to approve it for inclusion into the 2014 National Electrical Code.
Substantiation: When undertaking a design of a project and the load data is submitted to the utility company for transformer sizing, they typically undersize the transformer based on their historical data. Oversizing a transformer as currently required has a downstream affect on the overall design of a project in that it could increase the size requirement of the room, which then impacts the overall project budget and can impact the sizing of program space.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Negative: 1
Explanation of Negative:
ORLOWSKI, S.: See reason statement on Comment 2-108.

2-111 Log #911 NEC-P02 **Final Action: Accept**
(Table 220.12)

Submitter: Kevin Folsom, Dallas Theological Seminary
Comment on Proposal No: 2-228
Recommendation: Dallas Theological Seminary supports the acceptance of Proposal 2-228 that permits an exception to the prescriptive unit load lighting requirements of Table 220.12 and urge the technical committee to approve it for inclusion into the 2014 National Electrical Code.
Substantiation: For the past 50 years we have had a utility-owned oil-filled transformer that is installed in the basement of one building with feeders running out to 5 other other adjacent buildings at 480 volts. When it was installed in 1972 it was 70% underloaded. Today, it is 30% underloaded based upon their ambient ratings. (They could be driven up to 150% of rated kVA for very short periods of time). There are several problems with this:1. Even though the utility owns this transformer a large amount of un-used and unnecessary electrical energy has been present in the building that typically presents a proportional unnecessary flash risk to any electrician
2. This transformer has dumped unnecessary waste heat into the building for a half century and has raised our cooling costs
3. Now the aging transformers are failing and there is no way to get them out safely and quickly.
While utilities are not bound to NEC rules for calculating electrical load within the building, this installation demonstrates how prospective load assumptions for the other 5 buildings that are built into Chapter 2 calculation methods are not keeping pace with changes in energy codes that are driving power densities downward. While Proposal 2-228 may well create capital expenditure in terms of power monitoring systems, it is a significant step in the right direction.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Negative: 1
Explanation of Negative:
ORLOWSKI, S.: See reason statement on Comment 2-108.

2-119a Log #841 NEC-P02 **Final Action: Accept**
(220.12 (New))

Submitter: Gaylan Bishop, The University of North Carolina - Chapter Hill
Comment on Proposal No: 2-228
Recommendation: Continue to accept Proposal 2-228.
Substantiation: The University of North Carolina supports the effort by the education facilities industry, represented by APPA.ORG's Standards Council, to bring the 2014 NEC in step with rapidly evolving energy codes by reducing the size of building services which have shown themselves to be significantly oversized for decades. National energy codes are moving very quickly and confirm the wisdom of the committee's acceptance of this proposal.
Two pages from Addendum BH of ASHRAE 90.1 (the dominant energy code in the US) which asserts lower lighting power densities for a variety of spaces. Much of it is derived from Illuminating Engineering Society studies and is far more granular than Table 220.12 but a few samples where "unit load" and "lighting power densities" (measured in VA/sqft and watts/sqft. Respectively) confirm the need to continue to accept this proposal.
For Banks: Table 220.12 requires 3.5 VA/sqft but ASHRAE 90.1 requires 1.01 watts/sq ft.
For Schools: Table 220.12 requires 3.0 VA/sqft but ASHRAE 90.1 requires 1.34 watts/sq ft.
For Offices: Table 220.12 requires 3.5 VA/sqft but ASHRAE 90.1 requires 1.1 watts/sq ft.
For Assembly Halls: Table 220.12 requires 1.0 VA/sqft but ASHRAE 90.1 requires 0.63 watts/sq ft.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Negative: 1
Explanation of Negative:
ORLOWSKI, S.: See reason statement on Comment 2-108.

2-119b Log #1068 NEC-P02 **Final Action: Accept**
(220.12 (New))

Submitter: Michael A. Anthony, University of Michigan / Rep. APPA.ORG Standards and Codes Council
Comment on Proposal No: 2-228
Recommendation: Continue to accept Proposal 2-228.
Substantiation: Much more could be accomplished to reduce incident energy and to avoid energy loss and material waste. Coordinated changes to Table 220.42, Articles 230, 450 and 490 in the 2017 NEC revision by a Task Group appointed by the Technical Correlating Committee would be welcomed. For the moment, Proposal 2-228 -- derived from many safety concepts presented by many others in the past four NEC cycles, supported with significant technical substantiation accumulated by APPA.ORG's Standards Council in the proposal stage -- is a step in the right direction.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Negative: 1
Explanation of Negative:
ORLOWSKI, S.: See reason statement on Comment 2-108.
Comment on Affirmative:
KING, D.: See my comments on 2-119C.

2-119c Log #1069 NEC-P02 **Final Action: Reject**
(220.12 (New))

Submitter: Michael A. Anthony, University of Michigan / Rep. APPA.ORG Standards and Codes Council0
Comment on Proposal No: 2-228
Recommendation: Modify the Proposal 2-228 acceptance as follows:*Exception* ***1***: ***In other than dwelling occupancies,*** ~~*W*~~*where the building is designed and constructed to comply with an energy code adopted by the local authority, the lighting load shall be permitted to be calculated at the values specified in the energy code where the following conditions are met*
a. A power monitoring system is installed that will provide continuous information regarding the total general lighting load of the building.
b. The power monitoring system will be set with alarm values ***to*** *alert the building owner or manager if the lighting load exceeds the values set by the energy code.*
c. The demand factors specified in 220.42 are not applied to the general lighting load.
Exception 2. *In dwelling occupancies, lighting load shall be permitted to be calculated at the values specified in the energy code adopted by the local jurisdiction*
Exception 3. *If the lighting branch circuit in any of the occupancy types of Table 220.12 is supplied through a device that limits its current, the load shall be permitted to be calculated based on the rating of the device used to limit the current.*
Substantiation: Admittedly, this comment presents a fairly cumbersome set of exceptions to permit NEC-adopting jurisdictions to reconcile competing priorities of safety and economy.
The committee member representing the National Association of Homebuilders makes a fair point about the requirement for power monitoring in dwelling occupancies, however. There may be a simpler way to partition the applicability of this exception but at least this modification places an exception- within-an-exception for the committee to consider and changes the accepted language the least. This is the concept underlying Exception 2.
For the convenience of the committee, some of the lighting power densities, using the IES 'space-by-space' method, and referenced into ASHRAE 90.1 Addendum BH, are reproduced below:
Corridors: 0.66 VA/sqft
Food preparation areas: 1.21 VA/sqft
Laundry areas: 0.60 VA/sqft.
Lounges: 0.73 VA/sqft
Restrooms: 0.98 VA/sqft
Note the trend toward more granular identification of use-types within occupancies in the IES/ASHRAE documents. Table 220.12 specifies 3 VA/sqft for dwelling units with no further granularity. While ASHRAE 90.1 may only

deal with everything but 'Low-Rise Residential Buildings' it does offer insight into a trend in energy codes applicable to high-rise residential buildings, with space use roughly similar.

The concern by one of the negative votes that fixed lighting load will be transferred to task lighting is noteworthy but can be discussed in light of the following:1. Regarding: *"Energy code calculations immediately require the end user to supplement general lighting with additional task lighting"* Response: Even task lighting "bulbing" and controls are being driven downward by innovations in illumination technology.

2. Transformers for dwelling occupancies are typically remote (i.e. exterior) and owned by the utility. Branch circuit overloading is instantly removed with overcurrent and short circuit devices that minimizes fire hazard.

Exception 3 captures the concept underlying Proposal 2-335 Log #148 that CMP-2 Accepted in Principle during the last NEC revision cycle. That concept now appears as an exception in 220.43(B) and widens the practical application of this exception to the more common case in which a transformer supplies both lighting and receptacle loads. Dedicated panelboards or intelligent circuit breakers would not be required.

Much could be accomplished to reduce incident energy and avoid energy loss and material waste by making coordinated changes to Table 220.42 in the 2017 NEC revision cycle. For the moment, Proposal 2-228 -- derived from many safety concepts presented by others in the past 4 NEC cycles -- is a step in the right direction.

Panel Meeting Action: Reject

Panel Statement: The submitter adds two additional exceptions to a proposal for 220.12 but references 230.201 (New). The new Exception 2 removes the need for monitoring the lighting load in dwelling occupancies but without sufficient justification. The substantiation describes various VA/sqft loads in areas of buildings in other codes or documents. Further granularity in the lighting load for building corridors, lounges, and other non-dwelling areas of buildings is considered in Table 220.12.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 12 Negative: 1

Explanation of Negative:

ORLOWSKI, S.: See reason statement on Comment 2-108.

Comment on Affirmative:

KING, D.: I support the comment on ROP 2-228 with the emphasis on the resultant safety to workers that would occur with appropriate sizing and design of electrical equipment and systems. The potential reduced short circuit current and hence incident energy level reduce the significant risk to qualified persons working on those systems.

2-112 Log #37 NEC-P02 **Final Action: Accept**
(220.14(B))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 2-232

Recommendation: The Correlating Committee directs the panel to (1) clarify the action on Proposal 2-232 in regard to the appropriateness of the new heading for 220.55, (2) clarify and correlate with the action taken on Proposal 2-245, and (3) clarify the Heading of 220.14(B).

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Revise the title of 220.14(B) to read as follows: "Electric Dryers and Electric Cooking Appliances in Dwellings and Household Cooking Appliances used in Instructional Programs."

Panel Statement: The panel accept the Correlating Committee directive and acknowledges that the revision made in Proposal 2-232 should have been to revise the title in 220.14(B). The revision to 220.55 is covered by Proposal 2-245.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-113 Log #851 NEC-P02 **Final Action: Reject**
(220.42)

Submitter: Kathy Richards, Northern Michigan University

Comment on Proposal No: 2-254

Recommendation: Relocate language originally proposed in Proposal 2-254 as a new exception after existing Section 220.42

220.42 General Lighting. The demand factors specified in Table 220.42 shall apply to that portion of the total branch-circuit load calculated for general illumination. They shall not be applied in determining the number of branch circuits for general illumination.

Exception: As an alternative to the lighting load demand factors of Table 220.42 general lighting demand factors for new or existing loads shall be permitted to be based upon lighting power densities specified in an energy code provided the lighting load demand factor is determined by a registered professional engineer.

Substantiation: Table 220.42 needs a significant update – or needs to be removed entirely -- because the occupancy classes it contains is not granular enough for all the occupancy classes now identified in lighting energy codes.

The attachment to this comment (filed with NFPA Staff) is a listing of the various occupancy classes that have been modeled by the Illumination Engineering Society (IES) and ASHRAE 90.1 Addendum BH. Table 220.42 has four occupancy classes PLUS "everything else". The lighting power densities of the 10th Edition of the IES has about 40 different occupancy types. This proposal is a broadening of the applicability of Section 645.25 that was written into the 2011 NEC. It closes the gap between what this section requires for fire safety and what the actual lighting load will be as LED lighting technology.

The oversizing of transformers that results from the design-prescriptive requirements of Article 220 causes us to bring in far more energy into a building than is necessary. Across 40 medium voltage services that supply over 3 million square feet of a variety of occupancy classes typical in a campus setting in the upper peninsula of Michigan, the average demand on a typical service at Northern Michigan University is 21.2 percent of the ambient rating of the transformer. The average watt per square foot load across the Northern Michigan University campus is 1.53 watts per square foot. This loading data is typical for facilities in our industry. Technological innovation has driven down the power requirements of end-use equipment for many years now. An explicit exception to the Article 220 requirement will help our industry and others reduce flash hazard as well as contribute significantly our industry's sustainability objectives.

In light of this, Northern Michigan University supports the effort by the APPA. ORG Standards Council to bring the 2014 NEC in step with rapidly evolving energy codes and to reduce flash hazard by reducing the size of building services. We urge the NEC Technical Correlating Committee to assign a Task Force to discover ways of accomplishing this goal. We urge the NFPA Fire Protection Research Foundation to develop a research project to support the Task Force. In both cases, we would be happy to turn over our electrical demand information for further study.

Note: Supporting material is available for review at NFPA Headquarters.

Panel Meeting Action: Reject

Panel Statement: The suggestion to allow professional engineers to determine the demand factors for lighting loads is too broad for all of the situations involved in Table 220.42. The panel recognizes that in buildings designed to comply with energy codes, the lighting load can be calculated and monitored as defined in Proposal 2-228 allowing an exception to 220.12. In the exception to 220.12, the demand factors in Table 220.42 cannot be used.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-114 Log #1051 NEC-P02 **Final Action: Reject**
(220.58)

Submitter: George M. Stolz, II, Quicksilver Electrical Training

Comment on Proposal No: 2-247

Recommendation: Accept the proposal in part: substitute 83% where this proposal calls for a 88% reduction, per the action taken on Proposal 6-49a, and force the deletion of 310.15(B)(7).

Substantiation: CMP-2 appears to be unaware that CMP-6 has been effectively reducing the "calculated load" for 30 years with 2011's 310.15(B)(7). Since the reasoning behind 310.15(B)(7) is that dwelling units have a decreased LOAD due to the use of the occupancy, this concept should be moved to Article 220 and be a part of the actual LOAD CALCULATION. The substantiation for this proposal is the presence of 310.15(B)(7) in the 2011 NEC. And the acceptance of Proposal 6-49a in the 2014 cycle. 310.15(B)(7) should be deleted, and normal wire sizing rules should govern over the diverse LOAD.

If Article 220 takes this concept over, then Article 310 can focus on what to do with the load once it's been calculated.

Panel Meeting Action: Reject

Panel Statement: It appears that the submitter is taking aim at 310.15 to delete provisions of that article. However, there is no substantiation to change the way feeder and service conductor loads are computed for dwelling units.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-115 Log #1052 NEC-P02 **Final Action: Reject**
(220.82(A))

Submitter: George M. Stolz, II, Quicksilver Electrical Training

Comment on Proposal No: 2-248

Recommendation: Accept the proposal as coordinated with the original.

Substantiation: See substantiation of comment regarding Proposal 2-247.

Panel Meeting Action: Reject

Panel Statement: Adding a reference to 220.58 is not needed since the new 220.58 was rejected. See panel statement on Comment 2-114.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

2-116 Log #849 NEC-P02 **Final Action: Reject**
(220.86 (New))

Submitter: Jose Meijer, Peter Basso Associates, Inc.
Comment on Proposal No: 2-252
Recommendation: Accept Proposal 2-252 as written:
220.86+(NEW) Engineering Supervision. As an alternative to the feeder and service load calculations required by Parts III and IV of Article 220, feeder and service load calculations for new or existing loads shall be permitted to be used if performed by qualified persons under engineering supervision.
Substantiation: We would like to respond to the panel's statement point by point:
Claim 1: "*The submitter's substantiation does not justify how a qualified person under engineering supervision could improve upon the rules for calculations in Article 220."*
Response: We believe that a great deal of improvement is possible. From the standpoint of safety, the reduction in transformer kVA that will likely result from the application of informed professional judgment will – in all but a few cases – result in greater electrician safety. Four other committees were presented with significant data that spanned a range of occupancy classes to prove, overwhelmingly, that the prescriptive requirements in Article 220 results in power delivery apparatus that is at least 50 percent over-sized. As consulting engineers we see this every day.
Claim 2: *"The panel does not agree with allowing historical demand as the singular basis for determination of load under the NEC. Historical demand is an indicator of how a particular building is performing, but it is not necessarily providing all of the necessary information for another building in the future."*
Response: If the panel does not agree with allowing historical demand as the singular basis then how did the rules in Article 220 come to be in the first place? Where did the demand values originate from? We believe they were formulated from rules of thumb the better part of 50 years ago when the characteristics of end-use equipment was very different and when the US economy grew at a rate when "building extra capacity" was more likely to be cost-effective. In the economy in which we now live, however, it is more cost effective to wait until an expansion covers the cost of adding to supply service equipment rather than build the service with 50 percent more capacity assuming that the load will grow. The loads are not growing to justify the overcapacity built into the prescriptive requirements of this chapter.
Claim 3: *" The panel takes the position that if the Article 220 calculations are incorrect and arriving at oversized feeders and services (at peaks and not just averages), then proponents should complete a credible study noting how the current calculations are inaccurate and how they should be changed (e.g. lower lighting loading va/sq.ft. etc.)."*
Response: We did provide data in our original proposal. There are over 15 proposals submitted to this committee with similar data that tells the same story. Perhaps not everyone saw the data that accompanied these proposals since the data was contained in the accompanying "reference material" to committee members on a CD.
Finally, the committee should recognize precedent set in other parts of the Code where an engineer's judgment is permitted – Section 430.26 and Section 645.25. For the convenience of the committee those passages are reproduced below:
430.26 Feeder Demand Factor. Where reduced heating of the conductors results from motors operating on duty-cycle, intermittently, or from all motors not operating at one time, the authority having jurisdiction may grant permission for feeder conductors to have an ampacity less than specified in 430.24, provided the conductors have sufficient ampacity for the maximum load determined in accordance with the sizes and number of motors supplied and the character of their loads and duties.
Informational Note: *Demand factors determined in the design of new facilities can often be validated against actual historical experience from similar installations. Refer to ANSI/IEEE Std. 141, IEEE Recommended Practice for Electric Power Distribution for Industrial Plants, and ANSI/IEEE Std. 241, Recommended Practice for Electric Power Systems in Commercial Buildings, for information on the calculation of loads and demand factor.*
Another example:
645.25 Engineering Supervision. As an alternative to the feeder and service load calculations required by Parts III and IV of Article 220, feeder and service load calculations for new or existing loads shall be permitted to be used if performed by qualified persons under engineering supervision.
Panel Meeting Action: Reject
Panel Statement: The submitter points out that special circumstances allow the loads to be calculated to the satisfaction of the AHJ (430.26) or by qualified persons under engineering supervision (645.25). However, there is no substantiation for all load calculations required by Parts III and IV of Article 220 to be modified even if by a qualified person.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-117 Log #1342 NEC-P02 **Final Action: Reject**
(220.87)

Submitter: James E. Degnan, Sparling
Comment on Proposal No: 2-257
Recommendation: Revise text to read as follows:
220.~~87~~ ~~Determining Existing Loads. The calculation of a feeder or service load for existing installations shall be permitted to be determined use the actual maximum demand to determine the existing load under all of the following conditions:~~
~~(1) The maximum demand data is available for a 1 year period.~~
Exception: … ~~*If the maximum demand data for a 1 year period is not available, the calculated load shall be permitted to be based on the maximum demand (measure of average power demand over a 15 minute period) continuously recorded over a minimum 30 day period using a recording ammeter or power meter connected to the highest loaded phase of the feeder or service, based on the initial loading at the start of the recording. The recording shall reflect the maximum demand of the feeder or service by being taken when the building or space is occupied and shall include by measurement or calculation the larger of the heating or equipment load and other loads that may be periodic in nature due to seasonal or similar conditions.*~~
~~(2) The maximum demand at 125 percent plus the new load does not exceed the ampacity of the feeder or rating of the service.~~
~~(3) The feeder has overcurrent protection in accordance with 240.4 and the service has overload protection in accordance with 230.90.~~
220.87 **Existing Loads.** The existing load shall be permitted to be calculated in accordance with 220.87(A) under all of the conditions of either 220.87(B) or 220.87(C).
(A) Calculation. The feeder or service load shall be measured as the average power or current demand over a 15 minute periods, and continuously recorded. The calculated existing load shall be determined from the maximum demand load after adjustment for :
(1) Variations in occupancy
(2) The larger of the seasonal space heating or cooling load
(3) Variations in process or production
(4) Similar factors affecting the measured load
Adjustments shall be based on previous or projected: occupancy, process demand, or seasonal environment.
(B) General Metering
(1) The calculated existing load at 125 percent, plus the feeder calculations for any new load does not exceed the ampacity of the feeder or rating of the service.
(2) The service has overload protection in accordance with 230.90
(3) The metering is in place for a minimum of 30 days.
(4) The metered load is measured on the highest loaded phase after an initial measurement at the start of the recording.
(C) Permanent Metering on Feeders or Services Rated Over 1000 Amperes
(1)The maximum demand at 115 percent plus the feeder calculations for any new load does not exceed the ampacity of the feeder or rating of the service.
(2) The service has overload protection in accordance with 230.90
(3) The overcurrent protective device assembly for the feeder or service is larger than 1000 amperes and is listed for operation at 100% of its rating.
(4) The metering is permanent, has been in place for a minimum of one year and will remain in place, measures the current on each phase, and complies with one of the following:
a. The meter is the utility service meter and the service is being measured.
b. The metering is an integral part of the feeder or service overcurrent protective device. Metering data is displayed or exported to a data base that can be read at the facility.
c. The metering transducer is secured to the interior of the panelboard or switchboard, is mounted in a dedicated space, and labeled according to the associated feeder or service. Metering data is displayed or exported to a data base that can be read at the facility.
(5) The distribution system loading is regularly monitored and controlled by a Qualified Person.
(6) At the point where the load is measured the circuit conductors exceed 250 volts to ground.
Substantiation: The panel is encouraged to take another look at proposal 2-257. The above text is the nearly the same as the original text, except:
1. The amount of 110% has been increased to 115%.
2. (C)(6) has been added
3. "accessible" has been edited out for compatibility with the NEC definition of the word, and other minor editing.
In rejecting the proposal the panel seeks substantiation for reducing the safety margin from 125 to 110%. Many provisions of the NEC are written based on judgment and experience without a specific link to analysis that clarifies why one number was chosen as opposed to another number that might be different by a moderate amount. The new proposal of 115% is a reasonable choice, especially with the addition of provision (C)(6). We have to start somewhere!
Substantiation is as follows:
The present version of 220.87 has a safety margin that includes allowances for:
1. Power factor, if only kw is measured,
2. Phase unbalance, if the unbalance is not indicated at the initial measurement.
3. The extent that a load may actually have a substantial component that exists

for more than three hours, requiring derating as a continuous load, but is not revealed by 15 minute windows.

Requiring permanently fixed in place, 3 phase metering will eliminate the portion of the existing safety factor that exists for items 1 & 2. Requiring 100% rated circuit breakers will eliminate the portion of the safety factor that exists for item 3. The submitter maintains that this combined portion of the safety factor should justify the original reduction from 125% to 110%. However recognizing the NEC need for safety, this comment changes the reduction to 115% and adds an additional safety directive that it apply only to loads with a voltage to ground above 250 volts.

At 208 volts, a 100 amp feeder requires a 25% safety margin, yielding about (1.73*208*100*.25=) 9kVA. Applying the same safety margin to a 1000 amp, 208 volt feeder yields (1.73*208*1000*.25=) 90 kVA. It is much more likely for a 9 kVA load to appear after detailed load monitoring and exceed the capacity of a 100 amp system than it is for a 90 kVA load to appear and exceed the capacity of a 1000amp system (or even ten 9kVA loads to appear). Hence the justification for only allowing the reduced safety margin to apply to systems over 1000 amps. Still, the need for caution with a new code development is understood. With the addition of the requirement for the feeder to exceed 250 volts to ground the kVA safety margin will improve substantially over what the code would accept for 208 volt systems. In the preceding example, if the 1000 amp feeder is 480 volts instead of 208, the kVA safety margin increases to over 200kVA. . Reducing this to a 15% margin constitutes a load of 120kVA. Clearly in a facility that has permanently fixed in place metering, with Qualified Personnel, a load of this magnitude will not appear on the system without due consideration. The logic and benefits increase with even higher voltages.

This provision of the code will help to encourage permanent metering which will support more efficient use and safer electrical systems.

Panel Meeting Action: Reject

Panel Statement: The submitter had not provided data to show that the Code requirement for maximum demand plus 25% is excessive when adding loads to existing installations.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

ARTICLE 225 — OUTSIDE BRANCH CIRCUITS AND FEEDERS

4-2 Log #1248 NEC-P04 **Final Action: Reject**
(225.1)

Submitter: John Masarick, Independent Electrical Contractors, Inc.

Comment on Proposal No: 4-11

Recommendation: Reject this proposal which would change 600 volts to 1000 volts.

Substantiation: Replacing 600 volts with 1000 volts will have a major impact on installers, component manufacturers, and industry standards. Increased spacing must be considered when going from 600 volts to 1000 volts. Personal safety must also be considered.

Because the proposer has not provided enough information to the public to justify and understand all the ramifications of the proposal, the committee should continue to reject the submitter's proposal.

Panel Meeting Action: Reject

Panel Statement: The acceptance of the original proposal does not mandate that all equipment and systems be operated at the elevated voltage but rather allows the operation at a higher level if necessary. This change is necessary to keep pace with changes in technology.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 2

Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: While I recognize that certain systems operate above 600V and the High Voltage Task Group wanted to increase the low voltage threshold from 600V to 1000V throughout the Code, I do not feel that adequate technical substantiation was ever provided to support this wholesale change. There was never any substantiation presented that increasing the voltage level from 600V to 1000V would not affect equipment and terminal spacing, arc /blast effects on overcurrent devices,or working clearances, to name a few. Without this information, I believe we ignore the basic tenet of the NEC as outlined in 90.1(A).

4-3 Log #622 NEC-P04 **Final Action: Accept**
(225.1, Informational Note)

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 4-11

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use today at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc

Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 2

Explanation of Negative:

STAFFORD, T.: Making a universal change for increasing the voltage level allowed on conductors and equipment will present different working parameters into which electrical workers will be exposed. Additional information is needed by this panel member as to: how working spaces will be required to change, arc fault/blast clearances that will be updated, testing and utilization equipment used by electrical workers, terminal clearances, etc.

It is agreed by this panel member that renewable energy installations are seeking higher thresholds for efficiency. At the same time it is recognized by this panel member that allowance of 1000 volt systems is going to present unique challenges and introduce confusion due to misinformation. For example, a PV (or other renewable system) could have been installed in 2010 (600 volt) and an additional system to be installed in 2015 (1000 volt) such that two different voltage threshold systems may be installed on the same premises. There is no indication to the electrician that two different systems are present, at different working voltages. This will lead to improper protective equipment, metering devices, conductor insulation types being installed. The list is long and does reflect concerns into the safety integrity of the system, as well as to the electrical worker.

Without a method required to verify and mandate safety by all listing, testing and verification agencies, this will lead to mistakes in the field resulting in damage to equipment or personnel safety. It is agreed that training and qualified workers are to be performing all work on all systems. NFPA 70E does require that all persons who face a risk of electrical hazard to understand the hazards in place. This panel members concern is that not all electrical workers will be aware of ALL hazards involved including an increased voltage level for which they do not have the proper equipment, or PPE to satisfy the voltage level. This will not be due to lack of knowledge but rather confusion into a system level of which they will be exposed without knowledge.

ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-4 Log #659 NEC-P04 **Final Action: Accept**
(225.1, Informational Note)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-11
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-5 Log #623 NEC-P04 **Final Action: Accept**
(Table 225.3)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-14
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use today at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc
Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-6 Log #660 NEC-P04 **Final Action: Accept**
(Table 225.3)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-14
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The

success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 2

Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-7 Log #1099 NEC-P04 **Final Action: Reject**
(225.4 Exception)

Submitter: John Sigmund, American Chemical Council

Comment on Proposal No: 4-16

Recommendation: Revise text to read as follows:

225.4

Exception: Equipment ~~grounding~~ bonding conductors and grounded circuit conductors shall be permitted to be bare or covered as specifically permitted elsewhere in this code.

Substantiation: The term Equipment Grounding Conductor needs to be replaced. Those opposed have no technical reason for their opposition or any other valid reason. It is not worth the effort and everyone understands what is meant are common responses.

It is very simple: Grounding electrode conductors are the connection to the earth and accomplish grounding. In the present NEC, Equipment Grounding Conductors and bonding jumpers provide a “path back” to the source. Both are always performing a bonding function. If the Grounding Electrode connection is removed or broken, the bonding function remains intact.

Section 250.4 does not permit the earth (ground) to be used as an effective ground fault current path but the term equipment grounding conductor inherently incorrectly contains the word “ground”.

Visualize equipment supplied by a portable generator. The generator frame is not required to be connected to the earth.

The “green” wire in the flexible cord is not performing a grounding function but is performing a bonding function.

Visualize building one supplied by a service, having the grounded conductor connected to the grounding electrode system by a grounding electrode conductor. A feeder supplies a second building and a grounding electrode conductor is required for grounding any equipment in the second building. An equipment grounding conductor is required to be installed from building 1 to building 2. Not for grounding, but for bonding, providing an effective fault current path.

Making this change has the added benefit of being more harmonized with other international standards and usage of terminology.

Experienced NEC users have to ignore other concepts in other definitions and requirements to use the existing term.

This does not help the future NEC user or provide clarity in the existing NEC. Changing the term is the right thing to do and should be supported.

Panel Meeting Action: Reject

Panel Statement: The term, equipment grounding conductor (EGC), is used throughout the code and is well understood. Making this change in 225.4 will conflict with the use of EGC throughout the code.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 2

Explanation of Negative:

GIBBS, M.: The panel should accept the original proposal. The proposal improves the technical accuracy of the use of the terms “equipment grounding conductor” and “equipment bonding conductor”. The IEEE has reviewed all the statements on this subject by various panels. The following represents the IEEE position on the issue of equipment grounding conductor or equipment bonding conductor. Similar proposals have been presented in the past and have been rejected. Reasons given often relate to cost, significant changes in documentation required, or the fact that knowledgeable people understand the use of this conductor. There is no justification for retaining an incorrect and potentially hazardous electrical installation just because this definition has been used in the NEC for many years. Costs associated with documentation changes should never be an argument where safety is concerned. Further, not all electrical practitioners are knowledgeable in the main intent of this conductor. The intent of the proposed change is to provide a descriptive name to a construction element that has resulted in much misunderstanding with possible hazardous operating conditions in electrical installations. The use of the term “grounding” implies that grounding is its principal function. Although grounding may be desirable, providing an effective fault current path (i.e. bonding) is and should be the emphasis. There are many who assert that a connection to a water pipe meets the needs of equipment grounding, however, this connection does not perform the necessary effective fault current path back to the source. There are two conductors described in the Code performing the same function but named differently. The “bonding jumper” is a short conductor that assures the electrical integrity of enclosure to raceway. The longer conductor, intended to provide a low impedance path to the source, is presently named a “grounding” conductor instead of its real function as a “bonding” conductor. Technically, the definition in Article 100 may be adequate for Panel members and those that teach. Practically, the definition is confusing if the terminology does not fit the function performed. The equipment bonding conductor, as it should be called, provides its primary function whether or not it is grounded. For a grounded system, it is grounded because the system is grounded. For an ungrounded system, it is grounded to limit the voltage due to a lightning strike or contact with a higher voltage system. Changing the name will assist in educating users of the Code as to why they are installing a conductor that needs to be continuous all of the way back to the source.

SIGMUND, J.: The term “equipment grounding conductor” needs to be replaced with “equipment bonding conductor” throughout the NEC. Yes, the term equipment grounding conductor in Article 100 would need to be changed to the term equipment bonding conductor.

Some have argued that it is just a problem of education. Having the word “grounding” in a term describing conductor that is used primarily for a bonding function is not a problem to be solved by education.

The use of the term “equipment grounding conductor” is confusing both for those new to the electrical industry and even for some experienced users. The problem is compounded when dealing with other international standards.

No technical reason has been provided for not making the change. This conductor always provides a bonding function but does not always provide a grounding function such as in the case of a portable generator installed as a separately derived system.

Comment on Affirmative:

ROGERS, J.: In reality this is a dual purpose conductor, under normal conditions the submitter is correct and this conductor simply serves to bond various metallic parts together thus limiting any potential differences. However, under fault conditions this conductor serves as the “effective ground fault current return path” and in essence is at that time an extension of the ground connection. The main issue is not what the conductor is called but rather the proper training of personnel that install or service electrical installations so that they clearly understand the importance of this conductive path and how it should be installed. The NEC cannot serve as a training guide and it is not intended to do so all the NEC can do is define proper installation techniques and the language in 225.4 Exception doesn’t define the term “equipment grounding conductor” it simply uses the term to address the fact that these conductors could be bare when part of a branch circuit or feeder. If Panel 5 chose to rename this conductor then I am sure that Panel 4 would accept that renaming and make the appropriate change in any of the Articles that are under the purview of Panel 4.

4-8 Log #1277 NEC-P04 **Final Action: Reject**
(225.4 Exception)

Submitter: Elliot Rappaport, Electro Technology Consultants

Comment on Proposal No: 4-16

Recommendation: Accept proposal.

Substantiation: The term “equipment grounding conductor” is not well understood as evidenced by the number of questions raised at inspectors’ code sessions and code classes

The term “equipment grounding conductor” has a definite purpose that is not uniquely expressed in the term, i.e. “bond the equipment to a terminal at the source of voltage”. As a result, there is a misconception that “grounding”, without bonding to the source, will make a system safe. On the contrary, connecting equipment to ground without providing the bonding connection back to the source can make equipment less safe by increasing the time to clear the fault.

There is generally insufficient significance placed on the importance of bonding over grounding. Bonding provides sufficient ground fault current back to the source of voltage to operate an overcurrent device and clear the fault quickly. Connection to ground limits the voltage to ground on normally non-current-carrying parts during non-fault conditions. During fault conditions, the value of grounding is minimal since the primary safety concern is to remove the fault voltage as quickly as possible. A path to ground for fault current is not necessary since ground fault current must return to the source of voltage, not to ground.

Renaming this conductor as an "Equipment Bonding Conductor (EBC)" will clarify that the primary purpose of this conductor is to bond to the source in order to provide a known path for ground fault current that will facilitate rapid fault clearing.

It is recognized that the term "EGC" has been in use for a long time and that changing it to EBC will cause some concerns including changing written literature that uses the EGC term. After the initial period of understanding, users will correctly understand the purpose of this conductor and this will enhance the safety of personnel.

The fundamental purpose of this and companion proposals is to clearly state that "systems" are "grounded" and "equipment" is "bonded". The fact that the bonding conductor may be grounded also is secondary to the primary function of bonding.

Panel Meeting Action: Reject

Panel Statement: The term, equipment grounding conductor (EGC), is used throughout the code and is well understood. Making this change in 225.4 will conflict with the use of EGC throughout the code.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 11 Negative: 1

Explanation of Negative:

GIBBS, M.: See my Explanation of Negative vote on 4-7.

Comment on Affirmative:

ROGERS, J.: See my affirmative comment on Comment 4-7.

4-9 Log #624 NEC-P04 **Final Action: Accept**

(225.8)

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 4-18

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use to day at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc

Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 2

Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-10 Log #661 NEC-P04 **Final Action: Accept**

(225.8)

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 4-18

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 2

Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-11 Log #625 NEC-P04 **Final Action: Accept**

(225.10)

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 4-19

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use to day at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc

Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-12 Log #662 NEC-P04 **Final Action: Accept**
(225.10)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-19
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-13 Log #626 NEC-P04 **Final Action: Accept**
(225.14)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-29
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use to day at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc

Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-14 Log #663 NEC-P04 **Final Action: Accept**
(225.14)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-29
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-15 Log #400 NEC-P04 **Final Action: Reject**
(225.18)

Submitter: Thomas L. Adams, Macomb, IL
Comment on Proposal No: 4-31
Recommendation: This Proposal should be rejected.
Substantiation: The present text of OSHA 1926.403(i) limits the requirements in that paragraph to applications up to 600 Volts. Changing the application of the text in 225.18 will create a conflict between the two documents causing voltages from 601 to 1000 Volts to be in violation of OSHA requirements. In addition, a Note within the OSHA document states that “If the electrical installation is made in accordance with the National Electrical Code ANSI/NFPA 70-1984, exclusive of Formal Interpretations and Tentative Interim Amendments, it will be deemed to be in compliance with 1926.403 through 1926.408, except for 1926.404(b)(1) and 1926.405(a)(2)(ii)(E), (F), (G), and (J).” This would further conflict with the proposed text without significant amendment.

Panel Meeting Action: Reject
Panel Statement: This proposal addresses electrical installations and OSHA addresses electrical safety in the workplace. Although OSHA utilizes the NEC, it is not intended to harmonize the NEC with OSHA requirements.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:

MCDANIEL, R.: It is recognized that increasing the voltage from 600 to 1000 volts may be applicable to specific installations. However, the change in these sections will create a conflict between the NEC and OSHA 1926.403(i).

ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-16 Log #627 NEC-P04 **Final Action: Accept**
(225.18)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-31
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the “ voltage threshold level” of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use to day at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc

Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-17 Log #664 NEC-P04 **Final Action: Accept**
(225.18)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-31
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-18 Log #401 NEC-P04 **Final Action: Reject**
(225.19)

Submitter: Thomas L. Adams, Macomb, IL
Comment on Proposal No: 4-32
Recommendation: This Proposal should be rejected.
Substantiation: The present text of OSHA 1926.403(i) limits the requirements in that paragraph to applications up to 600 Volts. Changing the application of the text in 225.19 will create a conflict between the two documents causing voltages from 601 to 1000 Volts to be in violation of OSHA requirements. In addition, a Note within the OSHA document states that "If the electrical installation is made in accordance with the National Electrical Code ANSI/NFPA 70-1984, exclusive of Formal Interpretations and Tentative Interim Amendments, it will be deemed to be in compliance with 1926.403 through 1926.408, except for 1926.404(b)(1) and 1926.405(a)(2)(ii)(E), (F), (G), and (J)." This would further conflict with the proposed text without significant amendment.
Panel Meeting Action: Reject
Panel Statement: This proposal addresses electrical installations and OSHA addresses electrical safety in the workplace. Although OSHA utilizes the NEC, it is not intended to harmonize the NEC with OSHA requirements.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
MCDANIEL, R.: It is recognized that increasing the voltage from 600 to 1000 volts may be applicable to specific installations. However, the change in these sections will create a conflict between the NEC and OSHA 1926.403(i).
ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-19 Log #628 NEC-P04 **Final Action: Accept**
(225.19)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-32
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use to day at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc
Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-20 Log #665 NEC-P04 **Final Action: Accept**
(225.19)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-32
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-21 Log #510 NEC-P04 **Final Action: Reject**
(225.22)

Submitter: Robert A. Jones, IEC Texas Gulf Coast
Comment on Proposal No: 4-36
Recommendation: Accept proposal 4-36.
Substantiation: Please explain the meaning of "suitable for wet locations". According to the UL White Book 2012 "Electrical Equipment for use in Ordinary Locations" there are four definitions: dry location, damp location, wet location, and outdoor use. Under the heading "Enclosure Types" are the terms raintight, rainproof, and watertight and these terms are also defined in Article 100. I submitted proposal 1-66 to define the phrase "suitable for wet locations" as an effort to establish the criterion that an exterior installation would be required to meet. I do not know of any listing as "suitable for wet locations". I have tried to find a technical paper or report about condensation within a conduit and I cannot locate such a document. Since the panel statement refers to condensation I assume there must be a technical report or study to support that statement and I respectfully request Panel 4 to direct me to that study or report.
I still contend that if the installation is in compliance with all NEC requirements, the interior of a raceway that is raintight will not have anything to drain.
Panel Meeting Action: Reject
Panel Statement: Condensation in raceways is a real problem. Provisions are necessary to drain and/or prevent condensation from filling the raceway system and possibly infiltrating equipment to which the raceway is connected.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

4-22 Log #629 NEC-P04 **Final Action: Accept**
(225.30(C))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-46
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use to day at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc
Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-23 Log #666 NEC-P04 **Final Action: Accept**
(225.30(C))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-46
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-24 Log #241 NEC-P04 **Final Action: Reject**
(225.30(F) (New))

Submitter: Jim Yancey, NC State Construction Office
Comment on Proposal No: 4-47
Recommendation: Clarifying proposal: Proposal was to allow additional generators at a building not paralleling generators which is what the committee addressed.
Substantiation: Same as submitted: I would like the committee to address as written above not from a parallel generator stand point which was not the intention. That was just an exception not the main request.
Panel Meeting Action: Reject
Panel Statement: Multiple generators are permitted by 225.30(A), (B), (C), and (D).
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12
Comment on Affirmative:
ROGERS, J.: It is unclear why you believe that 230.2 needs to be used to address this issue when the same allowances exist in 225.30. You are correct that these are feeders and not services and 225 should be used. It is also unclear if the use of the generators in question is cogeneration, load shedding or alternative power sources for either optional or required standby systems. Any of the allowances listed in 225.30 A through E permit the installation of more than one feeder to a building for these purposes. The language in the original proposal would not meet the requirements found in the NEC Manual of Style as it doesn't make a complete concise requirement.

4-25 Log #128 NEC-P04 **Final Action: Accept**
(225.33(A))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-14j
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7.
It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 4 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

4-26 Log #129 NEC-P04 **Final Action: Accept**
(225.38(C))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-14k
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7.
It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 4 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

4-27 Log #630 NEC-P04 **Final Action: Accept**
(225.50)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-66
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use today at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc

Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 2

Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-28 Log #631 NEC-P04 **Final Action: Accept**
(225, Part III)

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 4-67

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the “ voltage threshold level” of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use today at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc

Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 2

Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-29 Log #667 NEC-P04 **Final Action: Accept**
(225.50)

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 4-66

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 2

Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-30 Log #668 NEC-P04 **Final Action: Accept**
(225, Part III)

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 4-67

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative vote on Comment 4-2.

4-31 Log #130 NEC-P04 **Final Action: Accept**
(225.51 Exception)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-14l
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of “Metal Enclosed Power Switchgear” to “Switchgear” in Proposal 9-7.

It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 4 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

4-32 Log #1552 NEC-P04 **Final Action: Accept**
(225.52(A))

TCC Action: The Correlating Committee directs 225.52(A) be revised to comply with the NEC Style Manual as follows:
“A building or structure disconnecting means shall be located in accordance with 225.32, or, if not readily accessible, it shall be operable by mechanical linkage from a readily accessible point. For multibuilding industrial installations under single management, it shall be permitted to be electrically operated by a located readily accessible remote-control device in a separate building or structure...”
Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 4-69
Recommendation: Accept the proposal.
Substantiation: The proposal does address the location of the disconnecting means, just as surely as 230.205(A) does the same for medium voltage service disconnecting means. For campus-style industrial occupancies, a pole-mounted disconnect will often be placed in an outdoor feeder and not in conductors supplied directly by the utility. The safety concerns will be identical to those that prompted CMP 4 to previously accept a proposal by this submitter and place the parallel language in the service article.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

4-33 Log #247 NEC-P04 **Final Action: Accept**
(225.52(C))

Submitter: Edward G. Kroth, Verona, WI
Comment on Proposal No: 4-74
Recommendation: Proposal 4-74 should have been “Accepted in Principle.”
Substantiation: Proposals 4-73 and 4-74 both address 225.52(C) and both are reported as accepted. Since these two proposals have slightly different wordings, but the same intent, one of these should have been reported as accepted in principle. Proposal 4-73 from the task group is the one that should be accepted as it aligns with similar proposals that have been accepted by other CMPs and would therefore provide consistency with these other sections which was one of the intentions of the task group and my individual proposal.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

4-34 Log #1579 NEC-P04 **Final Action: Reject**
(225.52(F))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 4-79
Recommendation: Revise text to read as follows:
225.52 Disconnecting Means.
(F) Identification. Where a building or structure has any combination of feeders, branch circuits, or services passing through or supplying it, a permanent plaque or directory shall be installed at each feeder and branch-circuit disconnect location that denotes all other services, feeders, or branch circuits supplying that building or structure or passing through that building or structure and the area served by each. <u>If the building or structure is not required to have disconnects, the permanent plaque or directory as required above shall be installed at each point the circuits passing through enter.</u>
Substantiation: Let us start with the purpose of 225.51(F). I believe it is to protect electricians working on circuits in the building or structure and to protect firemen in the case they need to enter the building under emergency conditions.
The most extreme case is a building or structure that has no electrical equipment but has circuits feeding through it.
Panel Meeting Action: Reject
Panel Statement: All feeder and branch circuit conductors that either enter or pass through a building are already required to have a disconnect.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

9-9 Log #47 NEC-P09 **Final Action: Accept**
(225.70)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-86
Recommendation: The Correlating Committee directs that Panel 4 reconsider the panel action accepting the words “shall include consideration of the following” as the wording is not enforceable and consider changing the text to “shall include the following” or similar wording.

The Correlating Committee clarifies that Code-Making Panel 4 has accepted Proposal 4-89 to transfer the text in 225.70 for substations to Article 490 covering equipment over 600 volts. By this transfer of text, the jurisdiction of the definition of “substation” is now assigned to Code-Making Panel 9 and the existing text in 225.70 is transferred to a new section in Article 490.

The Correlating Committee directs that this proposal be forwarded to Code-Making Panel 9 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Accept the assignment of jurisdiction from the Correlating Committee over the technical content of Proposal 4-86. Accept the underlying proposal in principle. Revise the version of new 490.48 as accepted under Proposal 9-179 to incorporate the concepts presented in Proposal 4-86, and the corrections offered under Comments 9-78 and 9-79, as follows:

490.48. Substation Design, Documentation, and Required Diagram.

(A) Design and Documentation. Substations shall be designed by a qualified licensed professional engineer. Where components or the entirety of the substation are listed by a qualified electrical testing laboratory, documentation of internal design features subject to the listing investigation shall not be required. The design shall address but not be limited to the following topics and the documentation of this design shall be made available to the authority having jurisdiction.
1. Clearances and exits
2. Electrical enclosures
3. Securing and support of electrical equipment
4. Fire protection
5. Safety ground connection provisions
6. Guarding live parts
7. Transformers and voltage regulation equipment

8. Conductor insulation, electrical and mechanical protection, isolation, and terminations
9. Application, arrangement, and disconnection of circuit breakers, switches, and fuses
10. Provisions for oil filled equipment
11. Switchgear
12. Surge arrestors

(B) Diagram. A permanent single-line diagram of the switchgear shall be provided in a readily visible location within the same room or enclosed area with the switchgear and this diagram shall clearly identify interlocks, isolation means, and all possible sources of voltage to the installation under normal or emergency conditions, and the marking on the switchgear shall cross-reference the diagram.

Exception: Where the equipment consists solely of a single cubicle or metal-enclosed unit substation containing only one set of high-voltage switching devices, diagrams shall not be required.

Panel Statement: CMP 9 has generally adhered to the concepts presented in Proposal 4-86, but with some reorganization leading to improved list formatting. The change in sentence structure addresses the Correlating Committee reservation relative to enforceable text. CMP 9 has removed the phrase “engaged primarily in the design of substations” because engineers who make this topic their primary occupational focus are extremely unusual; CMP 9 prefers to rely on the word “qualified” which should be used to exclude engineers without experience performing this design work. Legal constraints strongly discourage unqualified engineering work and CMP 9 prefers to rely on those constraints and not overly burden the design process. CMP 9 has also incorporated a design exclusion for the internal detail of listed equipment, in accordance with the general code principles set forth in 90.7. CMP 9 modified the topics from those accepted under Proposal 4-86 as follows:

1. The “General” heading has been removed and the constituent parts divided under other topics. The “rooms and spaces” and the “exits” topics are combined into “clearances and exits” in order to confine the coverage to electrical issues covered in the NEC and avoid purely architectural subjects.
2. “Protective Grounding” is changed to terminology used in 490.47 and to avoid confusion with equipment and system grounding topics covered in Article 250.
3. The “fire extinguishing equipment” topic is broadened to “fire protection” to encompass fire separations and sprinkler provisions addressed in Article 450.
4. “Guarding Live Parts” is unchanged.
5. “Transformers and Regulators” becomes “Transformers and voltage regulation equipment if provided” to clarify the intent because the term “regulator” is undefined in the NEC.
6. The “Conductors” topic is rearranged to read as a simple list item.
7. The “Circuit Breakers, Switches, and Fuses” topic is rearranged to read as a simple list item; “Devices containing oil” is changed to “Provisions for oil-filled equipment” in a separate list item because other components should be included, such as capacitors.
8. The “Switchgear Assemblies” item is simplified to “Switchgear”; all switchgear is assembled from constituent parts and sub-assemblies.
9. “Metal-Enclosed Bus” is deleted because the topic is completely addressed in Article 368.
10. “Surge Arrestors” is unchanged.

CMP 9 believes that all topics addressed in this comment have had full public review because the changes made are either editorial, or where technical the changes reduce and do not exceed the reach of the requirements proposed in Proposal 4-86. The qualifications of the designing engineer are in the wording but reduced in degree from the original proposal. The proposal required documentation of the design by a qualified person; this wording requires the design to be done by a qualified person (clearly implied but not expressly stated in Proposal 4-86) and then addresses the required documentation and who will have access to it.

Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:

YOUNG, R.: The requirement “Substations shall be designed by a qualified licensed professional engineer” is overly restrictive. It should at least be changed to “Substations should be designed by a competent engineer” The word “competent” is well defined in dictionaries. The requirement for the designing engineer to have a PE should be left to each state or area to decide. Another option would be to state that “Substations shall be designed by qualified persons knowledgeable about the design, selection of equipment and materials and installation of them”. The over all list should be changed to appear as an informational note as to what should be considered in the design. In part (B), the word “current” should be used in lieu of the word “permanent”.

Comment on Affirmative:

BREITKREUTZ, B.: I agree to accept the comment and jurisdiction but proposal 4-86 should be rejected. State laws cover requirements for engineering and architectural documents to be by licensed professionals or not. State and local laws cover requirements for submittals of engineering and architectural documents for construction permits. Requiring submittal of engineering documents to the AHJ may conflict with law. Requirements for fire protection are covered by other codes and fire protection engineering is a separate discipline.

9-10 Log #48 NEC-P09 **Final Action: Accept**
(225.70)

TCC Action: The Correlating Committee directs that comment 3-31 and Proposal 3-94 be reported as accept to ensure that warning labels are adequately addressed in Article 300.
Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-87
Recommendation: The Correlating Committee understands that Code-Making Panel 4 has accepted Proposal 4-89 to transfer the text in 225.70 for substations to Article 490 covering equipment over 600 volts. By this transfer of text, the jurisdiction of the definition of “substation” is now assigned to Code-Making Panel 9 and the existing text in 225.70 is transferred to a new section in Article 490.

The Correlating Committee directs that this proposal be forwarded to Code-Making Panel 9 for action.

This action will be considered as a public comment by Code-Making Panel 9.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept

CMP 9 accepts jurisdiction over the topic presented in Proposal 4-87 and rejects the proposal.

Panel Statement: CMP 9 accepts jurisdiction over the topic presented in Proposal 4-87 and rejects the proposal.

CMP 9 agrees with the substantiation presented in proposal 4-88, which sets forth the locations where this topic is already covered in the NEC. With respect to conductors, CMP 9 finds the topic is better covered in Part II of Article 300. CMP 9 notes with concern that CMP 3 rejected the correlating Proposal 3-94, and requests the Correlating Committee review the Final Action by CMP 3 on this topic, as addressed by Comment 3-31.

Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.
Comment on Affirmative:

HARTWELL, F.: The Correlating Committee should strongly consider reporting Comment 3-31 as “Accept” in order to avoid a technical requirement from disappearing from the NEC without substantiation. The CMP 3 action on the underlying Proposal 3-94 was at least in part the result of circular reasoning, in that it relied on the existence of 225.80. Not all points of access to conductors are addressed in 314.72(E) and 490.53.

9-11 Log #49 NEC-P09 **Final Action: Accept**
(225.70)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-88
Recommendation: The Correlating Committee understands that Code-Making Panel 4 has accepted Proposal 4-89 to transfer the text in 225.70 for substations to Article 490 covering equipment over 600 volts. By this transfer of text, the jurisdiction of the definition of “substation” is now assigned to Code-Making Panel 9 and the existing text in 225.70 is transferred to a new section in Article 490.

The Correlating Committee directs that this proposal be forwarded to Code-Making Panel 9 for action.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP 9 accepts jurisdiction over the topic presented in Proposal 4-88 and accepts the proposal.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-12 Log #50 NEC-P09 **Final Action: Accept**
(225.70)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-89
Recommendation: The Correlating Committee understands that Code-Making Panel 4 has accepted Proposal 4-89 to transfer the text in 225.70 for substations to Article 490 covering equipment over 600 volts. By this transfer of text, the jurisdiction of the definition of “substation” is now assigned to Code-Making Panel 9 and the existing text in 225.70 is transferred to a new section in Article 490.

The Correlating Committee directs that this proposal be forwarded to Code-Making Panel 9 for action.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept

CMP 9 accepts jurisdiction over the topic presented in Proposal 4-89 and

accepts the proposal in principle. See panel action on 9-11.
Panel Statement: Not all of the material is suitable for 490.48. Refer to the action on Comment 9-11, which fully addresses the concerns presented in the substantiation for the underlying proposal (4-89).
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-13 Log #51 NEC-P09 **Final Action: Accept**
(225.70(A)(1))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-90
Recommendation: The Correlating Committee understands that Code-Making Panel 4 has accepted Proposal 4-89 to transfer the text in 225.70 for substations to Article 490 covering equipment over 600 volts. By this transfer of text, the jurisdiction of the definition of "substation" is now assigned to Code-Making Panel 9 and the existing text in 225.70 is transferred to a new section in Article 490.
The Correlating Committee directs that this proposal be forwarded to Code-Making Panel 9 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
CMP 9 accepts jurisdiction over the topic presented in Proposal 4-90 and rejects the proposal.
Panel Statement: See the action on Comment 9-10, which covers the same topic.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-14 Log #52 NEC-P09 **Final Action: Accept**
(225.70(A)(1))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-91
Recommendation: The Correlating Committee understands that Code-Making Panel 4 has accepted Proposal 4-89 to transfer the text in 225.70 for substations to Article 490 covering equipment over 600 volts. By this transfer of text, the jurisdiction of the definition of "substation" is now assigned to Code-Making Panel 9 and the existing text in 225.70 is transferred to a new section in Article 490.
The Correlating Committee directs that this proposal be forwarded to Code-Making Panel 9 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: See panel action on Comment 9-10.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-15 Log #53 NEC-P09 **Final Action: Accept**
(225.70(A)(1) Exception(c) (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-92
Recommendation: The Correlating Committee understands that Code-Making Panel 4 has accepted Proposal 4-89 to transfer the text in 225.70 for substations to Article 490 covering equipment over 600 volts. By this transfer of text, the jurisdiction of the definition of "substation" is now assigned to Code-Making Panel 9 and the existing text in 225.70 is transferred to a new section in Article 490.
The Correlating Committee directs that this proposal be forwarded to Code-Making Panel 9 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
CMP 9 accepts jurisdiction over the topic presented in Proposal 4-92 and continues the CMP 4 rejection of the proposal.
Panel Statement: See the action on Comment 9-10. The proposal substantiation principally addresses medium voltage cable tray installations in industrial occupancies. This topic is covered in 392.18(H) and must be addressed by CMP 8.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-16 Log #54 NEC-P09 **Final Action: Accept**
(225.70(A)(5))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-93
Recommendation: The Correlating Committee understands that Code-Making Panel 4 has accepted Proposal 4-89 to transfer the text in 225.70 for substations to Article 490 covering equipment over 600 volts. By this transfer of text, the jurisdiction of the definition of "substation" is now assigned to Code-Making Panel 9 and the existing text in 225.70 is transferred to a new section in Article 490.
The Correlating Committee directs that this proposal be forwarded to Code-Making Panel 9 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: This material is no longer in 225.70.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-17 Log #55 NEC-P09 **Final Action: Accept**
(225.70(A)(5)(b))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-94
Recommendation: The Correlating Committee understands that Code-Making Panel 4 has accepted Proposal 4-89 to transfer the text in 225.70 for substations to Article 490 covering equipment over 600 volts. By this transfer of text, the jurisdiction of the definition of "substation" is now assigned to Code-Making Panel 9 and the existing text in 225.70 is transferred to a new section in Article 490.
The Correlating Committee directs that this proposal be forwarded to Code-Making Panel 9 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
CMP 9 accepts jurisdiction over the topic presented in Proposal 4-94 and rejects the proposal.
Panel Statement: See the action on Comment 9-10, which covers the same topic.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

4-35 Log #1553 NEC-P04 **Final Action: Reject**
(225.80 and 225.81 (New))

TCC Action: The Correlating Committee advises that articles, article scopes, numbers, titles, and assignment of articles within Chapters are the responsibility of the Correlating Committee and the Correlating Committee rejects the panel action. Outdoor overhead conductors over 600 volts are considered a wiring method much the same as the articles in Chapter 3 and belongs with Panel 7. This action correlates with the Panel 7 action of reject on Proposal 7-83 and Comment 7-18.
Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 4-95
Recommendation: Continue to accept the proposal in the form accepted by CMP 4 at the ROP meeting.
Substantiation: This is a companion comment to one submitted to remove Article 399 from the NEC. The Correlating Committee should allow this relocation to move forward in the best interests of the NEC. Article 399 does not describe a wiring method; it describes how to engineer outdoor overhead medium voltage wiring. As such it does not belong in Chapter 3. In addition, it should not be a stand-alone article due to the nature of the coverage; it fits perfectly in Part III of Article 225. This portion of the NEC already overhead conductor clearances above open areas (225.60) and above buildings (225.61). This location not only fits editorially within an article entitled "Outdoor Feeders and Branch Circuits", it also assures the subject matter will be addressed by the most qualified panel to tackle the subject. The wiring employed for overhead medium voltage construction does not employ cable constructions and it would be necessary to provide additional personnel within CMP 7 to duplicate the expertise already present in CMP 4 in order to address this topic properly. Any one of these three reasons would be sufficient to justify the relocation; the three of them together make a solid case in terms of sound of code administration.
Panel Meeting Action: Accept
Panel Statement: CMP 4 respects the opinion of the Correlating Committee on Proposal 4-95, that is the subject of this comment. However, CMP 4 agrees with the submitter that these requirements are more appropriate for both the installer and the enforcer in Article 225. These installations are becoming more prevalent throughout the country and the majority of them meet the description

of a feeder. CMP 4 respectfully requests the Correlating Committee review their actions on this proposal.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ARTICLE 230 — SERVICES

4-36 Log #632 NEC-P04 **Final Action: Accept**
(Figure 230.1)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-96
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use today at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc

Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-37 Log #669 NEC-P04 **Final Action: Accept**
(Figure 230.1)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-96
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-38 Log #633 NEC-P04 **Final Action: Accept**
(230.2(C))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-98
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use today at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc

Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-39 Log #670 NEC-P04 **Final Action: Accept**
(230.2(C))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-98
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

(Sequence #4-41 through 4-56 moved to 4-57 on page 92)

2-118 Log #56 NEC-P02 **Final Action: Accept**
(230.2(F) (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-101
Recommendation: The Correlating Committee directs that this proposal be referred to Code-Making Panel 2 for action in 220.87.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
The Panel 2 action on Proposal 4-101 is reject.
Panel Statement: The panel accepts the Correlating Committee directive to act on Proposal 4-101. The suggestion to allow professional engineers to determine the demand factors for lighting loads is too broad for all of the situations involved in Article 220.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

2-119 Log #57 NEC-P02 **Final Action: Accept**
(230.2(F) (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-102
Recommendation: The Correlating Committee directs that this proposal be referred to Code-Making Panel 2 for action in 220.87.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
The Panel 2 action on Proposal 4-102 is Reject.
Panel Statement: The panel accepts the Correlating Committee directive to act on Proposal 4-102. The suggestion to allow third party agencies to determine the demand factors for lighting loads is too broad for all of the situations involved in Article 220.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

4-57 Log #582 NEC-P04 **Final Action: Accept**
(230.7(D) (New))

Submitter: Trevor N. Bowmer, Telcordia Technologies / Rep. Alliance for Telecommunications Industry Solutions (ATIS)
Comment on Proposal No: 4-106
Recommendation: Continue to reject this proposal as per Panel 4 action.
Substantiation: The Panel acted correctly in rejecting the proposed action. The function of the Intersystem Bonding Termination (IBT) should not be confused with a service disconnecting means.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

4-41 Log #402 NEC-P04 **Final Action: Reject**
(230.24)

Submitter: Thomas L. Adams, Macomb, IL
Comment on Proposal No: 4-108
Recommendation: This Proposal should be rejected.
Substantiation: The present text of OSHA 1926.403(i) limits the requirements in that paragraph to applications up to 600 Volts. Changing the application of the text in 230.24 will create a conflict between the two documents causing voltages from 601 to 1000 Volts to be in violation of OSHA requirements. In addition, a Note within the OSHA document states that “If the electrical installation is made in accordance with the National Electrical Code ANSI/NFPA 70-1984, exclusive of Formal Interpretations and Tentative Interim

Amendments, it will be deemed to be in compliance with 1926.403 through 1926.408, except for 1926.404(b)(1) and 1926.405(a)(2)(ii)(E), (F), (G), and (J).” This would further conflict with the proposed text without significant amendment.

Panel Meeting Action: Reject

Panel Statement: This proposal addresses electrical installations and OSHA addresses electrical safety in the workplace. Although OSHA utilizes the NEC, it is not intended to harmonize the NEC with OSHA requirements.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 2

Explanation of Negative:

MCDANIEL, R.: It is recognized that increasing the voltage from 600 to 1000 volts may be applicable to specific installations. However, the change in these sections will create a conflict between the NEC and OSHA 1926.403(i).

ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-42 Log #634 NEC-P04 **Final Action: Accept**
(230.24)

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 4-108

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

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NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use today at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc

Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 2

Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-43 Log #671 NEC-P04 **Final Action: Accept**
(230.24)

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 4-108

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 2

Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-44 Log #58 NEC-P04 **Final Action: Accept**
(230.30)

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 4-115

Recommendation: The Correlating Committee directs that the panel review all wiring methods in Chapter 3 for possible inclusion, as necessary.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Panel Statement: A CMP 4 task group reviewed the wiring methods as per the Correlating Committee recommendations. Their report was that no further wiring methods be included at this time.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

4-45 Log #1432 NEC-P04 **Final Action: Accept**
(230.30)

Submitter: Christel K. Hunter, Alcan Cable, a General Cable Company
Comment on Proposal No: 4-115
Recommendation: Add text to read as follows:
<u>(8) Type USE conductors or cables</u>
Substantiation: It would clarify the language to add "conductors or", since both single conductor USE and multiconductor USE cables are listed for direct burial and acceptable for use as service conductors.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

4-46 Log #1601 NEC-P04 **Final Action: Reject**
(230.40)

Submitter: Susan Newman Searce, Halls, TN
Comment on Proposal No: 4-118
Recommendation: Revise text to read as follows:
Exception No. 3: A single-family dwelling unit<u>,</u> ~~and~~ its accessory structures and <u>two-family dwellings</u> shall be permitted to have one set of service-entrance conductors run to each from a single service drop, set of overhead service conductors, set of underground service conductors, or service lateral.
Exception No. 4: ~~Two-family dwellings,~~ multifamily dwellings, and multiple occupancy buildings shall be permitted to have one set of service-entrance conductors installed to supply the circuits covered in Section 210.25.
Substantiation: The panel's statement refers to allowing multiple sets of mains for the purpose of supplying common loads as area lighting, alarms and other common loads. This proposal is intended to apply to one and two family dwellings only. There is a need for a limit to the number of "sets" applied to a one and two family dwelling for fire safety and the safety of the occupant loads. The task of meeting the panel's concerns for area lighting, alarms and other common loads can be accomplished by eliminating the "multiple" sets and allowing a single set of mains.
As an inspector, seeing 6 SETS of mains on a single family (or two family dwelling) is of my opinion a fire and life safety hazard that has been abused far too long. Under present code, two-family dwellings can have multiple sets of mains in various locations creating a hazard for occupants and safety.
Panel Meeting Action: Reject
Panel Statement: The existing language is intended to allow more than one set of service entrance conductors in order to comply with 210.25. Section 210.25 mandates the source of supply that is independent of any occupancy for the purpose of supplying common area lighting, alarms and other common loads.
Neither the panel statement nor the current NEC requirements allow multiple sets of service entrance conductors to be installed in a two family dwelling. The language allows one set of service entrance conductors to supply loads required by 210.25 in addition to those allowed for dwelling unit normal power.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

4-47 Log #1092 NEC-P04 **Final Action: Accept**
(230.40 Exception No. 1)

Submitter: Ron B. Chilton, Rep. NC Code Clearing Committee
Comment on Proposal No: 4-119
Recommendation: The Proposal should continue to be rejected, based on the Panel Statement.
Substantiation: The wording in the 2002 NEC permitted multiple services by *Exception No. 1* based on what 230.2(D) provided for services with different characteristics. The improper reference of being "defined" in 230.2 was also stated, for which there is no definition. In other words, there were stipulations placed on allowing other services.
A Proposal for the 2005 NEC submitted by Phil Simmons would have deleted the *Exception* as not needed since Section 230.2(D) already permitted additional services based on the conditions of that Section. The Code Making Panel rejected the proposal stating the *Exception* was needed for services of different characteristics for more than one occupancy, still using the 230.2(D) language of "different characteristics".
During the Comments meeting for the 2005 NEC, the Code Making Panel "Accepted in Principle" the Proposal and deleted the reference to different characteristics and left out the reference to 230.2(D) also, the (D) was deleted. Whether or not this was intended, it opened the door to suggest that for multiple-occupancy buildings any number of service laterals could be installed simply due to being a group of occupancies and for services as defined in 230.2, again with no definition. 230.2(D) is still present in the 2011 NEC, however since no reference is explained in 230.40, *Exception No. 1*, it seemed to suggest that for any building with multiple-occupancies, for any reason, any number of service laterals may be installed with no regard to size of the building or the other conditions set forth in 230.2 allowing additional services other than the ONE, as the main rule. Also lacking were considerations that disconnects be grouped when any number of laterals were installed from the same Utility transformer.
The Panel Statement reference that the allowances described in 230.40 and exceptions are intended to allow a separate set of service entrance conductors to each occupancy for "each classification" of service,......provided they are supplied by only one service drop or service lateral, clarifies that the provisions in Sections 230.2(A) through (D) do apply. There should be less confusion as to grouping of disconnects being required when meeting these requirements.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

4-48 Log #1478 NEC-P04 **Final Action: Accept**
(230.42(A))

Submitter: Charles R. Miller, Charles R. Miller Electrical Education and Training
Comment on Proposal No: 4-120
Recommendation: Accept this proposal with the following changes:
(A) General. The ampacity of service-entrance conductors shall not be less than either 230.42(A)(1), (A)(2) or (A)(3). Loads shall be determined in accordance with Part III, IV, or V of Article 220, as applicable. Ampacity shall be determined from 310.15. The maximum allowable current of busways shall be that value for which the busway has been listed or labeled.
(1) The sum of the noncontinuous loads plus 1125 percent of continuous loads
Exception: Grounded conductors that are not connected to an overcurrent device shall be permitted to be sized at 100 percent of the continuous and noncontinuous load.
(2) The sum of the noncontinuous load plus the continuous load after ~~conditions of use have been applied~~ <u>the application of any adjustment or correction factors</u>.
(3) The sum of the noncontinuous load plus the continuous load if the service-entrance conductors terminate in an overcurrent device where both the overcurrent device and its assembly are listed for operation at 100 percent of their rating
Substantiation: A similar proposal was submitted to reword the text in 210.19(A)(1) and 215.2(A)(1). The proposals were accepted in principal. The current text is not clear. Section 230.42(A) is specifying to multiply continuous loads by 125 percent and then apply the correction and/or adjustment factors. This is not how it is taught at NFPA seminars. It is also not the way example D(3)(a) is calculated in Informative Annex D. These are two different and separate calculations. One calculation considers continuous loads without considering the correction and/or adjustment factors. The other calculation considers correction and/or adjustment factors with all loads (continuous and noncontinuous) calculated at 100 percent.
Even the panel's statement on proposal 4-120 is vague... "The current text is clear that conditions of use must be considered in addition to continuous loading." Does this mean to multiply continuous loads by 125 percent and then apply the correction and/or adjustment factors, or does this mean to perform two separate calculations?
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

4-49 Log #635 NEC-P04 **Final Action: Accept**
(230.43)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-121
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.
The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.
It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage

threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use today at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc

Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 2

Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-50 Log #672 NEC-P04 **Final Action: Accept**

(230.43)

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 4-121

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 2

Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-51 Log #800 NEC-P04 **Final Action: Reject**

(230.44)

Submitter: John Sigmund, American Chemical Council

Comment on Proposal No: 4-133

Recommendation: Add new text as follows:

Such cable trays shall be identified with permanently affixed labels with the wording “Service-Entrance Conductors”. The labels shall be located so as to be visible after installation and placed with a spacing not to exceed 3 m (10 ft) so that the service-entrance conductors are able to be readily traced through the entire length of the cable tray.

<u>*Exception: Where not accessible (as applied to equipment), in industrial establishments where the conditions of maintenance supervision ensure that only qualified persons service the installation, cable tray system warning notices which include “Service Entrance Conductors” shall be located where necessary for the installation to assure safe maintenance and operation.*</u>

Substantiation: The requirement to placard all cable tray installations with warning notices every 3 m (10 ft) is not practical and should address the readability and potential hazards. Some cable tray installations may be at elevated locations in which it would not be practical to install and see warning notices. Some cable tray installations may extend thousands of feet and having to post a notice is not a reasonable requirement. This exception was approved in the ROP (Proposal 8-182) by Panel 8 for section 392.18(H), and the exception should be included in 230.44 to correlate with 392.18(H).

Panel Meeting Action: Reject

Panel Statement: Warning signs are not there to identify hazards solely for maintenance personnel but for all persons. Electrical system cable trays may be in close proximity to other mechanical or piping tray systems. This requirement will help non-electrically qualified personnel identify above ground tray systems that support medium voltage electrical cables.

When service cables enter a building using cable trays indication of that is essential to those that might service the installation. The fact that these installations are in industrial locations does not minimize the safety issues involved. The lengths of these would be limited by the requirements for the location of the disconnecting means and thus the labeling would be limited in nature to those lengths anyway.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 11 Negative: 1

Explanation of Negative:

SIGMUND, J.: The requirement to placard all cable tray installations with warning notices every 3 m (10 ft) is not practical and should address the readability and potential hazards. Some cable tray installations may be at elevated locations in which it would not be practical to install and see warning notices. Some cable tray installations may extend thousands of feet and having to post a notice is not a reasonable requirement. This exception was approved in the ROP (Proposal 8-182) by Panel 8 for section 392.18(H), and the exception should be included in 230.44 to correlate with 392.18(H). The Technical Correlating committee should resolve the new exception in 392.18(H) with this labeling required in 230.44

4-52 Log #636 NEC-P04 **Final Action: Accept**

(Table 230.51(C))

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 4-136

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use today at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc

Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 2

Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-53 Log #673 NEC-P04 **Final Action: Accept**

(Table 230.51(C))

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 4-136

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 2

Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

13-1 Log #59 NEC-P13 **Final Action: Accept**

(230.62(C) (New))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 4-139

Recommendation: The Correlating Committee directs that this proposal be sent to Code-Making Panel 13 for action in Article 700.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Revise 700.16 as follows:

700.16 Emergency Illumination. Emergency illumination shall include all required means of egress lighting, illuminated exit signs, and all other lights specified as necessary to provide required illumination.

Emergency lighting systems shall be designed and installed so that the failure of any individual lighting element, such as the burning out of a lamp, cannot leave in total darkness any space that requires emergency illumination.

Where high-intensity discharge lighting such as high and low-pressure sodium, mercury vapor, and metal halide is used as the sole source of normal illumination, the emergency lighting system shall be required to operate until normal illumination has been restored.

<u>Where an emergency system is installed, emergency illumination shall be provided in the area of the disconnecting means required by 225.31 and 230.70, as applicable, where the disconnecting means are installed indoors.</u>

Exception: Alternative means that ensure emergency lighting illumination level is maintained shall be permitted.

CMP 13 rejects the remainder of Proposal 4-139.

Panel Statement: CMP 13 accepts the direction of the correlating committee to take action on Proposal 4-139. CMP 13 accepts in principle in part Proposal 4-139.

CMP-13 agrees that normal supply equipment, at the point it enters a building or structure, should be provided with emergency illumination in buildings or structures with an emergency system.

CMP- 13 rejects the remainder of the proposal because it is under the purview of CMP-4.

CMP-13 does not agree with all of the submitter's substantiation.

Number Eligible to Vote: 21

Ballot Results: Affirmative: 21

4-54 Log #1263 NEC-P04 **Final Action: Reject**

(230.62(C) (New))

Submitter: Donald A. Ganiere, Ottawa, IL

Comment on Proposal No: 4-140

Recommendation: This proposal should be accepted.

Substantiation: While this rule may belong in the product standards, the NEC has a history of using code rules to influence the development of product standards. The acceptance of the proposal would result in changes in the product standards.

While an electrician may be able to safely perform work in a service panel without the proposed line side barrier with the use of appropriate PPE, there is no permission to do such work in the OSHA rules. It would be a very very rare case where the electrical safe work rules would permit work in the service panel with the line side energized in a dwelling unit or commercial occupancy. The only permitted method of doing this work would be to have the utility disconnect the service conductors before working in the enclosure that contains the service disconnect.

The lack of the proposed line side barrier makes it impossible, in most cases, to comply with the electrical safe work rules when working in an enclosure that contains the service disconnect.

Panel Meeting Action: Reject

Panel Statement: The submitter has not provided any new information.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

4-55 Log #637 NEC-P04 **Final Action: Accept**
(230.66)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-141
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use to day at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc
Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-56 Log #674 NEC-P04 **Final Action: Accept**
(230.66)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-141
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-58 Log #1053 NEC-P04 **Final Action: Reject**
(230.70)

Submitter: George M. Stolz, II, Quicksilver Electrical Training
Comment on Proposal No: 4-144
Recommendation: Accept the proposal, in whole, principle or part.
Substantiation: To rebut each of the panel's excuses:

1. All service disconnects I have seen have a means for locking the disconnect closed with a padlock, which is permissible by code. To claim that there is a security risk involved is misleading. Security and communication equipment often have means for continued use after power loss; security systems have battery backup, and POTS does not require local power to operate.
2. An exception can be added if the panel feels that inner city environments would be adversely affected by this change.
3. An exception can be added for services over 1000V.
4. An exception can be added to allow Special Permission.
5. Data was presented to the panel in the last code cycle (Proposal 4-132 2010 ROP) detailing two separate incidents which resulted in property damage explicitly
because the service disconnects were allowed inside. It was remarkable in both incidents that there were no loss of life.
6. In the cases mentioned in item #5 above, no covers were removed by unqualified personnel - but covers were removed by arc blasts that could have claimed the lives of several people.
7. 240.24(D) already prohibits overcurrent devices from installation in corrosive environments, and this section does nothing to add to that concept.

Billions will be spent on AFCI breakers that may or may not make an impact on electrical safety. This proposal has no appreciable cost impact yet would make an indelible difference in safety to both workers and occupants. The panel should reconsider it's decision.

This proposal focused on the disconnecting safety aspect of the problem, but having conduits piped into structures connected to utility transformers full of combustible
oil is another reason to keep disconnects outside.
Panel Meeting Action: Reject

Panel Statement: This comment does not comply with Section 4.4.5(c) of the NFPA Regulations Governing Committee Projects in that it does not provide text of the comment, including the wording to be added, revised (and how revised), or deleted.

The NEC permits installation of outdoor main disconnects. Requiring an outdoor main disconnect will cause issues for security and space conflicts in inner city environments. The decision on whether to place a service disconnect inside or outside belongs to the building owner and designer unless there is a duly authorized utility company requirement.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

Comment on Affirmative:

ROGERS, J.: Emergency responders are not required to enter a building to shut off the service disconnect and they should not do so. One of the reasons that CMP 4 has held fast to allowing the service to a building being supplied by only one service lateral or drop, is that this allows for the building to be disconnected by the utility company at the service point or prior to. There are far too many cases of arc flash incidents in any given year, however, the location of the service disconnect cannot be factually contributed to the cause of these incidents. There are many good reasons to install a service disconnect either outside or inside a building and the NEC should not mandate only one such location. The anecdotal evidence submitted is clearly not sufficient to justify such a draconian change. If the submitter has access to hard factual data that quantifies a link between the location of a service disconnect and arc flash incidents that should be submitted for review by Panel 4 during the next code change cycle.

4-59 Log #131 NEC-P04 **Final Action: Accept**
(230.71(A))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 9-14m

Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7.

It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 4 for action.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

4-60 Log #132 NEC-P04 **Final Action: Accept**
(230.75)

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 9-14n

Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7.

It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 4 for action.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

4-61 Log #638 NEC-P04 **Final Action: Accept**
(230.82)

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 4-154

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use today at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc

Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 2

Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-62 Log #675 NEC-P04 **Final Action: Accept**
(230.82)

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 4-154

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-63 Log #870 NEC-P04 **Final Action: Reject**
(230.82)

Submitter: C. Douglas White, Center Point Energy/Rep. Edison Electric Institute/Electric Light & Power Group
Comment on Proposal No: 4-154
Recommendation: This proposal should be rejected and the text should remain as printed in the 2011 NEC.
Substantiation: Self contained meters or meter sockets are not available at voltages above 600 Volts. Most utilities offering services above 600 Volts require transformer rated meters with utility metering cabinets to install metering voltage and current transformers.
Panel Meeting Action: Reject
Panel Statement: This proposal does not mandate that all electrical equipment be operated at 1000 volts. It simply allows products that are listed for use on voltages up to 1000 to be used on those voltages in accordance with any listing restrictions.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11 Negative: 1
Explanation of Negative:
ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-64 Log #1554 NEC-P04 **Final Action: Accept**
(230.82(3))

TCC Action: The Correlating Committee directs that the word "substantially" be deleted since it is vague and not enforceable and does not comply with Table 3.2.1 of the NEC Style Manual as follows: "….load served. A meter disconnect shall be legibly field marked on its exterior in a manner suitable for the environment as follows: ..."
Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 4-156
Recommendation: Accept the proposal.
Substantiation: Although it is certainly true that the service disconnect will always be marked as such, it is equally true that the meter disconnect switch, given its justified ratings, will generally qualify in terms of its equipment characteristics as a service disconnect. One of the most important areas of concern within code administration and enforcement is making sure that all parties (owner, contractor, and enforcer) are on the same page as to where, exactly, the service disconnect is located. This label sends a very clear message to look elsewhere. It has solved numerous disagreements and provoked many educational, productive, and even at times entertaining discussions in Massachusetts where it has been required for many cycles at this point. The comment in the voting is very much on point.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12
Comment on Affirmative:
STAFFORD, T.: Inclusion of a informational note does provide additional wording to increase safety. This proposal adds no additional requirement it wants to make sure all requirements are considered and verified.

4-65 Log #639 NEC-P04 **Final Action: Accept**
(230.95)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-158
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use today at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc
Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative Vote on 4-2.

4-66 Log #676 NEC-P04 **Final Action: Accept**
(230.95)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-158
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative vote on Comment 4-2.

4-67 Log #640 NEC-P04 **Final Action: Accept**
(230, Part III Title)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-160
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the “ voltage threshold level” of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use to day at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc

Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative vote on Comment 4-2.

4-68 Log #677 NEC-P04 **Final Action: Accept**
(230, Part III Title)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-160
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative vote on Comment 4-2.

4-69 Log #840 NEC-P04 **Final Action: Reject**
(230.201 (New))

Submitter: Gaylan Bishop, The University of North Carolina - Chapter Hill
Comment on Proposal No: 4-161
Recommendation: Accept the proposal as written except with a clarification of our original intent with the use of the "plus (+)" symbol in the original proposal.
(NEW) "230.201 Service Capacity" As an alternative to the feeder and service load calculations required by Parts III and IV of Article 220, service transformer and switchgear capacity for medium voltage services covered by this code shall be permitted to be based upon the method of Section 220.87 if the determination of capacity is made by a registered professional engineer or an individual under their supervision.
The proposed language now fits between 230.200 and 230.202.
Substantiation: The University of North Carolina supports the effort by the education facilities industry, represented by APPA.ORG's Standards Council, to bring the 2014 NEC in step with rapidly evolving energy codes by reducing the size of building services which have shown themselves to be significantly oversized for decades.
We repeat our recommendation that the *NFPA Research Foundation* fund an investigation into the degree to which oversized transformers – based upon outdated power density requirements and assumptions about electric load growth – increases hazards to electricians and wastes energy and materials. This concept cuts across several NEC committees and a Task Force is needed to help these committees move in the same direction.
We would like the Article 230 committee to permit open-ended engineering methods to "right-size" transformers and related service switchgear in the interest of reconciling the competing objectives of fire safety, flash hazard reduction, and energy conservation. We believe that trusting trained and licensed professional engineering consultants with open-ended approaches made available in Article 230 will be quicker to the goal.
We disagree with the panel statement: *"Article 220 already provides alternative calculation methods and in some cases the use of existing load use for these calculations. This proposal would be more appropriate for Article 220 and is addressed in 220.87."*
On the contrary: we believe that medium voltage services are handled differently than low voltage services; thus, we have edited our original proposed language to include an explicit reference to 220.87 in Part VIII of Article 230 which deals with "Services Exceeding 600Volts, Nominal". It might be a bad idea to take a step in this direction now, in anticipation that service voltage classifications will be raised to a new cut-off of 1000V in the near future.
Panel Meeting Action: Reject
Panel Statement: Application of Article 220 in the initial sizing of electrical systems has had a successful history in providing sufficient system ampacity to serve facilities for decades. Section 220.87 allows alternate load calculation methods.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

4-73 Log #133 NEC-P04 **Final Action: Accept**
(230.204(A) Exception)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-14o
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7.
It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 4 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

4-74 Log #1321 NEC-P04 **Final Action: Hold**
(230.208, Informational Note)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 4-160
Recommendation: Revise text to read as follows:
VIII. Services Exceeding 1000 Volts, Nominal
230.208 Protection Requirements.
Informational Note: See 310.15 for ampacities of conductors rated 2000 volts and below. See Table 310.60(C)(67) through Table 310.60(C)(86) for ampacities of conductors rated 2001 volts and above.
Substantiation: Part VIII of 230 is for 1000 volts or above. The original informational note references ampacity only for 2001 volts and above.
Panel Meeting Action: Hold
Panel Statement: This comment was held because it would introduce a concept that has not had public review by being included in a related proposal as published in the Report on Proposals.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

4-75 Log #641 NEC-P04 **Final Action: Accept**
(230.208(B))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-164
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.
The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.
It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.
NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.
There are meters and other test instruments readily available for use today at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:
Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc
Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc
In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative vote on Comment 4-2.

4-76 Log #678 NEC-P04 **Final Action: Accept**
(230.208(B))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-164
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.
The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC

systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative vote on Comment 4-2.

4-77 Log #134 NEC-P04 **Final Action: Accept**
(230.211)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-14p
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7.

It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 4 for action.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

4-78 Log #135 NEC-P04 **Final Action: Accept**
(230.212)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-14q
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7.

It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 4 for action.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ARTICLE 240 — OVERCURRENT PROTECTION

10-6 Log #736 NEC-P10 **Final Action: Accept**
(240.1)

TCC Action: The Correlating Committee advises that article scope statements are the responsibility of the Correlating Committee and the Correlating Committee Accepts the panel action.Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 10-16
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

10-7 Log #1249 NEC-P10 **Final Action: Reject**
(240.1)

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 10-16
Recommendation: Reject this proposal which would change 600 volts to 1000 volts.
Substantiation: Replacing 600 volts with 1000 volts will have a major impact on installers, component manufacturers, and industry standards. Increased spacing must be considered when going from 600 volts to 1000 volts. Personal safety must also be considered.

Because the proposer has not provided enough information to the public to justify and understand all the ramifications of the proposal, the committee should reject the submitter's proposal.
Panel Meeting Action: Reject
Panel Statement: The substantiation does not include the specific safety issues that would arise as a result of the change from 600 to 1000 volts. See the substantiation provided on Comment 10-6.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

10-8 Log #1012 NEC-P10 **Final Action: Accept**
(240.4)

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 10-18
Recommendation: Reject the proposal.
Substantiation: This proposal didn't include any examples of real-world problems. The substantiation claims that "Persons could look at the conductor size and install larger overcurrent protection." While this is indeed true, we can't start making Code rules based on this logic. If we were to accept all of the proposals that contain this type of anecdotal substantiation we would have a three thousand page Code book in a matter of 6 years.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11 Negative: 1
Explanation of Negative:
KAUER, R.: There is an issue when conductors are increased in size and the reason for the increase is not readily apparent due to the conductors being concealed. It makes it very difficult to determine the correct overcurrent protective device for future repairs and replacements when these conditions exist. Labeling of the conductors, when oversized, with the maximum overcurrent protective device size will help future repairs and replacements be made in a safe and code compliant manner.

10-9 Log #1390 NEC-P10 **Final Action: Accept**
(240.4)

Submitter: Dennis Darling, Stantec Consulting Ltd.
Comment on Proposal No: 10-18
Recommendation: Reject the proposal.
Substantiation: The submitter has provided no substantiation that a problem exists and the proposed change places an undue burden on the installer.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11 Negative: 1
Explanation of Negative:
KAUER, R.: See my explanation of negative vote on Comment 10-9.

10-10 Log #1420 NEC-P10 **Final Action: Accept**
(240.4)

Submitter: Keith Fager, Bayer CropScience
Comment on Proposal No: 10-18
Recommendation: The panel action should have been Reject and the proposed Section 240.11 should be deleted.
Substantiation: It is not practical to document the electrical design by adding field labels and tags to the equipment and conductors. If half of the conductors originating in a fully utilized 42 pole panel are derated for temperature, each of the 21 circuits would have to be tagged at the panel. The exact location of the tags is not specified in the proposed section, but it would seem they would have to be located inside the panel and attached to the respective conductors. Inside the panel, they should only be accessible by qualified persons. As pointed out by R. Sobel, a qualified person would not assume there is spare capacity on an oversized conductor.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11 Negative: 1
Explanation of Negative:
KAUER, R.: See my explanation of negative vote on Comment 10-9.

10-11 Log #1122 NEC-P10 **Final Action: Reject**
(240.11)

Submitter: Phil Simmons, Simmons Electrical Services
Comment on Proposal No: 10-18
Recommendation: Revise the text of the 2014 NEC ROP Draft as follows:
Exception: <u>The marking shall not be required</u> where conditions of maintenance and engineering supervision ensure that only qualified persons monitor, service, and document the system.
Substantiation: The 2011 NEC Style Manual in 3.1.4.1 requires that exceptions be stated in complete sentences. This Comment is intended to make the exception comply without making other than editorial changes.
Panel Meeting Action: Reject
Panel Statement: The submitter has provided guidance to address editorial language revisions to align with the NEC style manual. This action is no longer necessary due to the panel rejecting the language of the original proposal. See panel action on Comments 10-8, 10-9, and 10-10.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

10-12 Log #737 NEC-P10 **Final Action: Accept**
(240.13)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 10-24
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.
The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.
The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.
Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.
Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.
If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

10-13 Log #136 NEC-P10 **Final Action: Accept**
(240.21(B)(1)(2&3))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-14r
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7.
It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 10 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept
Panel Statement: CMP-10 accepts the direction of the NEC Correlating Committee to take action on Proposal 9-14r.
CMP-10 accepts the action on Proposal 9-14r.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

10-14 Log #1124 NEC-P10 **Final Action: Accept in Principle**
(240.21(B)(1) Exception (New))

TCC Action: The Correlating Committee directs, for clarity and compliance with Style Manual 2.6.1, that the proper location of the Exception is under 240.21(B)(1)(1)b and the title of the Exception should be: "Exception to b."
Submitter: Phil Simmons, Simmons Electrical Services
Comment on Proposal No: 10-32
Recommendation: Revise the existing text of the 2011 NEC as follows:
Exception: Listed surge protective device(s) (SPD) shall be permitted to be installed in accordance with 285.23 or 285.24.
Substantiation: The 2011 NEC Style Manual in 3.1.4.1 requires that exceptions be stated in complete sentences. This Comment is intended to make the exception comply without making other than editorial changes.
Panel Meeting Action: Accept in Principle
Modify the exception to read:
Exception: Where listed equipment, such as surge protective device(s) (SPDs), are provided with specific instructions on minimum conductor sizing, the ampacity of the tap conductors supplying that equipment shall be permitted to be determined based on the manufacturer's instructions.
Panel Statement: The exception was modified by CMP-10 for clarity and to additionally apply to other non-energy consuming devices.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12
Comment on Affirmative:
MANCHE, A.: The location of the exception is not clear based on the panel action in proposal 10-32 and comment 10-14. The exception should be located as an exception to 240.21(B)(1)(1)(b).

10-15 Log #137 NEC-P10 **Final Action: Accept**
(240.21(C)(2), 3)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-14s
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7.
It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 10 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-10 accepts the direction of the NEC Correlating Committee to take action on Proposal 9-14s.
CMP-10 accepts the action on Proposal 9-14s.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

10-16 Log #1123 NEC-P10 **Final Action: Accept in Principle**
(240.21(C)(2) Exception (New))

Submitter: Phil Simmons, Simmons Electrical Services
Comment on Proposal No: 10-39
Recommendation: Revise the existing text of the 2011 NEC as follows:
Exception: Listed surge protective device(s) (SPD) shall be permitted to be installed in accordance with 285.23 or 285.24.
Substantiation: The 2011 NEC Style Manual in 3.1.4.1 requires that exceptions be stated in complete sentences. This Comment is intended to make the exception comply without making other than editorial changes.
Panel Meeting Action: Accept in Principle
Modify the exception to read:
Exception: Where listed equipment, such as surge protective device(s) (SPDs), are provided with specific instructions on minimum conductor sizing, the ampacity of the tap conductors supplying that equipment shall be permitted to be determined based on the manufacturer's instructions.
Panel Statement: The exception was modified by CMP-10 for clarity and to additionally apply to other non-energy consuming devices.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

10-17 Log #1393 NEC-P10 **Final Action: Accept**
(240.21(C)(3))

Submitter: Dennis Darling, Stantec Consulting Ltd.
Comment on Proposal No: 10-42
Recommendation: Revise the opening paragraph as follows:
(3) Industrial Installation Secondary Conductors Not over 7.5 m (25 ft) Long. For the supply of switchgear or switchboards in industrial installations only, where the length of the secondary conductors does not exceed 7.5 m (25 ft) and complies with all of the following:
Substantiation: The text should read: "For the supply of switchgear or switchboards."
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

10-18 Log #738 NEC-P10 **Final Action: Accept**
(240.61)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 10-50
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.
The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.
The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.
Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.
Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.
If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

10-19 Log #739 NEC-P10 **Final Action: Accept**
(240.83)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 10-51
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

10-20 Log #358 NEC-P10 **Final Action: Accept**
(240.87)

TCC Action: The Correlating Committee understands that the text of 240.87 was changed by the Panel Action on Comment 10-24.
Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 10-53a
Recommendation: Revise text to read as follows:
240.87 ~~Noninstantaneous Trip~~ Arc Energy Reduction.
The remaining text is unchanged from that accepted in the Panel Action on Proposal 10-53a.
Substantiation: NEMA supports the Panel Action to "Accept in Principle" Proposal 10-53a. We also recommend that the title should additionally be changed to "Arc Energy Reduction" as it better reflects the true intent of this requirement.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

10-21 Log #451 NEC-P10 **Final Action: Reject**
(240.87)

Submitter: Carl Fredericks, American Chemistry Council
Comment on Proposal No: 10-57
Recommendation: Accept Proposal 10-57.
Substantiation: Application of 240.87 should not be required for Supervised Industrial Installations where work practices and available PPE protect the workers from potential arc flash hazards. As a minimum and as commented in my explanation of negative vote to the panel action, an exception should be allowed for Supervised Industrial Installations where a non-orderly shutdown will introduce additional or increased hazards, similar to the exemption from GFPE requirements that is provided in 240.13. An energy-reducing switch introduces the possibility of a false trip whenever it is engaged, not just when an arc flash occurs. Alternative allowed protection means such as zone-selective interlocking do not extend past the equipment in question and so do not cover feeder breakers.
Panel Meeting Action: Reject
Panel Statement: CMP-10 continues to support the rejection of Proposal 10-57 with the same statement: The arc-flash hazards mitigated by the requirements of 240.87 are just as real and just as serious in a supervised industrial installation as they are in all other installations.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:

DARLING, D.: The Panel should have accepted the comment. The IEEE agrees with the commenter's substantiation that a non-orderly shutdown due to a false trip or unplanned event can add to the hazards, which may not be solely electrical in nature. A risk analysis needs to be performed to determine what is necessary for effective mitigation of injury to personnel from the hazards of arc flash.

FREDERICKS, C.: I'm voting negative on the panel action; the panel action should have been to Accept. As in the ROP stage, the panel statement has not responded at all to the technical substantiation provided with this comment, or to the substantiation that was provided with Proposal 10-57, or my explanation of negative vote on Proposal 10-57.

The panel's statement that arc flash hazards are as serious in Supervised Industrial Installations was never disputed. But even so, many Supervised Industrial Installations have significantly better safety records than general commercial and industry installations, and have successfully managed the associated hazards much better than national averages. There are also hazards that must be addressed in addition to arc flash in some Supervised Industrial Installations, which the requirements of 240.87 are not compatible with and this comment was intended to address.

10-22 Log #763 NEC-P10 **Final Action: Accept in Principle**
(240.87)

Submitter: Rob Redfoot, Eaton Corp.
Comment on Proposal No: 10-54
Recommendation: Revise text to read as follows:

~~Non-instantaneous Trip~~ Arc Energy Reduction: Where a circuit breaker without an instantaneous trip rated for, or can be adjusted to 1000 Amperes or more is utilized, one of the following or approved equivalent means shall be provided:

(1) Zone-selective interlocking
(2) Differential relaying
(3) Energy-reducing maintenance switching with local status indicator

Substantiation: The panel acknowledges that arc flash hazards may increase if circuit breaker does not have instantaneous trip. The problem is that even though a breaker has instantaneous trip, it does no good if the arcing fault current is not in the range of the instantaneous trip. IEEE estimates arcing faults currents to be 30% - 50% of bolted fault currents. At these fault levels the instantaneous protection will often not come into play even when the breaker is equipped with instantaneous protection. The goal of the submitter is to get the circuit breaker to trip instantaneously during a fault event to minimize the hazard. This is a worthy goal and seems to be the intent of this article.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and statement on Comment 10-24.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:

DARLING, D.: See my negative statement for comment 10-24.

FREDERICKS, C.: I'm voting negative on the panel action; the panel should have accepted the title change only. Please see my explanation of negative vote provided for Comment 10-24.

10-23 Log #946 NEC-P10 **Final Action: Accept in Part**
(240.87)

Submitter: Ed Larsen, Schneider Electric USA
Comment on Proposal No: 10-53a
Recommendation: Revise text to read as follows:
240.87 ~~Noninstantaneous Trip~~Arc Energy Reduction. Where a circuit breaker:
~~(1) Utilizes short time delay and~~
(~~2~~1) Does not have an adjustable instantaneous trip function ~~engaged and~~ set below the arcing current or
(~~3~~2) Does not have an instantaneous override or the instantaneous override setting is above the arcing current then (A) and (B) shall apply.
(A) Documentation. Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the circuit breaker(s).
(B) Method to Reduce Clearing Time. One of the following means shall be provided:
(1) Zone-selective interlocking or
(2) Differential relaying or
(3) Energy-reducing maintenance switching with local status indicator or
(4) Energy-reducing active arc flash mitigation system or
(5) An approved equivalent means
Substantiation: Arc energy reduction is the subject of this section. The Panel should have accepted the part of ROP 10-54 that proposed changing the title of the section.
The concern of the Panel appears to be having an instantaneous trip or some other clearing time reduction method set below the level of arcing current. If this is the case, as indeed it should be, then the presence or absence of a short time delay function has nothing to do with it and should be deleted. Further, the Panel's concern for the instantaneous override setting should be extended to the adjustable instantaneous setting as well.
The insertion of "or" in (B)(4) corrects what seems to be an oversight.
Panel Meeting Action: Accept in Part
CMP-10 accepts the revision to the section title.
CMP-10 rejects the remainder of the proposed revision.
Panel Statement: CMP-10 rejects the proposed revisions to the list items because they have been deleted in the action on Comment 10-24.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11 Negative: 1
Explanation of Negative:
DARLING, D.: See my negative statement for comment 10-24.

10-24 Log #1180 NEC-P10 **Final Action: Accept in Principle in Part**
(240.87)

Submitter: Christopher G. Walker, Eaton Corporation
Comment on Proposal No: 10-53a
Recommendation: Revise text to read as follows:
240.87 ~~Noninstantaneous Trip~~ Arc Energy Reduction. Where a circuit breaker:
(1) ~~Utilizes short time delay~~ Rated 1,000Amps and above and
(2) Does not have an adjustable instantaneous trip function engaged ~~and~~
~~(3) Does not have an instantaneous override or the instantaneous override setting is above the arcing current~~ then (A) and (B) shall apply.
(A) Documentation. Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the circuit breaker(s).
(B) Method to Reduce Clearing Time. One of the following means shall be provided:
(1) Zone-selective interlocking or
(2) Differential relaying or
(3) Energy-reducing maintenance switching with local status indicator or
(4) Energy-reducing active arc flash mitigation system
(5) An approved equivalent means
Informational Note No. 1: An energy-reducing maintenance switch allows a worker to set a circuit breaker trip unit to "no intentional delay" to reduce the clearing time while the worker is working within an arc-flash boundary as defined in NFPA 70E-2009, Standard for Electrical Safety in the Workplace, and then to set the trip unit back to a normal setting after the potentially hazardous work is complete.
Informational Note No. 2: An energy-reducing active arc flash mitigation system helps in reducing arcing duration in the electrical distribution system. No change in circuit breaker or the settings of other devices is required during maintenance when a worker is working within an arc-flash boundary as defined in NFPA 70E-2012, Standard for Electrical Safety in the Workplace.
Substantiation: The first change is to correct the title to "Arc Energy Reduction" as that is the intent of this section. This aligns with the NEMA affirmative comment by Mr. A. Manche.
The language accepted at the ROP meetings could extend the interpretation of this requirement to apply to many smaller molded case circuit breakers which were not originally intended to be addressed, (down to a 225A frame based upon products available from at least one manufacturer).
The ROP accepted language also makes it extremely difficult for the AHJ to enforce as they must now determine arcing currents for each circuit breaker being inspected.
In the panel statement to the rejection of Proposal 10-54, it is understood that the 1000A level is not the sole criteria for increasing arc flash hazards, but recognizes that not having an instantaneous trip affects it too. This comment proposes that BOTH 1000A AND the instantaneous trip engagement be used as the determining factor. This removes the requirement from the smaller molded case breakers which were not originally intended to be addressed. It also makes the applicability of this requirement clear and enforceable by the AHJ.
Panel Meeting Action: Accept in Principle in Part
Revise comment to read as follows:
240.87 Arc Energy Reduction. Where the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated or can be adjusted is 1200 amperes or higher then (A) and (B) shall apply.
(A) Documentation. Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the circuit breaker(s).
(B) Method to Reduce Clearing Time. One of the following or approved equivalent means shall be provided:
(1) Zone-selective interlocking or
(2) Differential relaying or
(3) Energy-reducing maintenance switching with local status indicator or
(4) Energy-reducing active arc flash mitigation system or
(5) An approved equivalent means
Informational Note No. 1: (no change)
Informational Note No. 2: An energy-reducing active arc flash mitigation system helps in reducing arcing duration in the electrical distribution system. No change in circuit breaker or the settings of other devices is required during maintenance when a worker is working within an arc-flash boundary as defined in NFPA 70E-2012, *Standard for Electrical Safety in the Workplace*.
Panel Statement: CMP-10 accepts the title change to better reflect the subject. The panel rejected the proposed revisions to items (2) and (3) because the panel has deleted those list items to provide clarity for this requirement. The panel increased 1000 to 1200 amperes to limit the number of circuit breakers affected.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 9 Negative: 3
Explanation of Negative:
DARLING, D.: The following is a quote from the ROP on Proposal 10-54: "Panel Statement: Arc-flash hazards are not increased simply because the ampere rating of a circuit breaker equals or exceeds 1000 amperes. Arc-flash hazards however may be increased when the circuit breaker does not have an instantaneous trip capability." The Panel action on this Comment contradicted the earlier panel statement. The Panel offered no technical substantiation for including these requirements for all breakers 1200A and above and did not explain in the panel statement the ramifications of deleting lines two and three. The comment as revised by the Panel expanded the requirement to include breakers with instantaneous trip which the original proposal continued to exclude. The panel discussion indicates that instantaneous trip is a useful criteria for limiting arc flash hazard but this should be made clear in the code language itself. The comment should be revised to continue to exclude breakers with instantaneous trip. A risk analysis needs to be performed to determine what is necessary for effective mitigation of injury to personnel from the hazards of arc flash.
FREDERICKS, C.: I disagree with the panel action; the panel should have accepted the title change only. There was no substantiation provided that breakers rated at and above either 1000 or 1200 amperes have increased arc flash hazards just based on their size, as the panel correctly stated at the ROP stage. The comment and the accepted code text do not even contain an arc flash energy level target, so will result in an unnecessary requirement for some installations and could give an unwarranted belief about safety for others.
Also I believe the panel action in deleting item (2) from the existing 240.87 text is a significant error, because the code text no longer acknowledges that that a breaker instantaneous function could meet the intent of the 240.87 requirement. If the breaker has an instantaneous function engaged that is responsive to the minimum arcing current, then no energy reduction below that is possible, even with an additional maintenance switch or any other additional provision.
The change in deleting item (2) from the existing 240.87 text was not requested by the submitter and was not substantiated in the panel statement, so I believe that is a further reason this part of the panel action is in error. If this part of the panel action remains in place after the written ballot, I believe it should be reviewed by the Correlating Committee.
An additional editorial problem in the accepted text is that (B)(5) is redundant to text in (B); I believe this should be corrected editorially regardless.
Please see also my explanations of negative vote provided for Comments 10-21 and 10-28.
VARTANIAN, J.: At the review of the comments for this proposal, the changes made removed a key part of 240.87. Removal of the instantaneous trip function removes a significant part the limitation of an arc-flash hazard, using the circuit breaker rating of 1200 amps does not take the place of limiting the arc-flash hazard. Additional clarity is needed in the text to address limiting the arc-flash hazard. Comment 10-24 along with proposal 10-53a must be rejected and the language returned to the 2011 language until acceptable language can be developed and supported by the industry.

Comment on Affirmative:

KAUER, R.: Code Panel 10 did not make it clear that the instantaneous breaker should be accepted as a means to mitigate arc flash energy. If the instantaneous function is permitted as an alternative means to mitigate the arc energy, than it should have been added to the list of solutions.

Because it is not spelled out in the code language, the authority having jurisdiction in one part of the country may accept the instantaneous function as an alternative method and an inspector in another part may not. I don't believe that the way it is written now, that we have good code language that is enforceable. I know that it does not say that instantaneous function cannot be used but it does not say that it can.

10-25 Log #1181 NEC-P10 **Final Action: Accept in Principle**
(240.87)

Submitter: Christopher G. Walker, Eaton Corporation
Comment on Proposal No: 10-54
Recommendation: This proposal should have been accepted.
Substantiation: The language accepted at the ROP meetings could extend the interpretation of this requirement to apply to many smaller molded case circuit breakers which were not originally intended to be addressed, (down to a 225A frame based upon products available from at least one manufacturer).

The ROP accepted language also makes it extremely difficult for the AHJ to enforce as they must now determine arcing currents for each circuit breaker being inspected. This proposal makes the applicability of this requirement clear and enforceable by the AHJ.

Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and statement on Comment 10-24.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:

DARLING, D.: See my negative statement for comment 10-24.

FREDERICKS, C.: I'm voting negative on the panel action; the panel action should have been to Reject. Please see my explanation of negative vote provided for Comment 10-24.

10-26 Log #1391 NEC-P10 **Final Action: Reject**
(240.87)

Submitter: Dennis Darling, Stantec Consulting Ltd.
Comment on Proposal No: 10-53a
Recommendation: Accept the ROP text except change the word "utilizes" in the second line to "uses."
Substantiation: The NEC Style Manual Section 3.3.4 indicates that the word "use" should be used rather than "utilized". The use of "utilized" is not clear in this context.
Panel Meeting Action: Reject
Panel Statement: CMP-10 rejects the proposed revision to the list item because it has been deleted in the action on Comment 10-24.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

10-27 Log #1394 NEC-P10 **Final Action: Reject**
(240.87)

Submitter: Dennis Darling, Stantec Consulting Ltd.
Comment on Proposal No: 10-53a
Recommendation: Accept the ROP text with the following new Informational Note No. 1 and increment the numbers of the other two Informational Notes by one.

New Informational Note No. 1: It should be understood that even with the application of any mitigation techniques, the arc flash hazard may still be above that which is suitable for personnel protection. Specific use of a protective function without corresponding engineering analysis may not lead to improved safety.

Substantiation: The first step for any worker should be to establish an electrically safe work condition as defined in NFPA 70E. Subsequent work on any energized equipment should only be performed after evaluating the risks and suitable mitigation methods. The language as written implies that it is safe to work if the mitigation techniques in (A) or (B) are employed. As written, it would be almost required to employ one of the techniques in section (B). In addition, it should be understood that even with the application of mitigation techniques the arc flash hazard may still be above that is suitable for personnel protection.
Panel Meeting Action: Reject
Panel Statement: The NEC is an installation code. The proposed informational note references "work practices" which are covered in NFPA 70E, *Standard for Electrical Safety in the Workplace*.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11 Negative: 1
Explanation of Negative:

DARLING, D.: The panel should have accepted the comment. The language proposed did not mention work practices included in the panel statement as the basis for rejection. This new Informational Note is intended to enhance personnel safety by informing users that simply complying with the requirements of the Code without performing any risk analysis may not provide the necessary protection for personnel.

10-28 Log #586 NEC-P10 **Final Action: Reject**
(240.87 Exception (New))

Submitter: Charles L. Powell, Eastman Chemical Company
Comment on Proposal No: 10-59
Recommendation: Add the following new text:
<u>Exception: If the load served is a chemical (or other potentially hazardous material) manufacturing plant where sudden loss of electrical power may result in an increased hazard, and the available incident energy level when short-time protection is utilized is within manageable levels of commonly available personal protective equipment, the additional requirements of 240.87 (1), (2) or (3) are not required.</u>
Substantiation: Based on the ROP panel statement, I feel additional comment regarding original substantiation is warranted.

70E does not require that I modify a system to lower arc flash values when energized. It does require that I place it in a safe work condition (de-energize) unless de-energization creates a greater hazard or is infeasible, or is less than 50 V. (70E Article 130 – 2012). If the equipment is justified to work energized an energized electrical work permit is required which includes several requirements regarding identification or hazards, and an appropriate work plan to protect personnel from the hazards including appropriate protective equipment. It does not require that I reduce the calculated arc-flash energy.

The panel statement in the ROP seems to indicate that the panel understands that use of a maintenance mode defeats selective coordination. However, I did not state in my substantiation, that defeating of selective coordination by a maintenance switch was the only reason that the likelihood of a larger scale interruption was increase by the requirements of 240.87. Therefore, I must comment and specify how each of the accepted methods specified in 240.87 increases the likelihood of a larger scale service interruption that could result in additional hazards.

(1) Zone selective interlocking – This technology works by "restraint". The downstream breaker restrains the instantaneous function of the upstream breaker. In the case of a unit substation, the feeder breakers restrain the main breaker. This restraint is dependent on the communication link between the breakers and/or relays. Since it operates on restraint rather than permissive, if the communication link is compromised, the main breaker is not restrained. The loss of communication between trip units may not be rapidly recognized. If a fault occurs downstream of a feeder breaker, and the communication link is compromised, the main breaker does not receive the restraint signal and opens, clearing the bus not because of a failure of the feeder breaker, but because of the failure of a communication link. This would shut down all loads fed from this bus. This scenario can happen at any time, not just when maintenance is occurring.

(2) Differential relaying – Most low voltage substations utilize trip units rather than relays with the CTs mounted on the draw-out breaker stabs. Additional differential relays would be required which in turn would require additional CTs. Looking at the design of the typical currently available low voltage substation, it seems these CTs would have to be mounted in the outgoing sections, probably downstream of the outgoing connections such that the outgoing cables would have to pass through them. This would put the cable connection to the runbacks (a common failure point in LV substations) within the differential zone. A fault at this location is typically cleared by the feeder breaker, but being in the differential zone would now additionally be cleared by the differential relay operating and opening every breaker on the bus. This would shut down all loads fed from this bus. This scenario can happen at any time, not just when maintenance is occurring.

(3) Maintenance mode switching – Reduces AF hazard when placed in this mode by compromising the selective coordination. The panel ROP statement seems to indicate that the panel recognizes this situation.

I continue to contend that all three of the allowed methods increases the likelihood of larger scale unplanned interruptions. These unplanned interruptions can cause serious non-electrical hazards if the load served is a chemical or other hazardous manufacturing facility. If energy levels without these methods are within limits of which electrical workers can be protected with commonly available PPE the exception should be allowed. I am strongly committed to making every job as safe as possible. I believe that not allowing the exception I proposed detracts from, rather than enhances the overall safety of the installations the proposal targets.

I request the panel re-consider their decision to reject the original proposal.
Panel Meeting Action: Reject
Panel Statement: The determination of arc-flash energy and requirements for personal protective equipment for persons within an arc-flash boundary is under the purview of the NFPA 70E committee. The methods outlined in 240.87 to reduce the arc-flash hazard(s) are compatible with the selective coordination that is necessary for chemical (or other potentially hazardous material) manufacturing plants. Arc-flash hazard levels should be limited as much as possible, not just limited if above subjective high levels.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:

DARLING, D.: Refer to my statement on comment 10-21.

FREDERICKS, C.: I'm voting negative on the panel action; the panel action should have been to Accept. The panel statement that the 240.87 requirements are compatible with selective coordination is not correct. See the detailed substantiation provided by the submitter.

10-29 Log #600 NEC-P10 **Final Action: Reject**
(240.87(B)(5))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 10-53a
Recommendation: Revise text to read as follows:
240.87 Noninstantaneous Trip.
(B) Method to Reduce Clearing Time.
5. An approved equivalent means
~~Informational Note No. 2:~~ *Exception:* ~~*An energy-reducing active arc flash mitigation system helps in reducing arcing duration in the electrical distribution system.*~~ *No change in circuit breaker settings or the settings of other devices is required during maintenance when a worker is working* ~~*within*~~ *outside an arc-flash boundary as defined in NFPA 70E-2012, Standard for Electrical Safety in the Workplace.*
Informational Note~~ No. 1~~: An energy-reducing maintenance switch allows a worker to set a circuit breaker trip unit to "no intentional delay" to reduce the clearing time while the worker is working within an arc-flash boundary as defined in NFPA 70E-2009, *Standard for Electrical Safety in the Workplace*, and then to set the trip unit back to a normal setting after the potentially hazardous work is complete. **[ROP 10–53a]**
Substantiation: Protection not required when ***outside***. Change <info 2> to exception. Move to above original <info 1>
Panel Meeting Action: Reject
Panel Statement: The informational note is intended only to provide information, not a requirement.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

10-30 Log #138 NEC-P10 **Final Action: Accept**
(240.92(C)(2)(2))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-15a
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7.
It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 10 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-10 accepts the direction of the NEC Correlating Committee to take action on Proposal 9-15a.
CMP-10 accepts the action on Proposal 9-15a.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

10-31 Log #139 NEC-P10 **Final Action: Accept**
(240.92(D)(2))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-15b
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7.
It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 10 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-10 accepts the direction of the NEC Correlating Committee to take action on Proposal 9-15b.
CMP-10 accepts the action on Proposal 9-15b.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

10-32 Log #740 NEC-P10 **Final Action: Accept**
(240, Part IX)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 10-60
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.
The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.
The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.
Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.
Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.
If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ARTICLE 250 — GROUNDING AND BONDING

5-12 Log #90 NEC-P05 **Final Action: Accept in Principle**
(250 and Table 250.102(C))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 5-42
Recommendation: The Correlating Committee directs that the panel clarify the panel action on this proposal relative to the Informational Note with conductor sizes "18 AWG through 4/0 AWG."
This action will be considered as a public comment.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and statement on Comment 5-56.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-13 Log #1146 NEC-P05 **Final Action: Reject**
(250, Parts I, II, III, IV, and V)

Submitter: Paul Dobrowsky, American Chemistry Council
Comment on Proposal No: 5-44
Recommendation: The proposal should have been accepted.
Substantiation: The term Equipment Grounding Conductor needs to be replaced. Those opposed have no technical reason for their opposition or any other valid reason. It is not worth the effort and everyone understands what is

meant are common responses.

It is very simple: Grounding electrode conductors are the connection to the earth and accomplish grounding. In the present NEC, Equipment Grounding Conductors and bonding jumpers provide a "path back" to the source. Both are always performing a bonding function. If the Grounding Electrode connection is removed or broken, the bonding function remains intact.

Section 250.4 does not permit the earth (ground) to be used as an effective ground fault current path but the term equipment grounding conductor inherently incorrectly contains the word "ground".

Visualize equipment supplied by a portable generator. The generator frame is not required to be connected to the earth. The "green" wire in the flexible cord is not performing a grounding function but is performing a bonding function.

Visualize building one supplied by a service, having the grounded conductor connected to the grounding electrode system by a grounding electrode conductor. A feeder supplies a second building and a grounding electrode conductor is required for grounding any equipment in the second building. An equipment grounding conductor is required to be installed from building 1 to building 2. Not for grounding, but for bonding, providing an effective fault current path.

Making this change has the added benefit of being more harmonized with other international standards and usage of terminology.

Experienced NEC users have to ignore other concepts in other definitions and requirements to use the existing term. This does not help the future NEC user or provide clarity in the existing NEC. Changing the term is the right thing to do and should be supported.

Panel Meeting Action: Reject

Panel Statement: See panel action and statement on Comment 5-1.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 13 Negative: 3

Explanation of Negative:

DOBROWSKY, P.: See my negative ballot comment on 5-1.

MOHLA, D.: See my explanation of negative vote on Comment 5-1.

WILLIAMS, D.: See my negative vote substantiation written for Comment 5-1

Comment on Affirmative:

PORTER, C.: See my statement in comment 5-1.

5-14 Log #532 NEC-P05 **Final Action: Accept**
(250.2.Effective Ground-Fault Current Path)

Submitter: James F. Williams, Fairmont, WV

Comment on Proposal No: 5-46

Recommendation: Revise text to read as follows:

100 Definitions.

Effective Ground-Fault Current Path. An intentionally constructed, low-impedance electrically conductive path designed and intended to carry current under ground-fault conditions from the point of a ground fault on a wiring system to the electrical supply source and that facilitates the operation of the overcurrent protective device or ground-fault detectors. **[ROP 5–6]**

250.2 Definitions~~.~~

~~**Effective Ground-Fault Current Path.** An intentionally constructed, low-impedance electrically conductive path designed and intended to carry current under ground-fault conditions from the point of a ground fault on a wiring system to the electrical supply source and that facilitates the operation of the overcurrent protective device or ground-fault detectors.~~ **[ROP 5–46] [ROP 5–13, ROP 5–14]**

Substantiation: In 100 insert a space between *under* and *ground-fault*

In 250 delete the definition. 100 definitions apply to 250. Duplicating the definition – word-for-word – serves no purpose.

Panel Meeting Action: Accept

Panel Statement: The action on Proposal 5-46 is correct in the ROP. The panel action in the proposal stage was to revise this definition and to relocate it to Article 100. To clarify, the panel action is to remove this definition from 250.2 and the definition as revised is to remain in Article 100.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-15 Log #1147 NEC-P05 **Final Action: Reject**
(250.4(A)(2) and (3)

Submitter: Paul Dobrowsky, American Chemistry Council

Comment on Proposal No: 5-49

Recommendation: The proposal should have been accepted.

Substantiation: The term Equipment Grounding Conductor needs to be replaced. Those opposed have no technical reason for their opposition or any other valid reason. It is not worth the effort and everyone understands what is meant are common responses.

It is very simple: Grounding electrode conductors are the connection to the earth and accomplish grounding. In the present NEC, Equipment Grounding Conductors and bonding jumpers provide a "path back" to the source. Both are always performing a bonding function. If the Grounding Electrode connection is removed or broken, the bonding function remains intact.

Section 250.4 does not permit the earth (ground) to be used as an effective ground fault current path but the term equipment grounding conductor inherently incorrectly contains the word "ground".

Visualize equipment supplied by a portable generator. The generator frame is not required to be connected to the earth. The "green" wire in the flexible cord is not performing a grounding function but is performing a bonding function.

Visualize building one supplied by a service, having the grounded conductor connected to the grounding electrode system by a grounding electrode conductor. A feeder supplies a second building and a grounding electrode conductor is required for grounding any equipment in the second building. An equipment grounding conductor is required to be installed from building 1 to building 2. Not for grounding, but for bonding, providing an effective fault current path.

Making this change has the added benefit of being more harmonized with other international standards and usage of terminology.

Experienced NEC users have to ignore other concepts in other definitions and requirements to use the existing term. This does not help the future NEC user or provide clarity in the existing NEC. Changing the term is the right thing to do and should be supported.

Panel Meeting Action: Reject

Panel Statement: See panel action and statement on Comment 5-1.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 13 Negative: 3

Explanation of Negative:

DOBROWSKY, P.: See my negative ballot comment on 5-1.

MOHLA, D.: The comment should be accepted.

The Panel Comment is not applicable to Proposal 5-49. The Proposal merely separates the functions of grounding of systems from bonding of equipment. It is here where the User of the Code is directed to the idea that grounding of equipment will make equipment safer. The paragraph to be deleted indicates that grounding of non-current-carrying materials will "limit the voltage to ground". That this is not true is evident when one considers the voltage drop along the "grounded" "equipment grounding conductor" during a fault. Because the bonding conductor, per Table 250.122, is substantially smaller than the phase conductor, most of the voltage drop, during a fault, occurs across the "bonding" conductor. Thus the voltage at the faulted material is elevated to near the supply voltage with respect to ground and not to ground or earth potential. The installation is "safer" due to faster operation of overcurrent device because this bonding conductor is an intentionally constructed, low-impedance electrically conductive path designed and intended to carry current under fault conditions from the point of a fault on a wiring system to the electrical supply source and that facilitates the operation of the overcurrent protective device. This is the primary purpose of this conductor and calling it an equipment bonding conductor will convey its primary purpose

Deleting this section and using the deletion as a teaching tool will go a long way to making it clear to the users of the National Electrical Code as to why it is necessary and essential we bond equipment to the source rather than ground it.

WILLIAMS, D.: See my negative vote substantiation written for Comment 5-1

Comment on Affirmative:

PORTER, C.: See my statement in comment 5-1.

5-16 Log #1148 NEC-P05 **Final Action: Reject**
(250.6(B))

Submitter: Paul Dobrowsky, American Chemistry Council

Comment on Proposal No: 5-52

Recommendation: The proposal should have been accepted.

Substantiation: The term Equipment Grounding Conductor needs to be replaced. Those opposed have no technical reason for their opposition or any other valid reason. It is not worth the effort and everyone understands what is meant are common responses.

It is very simple: Grounding electrode conductors are the connection to the earth and accomplish grounding. In the present NEC, Equipment Grounding Conductors and bonding jumpers provide a "path back" to the source. Both are always performing a bonding function. If the Grounding Electrode connection is removed or broken, the bonding function remains intact.

Section 250.4 does not permit the earth (ground) to be used as an effective ground fault current path but the term equipment grounding conductor inherently incorrectly contains the word "ground".

Visualize equipment supplied by a portable generator. The generator frame is not required to be connected to the earth. The "green" wire in the flexible cord is not performing a grounding function but is performing a bonding function.

Visualize building one supplied by a service, having the grounded conductor connected to the grounding electrode system by a grounding electrode conductor. A feeder supplies a second building and a grounding electrode conductor is required for grounding any equipment in the second building. An equipment grounding conductor is required to be installed from building 1 to building 2. Not for grounding, but for bonding, providing an effective fault current path.

Making this change has the added benefit of being more harmonized with other international standards and usage of terminology.

Experienced NEC users have to ignore other concepts in other definitions and requirements to use the existing term. This does not help the future NEC user or provide clarity in the existing NEC. Changing the term is the right thing

to do and should be supported.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 5-1.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 13 Negative: 3
Explanation of Negative:
DOBROWSKY, P.: See my negative ballot comment on 5-1.
MOHLA, D.: See my explanation of negative vote on Comment 5-1.
WILLIAMS, D.: See my negative vote substantiation written for Comment 5-1
Comment on Affirmative:
PORTER, C.: See my statement in comment 5-1.

5-17 Log #1149 NEC-P05 **Final Action: Reject**
(250.8(A))

Submitter: Paul Dobrowsky, American Chemistry Council
Comment on Proposal No: 5-54
Recommendation: The proposal should have been accepted.
Substantiation: The term Equipment Grounding Conductor needs to be replaced. Those opposed have no technical reason for their opposition or any other valid reason. It is not worth the effort and everyone understands what is meant are common responses.

It is very simple: Grounding electrode conductors are the connection to the earth and accomplish grounding. In the present NEC, Equipment Grounding Conductors and bonding jumpers provide a “path back” to the source. Both are always performing a bonding function. If the Grounding Electrode connection is removed or broken, the bonding function remains intact.

Section 250.4 does not permit the earth (ground) to be used as an effective ground fault current path but the term equipment grounding conductor inherently incorrectly contains the word “ground”.

Visualize equipment supplied by a portable generator. The generator frame is not required to be connected to the earth. The “green” wire in the flexible cord is not performing a grounding function but is performing a bonding function.

Visualize building one supplied by a service, having the grounded conductor connected to the grounding electrode system by a grounding electrode conductor. A feeder supplies a second building and a grounding electrode conductor is required for grounding any equipment in the second building. An equipment grounding conductor is required to be installed from building 1 to building 2. Not for grounding, but for bonding, providing an effective fault current path.

Making this change has the added benefit of being more harmonized with other international standards and usage of terminology.

Experienced NEC users have to ignore other concepts in other definitions and requirements to use the existing term. This does not help the future NEC user or provide clarity in the existing NEC. Changing the term is the right thing to do and should be supported.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 5-1.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 13 Negative: 3
Explanation of Negative:
DOBROWSKY, P.: See my negative ballot comment on 5-1.
MOHLA, D.: See my explanation of negative vote on Comment 5-1.
WILLIAMS, D.: See my negative vote substantiation written for Comment 5-1
Comment on Affirmative:
PORTER, C.: See my statement in comment 5-1.

5-18 Log #1125 NEC-P05 **Final Action: Reject**
(250.24(A)(4))

Submitter: Phil Simmons, Copper Development Association, Inc.
Comment on Proposal No: 5-72
Recommendation: Accept the Proposal.
Substantiation: The general requirement in 250.24(A)(1) is that the grounding electrode conductor be connected to the grounded conductor at any accessible location on the load side of the service drop or service lateral up to the terminal bar in the service equipment. Making a connection on the load side of the neutral terminal bar is in essence a violation of 250.64(C) as it would constitute a splice in the grounding electrode conductor.

Section 250.24(A)(4) acts as an exception to the general requirement for where the grounding electrode connection is required to be made but is permitted only if the main bonding jumper is a wire or a bus bar. The grounding electrode conductor is required to be connected directly to the grounded service conductor at the service equipment if the main bonding jumper is a screw or strap.
Panel Meeting Action: Reject
Panel Statement: The connection of the grounding electrode conductor to the equipment grounding terminal bar is permitted where there is a properly installed wire or bus main bonding jumper. The main bonding jumper is required to be connected to the grounded conductor (neutral) on the supply side of the neutral disconnect link that is the point defining the supply or load side of the neutral bus. The option connection of the grounding electrode conductor has been in the NEC since the 1981 edition. The change made then as new exception 5 to 250-23 has not been substantially changed since that time. There has been no evidence of failures or of unsafe conditions from the application of this optional connection. As for the equipment grounding bar possibly being undersized, 408.3 and 409.60 both specifically state the equipment grounding bar is to be sized per Table 250.122 while the grounded conductor and grounding electrode conductor are sized to Table 250.66, so the installation in question is actually in accordance with Code provisions. An analysis of actual construction, considering standard bus bar sizes, has been completed and in no case would the equipment grounding busbar in a dead front switchboard be sized smaller than the required grounding electrode conductor. (See Table below)

Service Switchboard Rating	Service Entrance Cond (Cu)	Equivalent	GEC (NEC T250.66)	Equip Gnd Cond (NEC)	Equip Gnd Cond (UL 891	Std Gnd Busbar		MBJ (NEC)	MBJ (UL 891)
400	500 Kcmil	500 Kcmil	1/0	3 AWG	3 AWG	1/4 x 7/8	>4/0	1/0	1/0
600	3-350 Kcmil	700 Kcmil	2/0	1 AWG	1 AWG	1/4 x 7/8	>4/0	2/0	2/0
800	2-500 Kcmil	1000 Kcmil	2/0	1/0	1/0	1/4 x 7/8	>4/0	2/0	2/0
1200	3-600 Kcmil	1800 Kcmil	3/0	3/0	3/0	1/4 x 11/2	>350 <400	250	250
1600	5-400 Kcmil	2000 Kcmil	3/0	4/0	4/0	1/4 x 2	>400 <500	250	300
2000	6-400 Kcmil	2400 Kcmil	3/0	250	250	1/4 x 2	>400 <500	300	400
	5-600 Kcmil	3000 Kcmil	3/0	250	250	1/4 x 2	>400 <500	400	400

5-18 (Log #1125)

Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-19 Log #273 NEC-P05 **Final Action: Accept**
(250.26(6) (New))

Submitter: Code-Making Panel 12,
Comment on Proposal No: 5-78
Recommendation: No change to the current NEC is required. Continue to Reject the proposal.
Substantiation: NEC Code-Making Panel 12 agrees with Code-Making Panel 5 on the Rejection of Proposal 5-78. The submitter's substantiation for the proposal is incorrect because the current language in 250.26(2) correlates with the language of 647.3, 647.6, 250.30, and the definitions in Article 100 of "Neutral Conductor" and "Grounded Conductor."

This comment was developed by the CMP-12 Chair and balloted through the entire panel with the following ballot results:

18 Eligible to vote

14 Affirmative

4 Ballots Not Returned (K.M. Cunningham, A.E. Schlueter, Jr., R.G. Ward, and K. White)

The following Affirmative Comments on Vote were received:

T.R. Brown: It is understood that the technical equipment ground is a noncurrent carrying part during normal operation. It is also understood that the center tap of the secondary winding of the supply transformer for sensitive electronic equipment supply is to be grounded in accordance with 250.30.

J.L. HOLMES: Continue to Reject this Proposal. 90.3 of the NEC states that Chapter 6 will supplement or modify Chapters 1-4. The reference in 647.6(A) does that. The addition to 250.26 is not needed.

R.E. JOHNSON: There is no problem calling the center tab a neutral even though it has no other function than as a ground point.
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-20 Log #997 NEC-P05 **Final Action: Hold**
(250.28, 250.52)

TCC Action: The Technical Correlating Committee directs that this comment be reported as "Hold" in accordance with Section 4.4.6.2.2 of the NFPA Regulations Governing Committee Projects. The Comment does not relate to any specific Proposal and introduces material that has not had public review.
Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 5-80
Recommendation: Revise text to read as follows:
250.28 Main Bonding Jumper and System Bonding Jumper.
(D)(1) General. Main bonding jumpers and system bonding jumpers shall not be smaller than specified in Table 250.102(C)-.
250.30 Grounding Separately Derived Alternating-Current Systems.
(A)(3)(a) *Sizing for a Single Raceway.* The grounded conductor shall not be smaller than specified in Table 250.102(C)-.
250.52 Grounding Electrodes.
(A)(3) Metallic components shall be encased by at least 50 mm (2 in.) of concrete and shall be located horizontally within that portion of a concrete foundation or footing that is in direct contact with the earth or within vertical foundations or structural components or members that are in direct contact with the earth.
250.52 Grounding Electrodes.
(A)(7) Plate Electrodes. Each plate electrode shall expose not less than 0.186 m2 (2 ft2) of surface to exterior soil. Electrodes
of bare or ~~conductively~~ <u>electrically conductive</u> coated iron or steel plates shall be at least 6.4 mm (1/4 in.) in thickness.
250.64 Grounding Electrode Conductor Installation.
(B) Securing and Protection Against Physical Damage.
Grounding electrode conductors smaller than 6 AWG shall be protected in ~~(~~RMC~~)~~, IMC, PVC-, RTRC, ~~(~~EMT~~)~~, or cable armor.
Substantiation: 250.28(D)(1) delete space between (C) and period
250.30(A)(3)(a) delete space between (C) and period
250.52(A)(3) <para 2> delete space between wi and thin
250.52(A)(7) use the same terminology for the same thing (see 250.52(A)(3)(1))
250.64(B) delete parens in this sentence, delete space between PVC and comma
Panel Meeting Action: Accept in Part
Revise 250.52(A)(7) to read as follows:
(A)(7) Plate Electrodes. Each plate electrode shall expose not less than 0.186 m2 (2 ft2) of surface to exterior soil. Electrodes of bare or electrically conductive coated iron or steel plates shall be at least 6.4 mm (1/4 in.) in thickness.
Panel Statement: The panel accepts the change to 250.52(A)(7). The panel rejects the rest of the proposed changes which are from errors in ROP draft. The ROP text is correct.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-21 Log #1126 NEC-P05 **Final Action: Accept**
(250.28(A))

Submitter: Phil Simmons, Copper Development Association, Inc.
Comment on Proposal No: 5-79
Recommendation: Continue to Reject the Proposal.
Substantiation: The submitter has failed to provide sufficient technical justification for the Proposal. A fact finding report that demonstrates that this product is suitable for the proposed application has not been provided. There is no indication how one would determine whether the conductor is 30% or 40% conductivity material. In addition, there is no indication that terminals on equipment are designed, tested and suitable for terminating copper-clad steel conductors.
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-22 Log #1127 NEC-P05 **Final Action: Accept**
(250.28(D)(1))

Submitter: Phil Simmons, Copper Development Association, Inc.
Comment on Proposal No: 5-80
Recommendation: Continue to Reject the Proposal.
Substantiation: The submitter has failed to provide sufficient technical justification for the Proposal. A fact finding report that demonstrates that this product is suitable for the proposed application has not been provided. There is no indication how one would determine whether the conductor is 30% or 40% conductivity material. In addition, there is no indication that terminals on equipment are designed, tested and suitable for terminating copper-clad steel conductors.
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-23 Log #252 NEC-P05 **Final Action: Reject**
(250.30)

Submitter: Raymond J. Dezik, 400 Hz Repair
Comment on Proposal No: 5-81
Recommendation: We ask that the secondary of the transformer be allowed to have the neutral tied to ground through a capacitor, thus preventing arc when static grounding.
Substantiation: A feeding transformer feeding an aircraft has to be grounded as stated in Section 350.30. This conflicts with the 400 Hz system when they ground the aircraft separately. That second ground carries neutral current and causes and arc when connecting or disconnecting that static ground. We ask that the secondary of the transformer be allowed to have the neutral tied to ground through a capacitor, thus preventing arc when static grounding. This prevents the arc and offers other protection. Boeing has been implanting this procedure for 30 years.
Panel Meeting Action: Reject
Panel Statement: The submitted comment provides no specific text on how the proposed addition should be written as required by 4.4.5(c) of the Regulations Governing Committee Projects.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-24 Log #1128 NEC-P05 **Final Action: Reject**
(250.30(A)(5) Exception No. 1)

Submitter: Phil Simmons, Copper Development Association, Inc.
Comment on Proposal No: 5-89
Recommendation: Accept the Proposal.
Substantiation: The general requirement in 250.30(A)(5) is that the grounding electrode conductor be connected to the grounded conductor of the separately derived system had the same point the system bonding jumper is connected to the system. Making a connection on the load side of the system bonding jumper connection to the separately derived system is in essence a violation of 250.64(C) as it would constitute a splice in the grounding electrode conductor.

The exception to the general requirement for where the grounding electrode connection is required to be made is permitted only if the system bonding jumper is a wire or a bus bar. The grounding electrode conductor is required to be connected directly to the grounded conductor of the separately derived system if the system bonding jumper is a screw or strap.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 5-18.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-25 Log #1150 NEC-P05 **Final Action: Reject**
(250.32(A) Exception)

Submitter: Paul Dobrowsky, American Chemistry Council
Comment on Proposal No: 5-94
Recommendation: The proposal should have been accepted.
Substantiation: The term Equipment Grounding Conductor needs to be replaced. Those opposed have no technical reason for their opposition or any other valid reason. It is not worth the effort and everyone understands what is meant are common responses.

It is very simple: Grounding electrode conductors are the connection to the earth and accomplish grounding. In the present NEC, Equipment Grounding Conductors and bonding jumpers provide a “path back” to the source. Both are always performing a bonding function. If the Grounding Electrode connection is removed or broken, the bonding function remains intact.

Section 250.4 does not permit the earth (ground) to be used as an effective ground fault current path but the term equipment grounding conductor inherently incorrectly contains the word “ground”.

Visualize equipment supplied by a portable generator. The generator frame is not required to be connected to the earth. The “green” wire in the flexible cord is not performing a grounding function but is performing a bonding function.

Visualize building one supplied by a service, having the grounded conductor connected to the grounding electrode system by a grounding electrode conductor. A feeder supplies a second building and a grounding electrode conductor is required for grounding any equipment in the second building. An equipment grounding conductor is required to be installed from building 1 to building 2. Not for grounding, but for bonding, providing an effective fault current path.

Making this change has the added benefit of being more harmonized with other international standards and usage of terminology.

Experienced NEC users have to ignore other concepts in other definitions and requirements to use the existing term. This does not help the future NEC user or provide clarity in the existing NEC. Changing the term is the right thing to do and should be supported.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 5-1.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 14 Negative: 2
Explanation of Negative:
DOBROWSKY, P.: See my negative ballot comment on 5-1.
WILLIAMS, D.: See my negative vote substantiation written for Comment 5-1
Comment on Affirmative:
PORTER, C.: See my statement in comment 5-1.

5-26 Log #1300 NEC-P05 **Final Action: Accept**
(250.34)

Submitter: James Jongkind, American Honda Motor Co., Inc.
Comment on Proposal No: 5-95
Recommendation: Please reject the proposal.
Substantiation: Most of the portable generators that Honda has sold for the past 40 years are of the floating neutral design and are used safely everyday by millions of consumers. To require that all newly produced portable generators be bonded is not only unjustified by the lack of incident data, but it would also introduce a safety risk where one did not previously exist. The output on these floating neutral generators is isolated so there is no path back to the source through which users can be shocked. This is a well established and proven safety strategy for this type of product and should not be arbitrarily eliminated.
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 12 Negative: 4
Explanation of Negative:
BRENDER, D.: The Comment should have been rejected. The text in 250.34(C) of the present and many previous editions of the NEC have required the conductor that is required to be grounded in 250.26 to be bonded to the generator frame. This is not a new requirement.
Confusion may have existed in the past by not recognizing that stand-alone portable and vehicle-mounted generators are a separately derived system. The generator may be connected as a separately derived system or a non-separately derived system when connecting to a premises wiring system.
A path for ground-fault current to return to the source does not exist if the grounded conductor is not bonded to the frame to complete the circuit to the equipment grounding conductor. This is an unsafe practice for “floating neutral” generator systems.

DOBROWSKY, P.: Section 250.34 was revised based on proposal 5-95 to improve the clarity and usability - not for making any technical changes. At the comment meeting CMP 5 accepted comments to reject the proposal - based on technical reasons. Generator manufacturers and others did not want to bond the grounded conductor to the generator frame. But that is not a new requirement. The result of rejecting proposal 5-95 now causes the language to revert back to that of the 2011 NEC. Section 250.34(C) of the 2011 NEC requires that generators connected as separately derived systems have any required grounded conductors connected to the generator frame.
The concern is that that the commenters now believe that bonding is not required when it is if the generator is used as a separately derived system described in 250.34(C).

MELLO, C.: The panel should have rejected the comment. Proposal 5-95 reorganized requirements that have been in the NEC for well over 40 years. No new requirements were created as incorrectly stated in the various substantiations in Comments 5-26 to 5-32. The fact that some manufacturers have produced a product that does not comply with minimum adopted safety standard is not just cause to reverse the requirement. It was interesting to note that these same manufacturers produce a Code compliant product for the construction industry to meet NEC section 590.6. No independently corroborated evidence was provided to back-up the statements in the substantiation that a floating neutral generator is “safe” or “safer” than ones with a bonded neutral in compliance with present Code.
The real issue seems to be that these manufacturers want to produce a single product that can serve two functions that may be mutually exclusive. As a stand-alone system the bonding of the neutral provides for a low impedance path for any ground fault current from utilization equipment to return to the source and cause the overcurrent device to trip meeting the performance requirements of 250.4(A). The other use is to supply alternate power for a building or structure in the event of a normal service power outage. With the bonded neutral configuration this would require a transfer switch that switches the neutral to correctly maintain the generator as a separately derived system. The argument that there are not transfer switches to accomplish this is incorrect. There are many manufacturers that produce listed 3 pole automatic transfer switches rated as low as 50 Amps. . While most of the automatic transfer switches are set up for 3-phase type systems, these same manufacturers have alternate control packages for single phase use that could be employed. Other manufacturers produce 3-pole manual transfer switches that would also meet the needs
In addition to be in violation of section 250.34(C) of the present Code, these generators are in violation of section 250.20(B)(1) where it is required that any AC energy source that can be “grounded” so the voltage from any ungrounded conductor to ground does not exceed 150 Volts shall be grounded. There is no exception there for portable generators. What 250.34 allows specifically for portable and vehicle mounted generators is not to have to be connected to one of the grounding electrodes specified in Part III of Article 250. For this application the generator frame serves as the reference point.
If the premise that a floating neutral is safe for these portable generators up to 15 KW, then why is it unsafe to have a floating neutral any a 15 KVA 240/120 Volt transformer in a building? Following the premise in the substantiation, then 3-prong receptacles and 3-conductor cords are not necessary from portable and vehicle mounted generators to utilization equipment. If the substantiation is to be believed, then 2-prong receptacles and 2-conductor cords are “safer”. Lastly, section 250.34 applies to all portable and vehicle mounted generators with ratings up to and including 1000 KW, or more, and voltages from the 120 Volts or 240/120 Volts, being discussed in the substantiation, 480/277 Volts and even up to medium voltage systems. To blanket allow any of these generators to now have a floating neutral to satisfy a specific small group of manufactures was not substantiated.

WILLIAMS, D.: The requirement to bond the neutral to the generator was required before the changes made to this section and the actions of the panel does not change that requirement.
Comment on Affirmative:
HARDING, J.: Although Proposal 5-95 was accepted at the ROP stage, it became apparent during the ROC meeting that many panel members were unaware of the full implications of the proposal and the major disruption it will cause to industry, since 50% of the portable generators sold in the U.S.A. annually would have to change in design for no demonstrated safety reason. Instead, there is the potential to create negative safety implications. Most panel members agreed and therefore accepted this comment to reject the original proposal. It is clear that there is no consensus on this issue within CMP-5. This issue should therefore be resolved during the next code cycle.

5-27 Log #1464 NEC-P05 **Final Action: Accept**
(250.34)

Submitter: Michael O. Flegel, Reliance Controls Corporation
Comment on Proposal No: 5-95
Recommendation: Reject the proposal.
Substantiation: There has been no substantiation of a safety problem even though both floating neutral and bonded neutral generators are being used safely every day in many applications.
Floating-neutral generators in stand-alone use allow a level of safety from ground faults through isolation of the electrical system from ground where bonded neutral generators take one step closer to ground faults by connecting an electrical conductor to the generator frame. Floating neutral generators have a proven safety record and should not be eliminated just because they do not duplicate a utility premises wiring system. Utility systems have to be bonded and grounded for reasons that do not apply to most portable generators applications. Further, floating-neutral generators are allowed to be part of a non-separately derived system in other parts of the code and represent the best and most popular way to connect generator power to a premises wiring system. It is by far the most widely used method in practice today with no reported

safety issues.

Our company manufactures manual transfer switches for use with portable generators for both separately and non-separately derived systems. In the last twelve months, 99.5% of our unit sales have been for non-separately derived systems and.5% for separately derived systems. We are in most major retailers so our market share is very representative of the total market so these percentages are a good estimate of the market as a whole and backs up my statement as to how wide spread the use of non-separately derived systems are. The installed base is very similar so when a person replaces his floating neutral generator with a bonded neutral generator, he may also have to install a different transfer switch. This could be justified if it was proven that non-separately derived systems are unsafe but they are not. They have been around as long as the code has allowed them, which is before I can remember. Does the panel think users would install a new transfer switch or would they modify the installation to make it work but then not comply with the NEC?

So let's talk about a real safety issue, getting people to use a transfer switch as required by the NEC instead of back feeding which is extremely dangerous and has many reported injuries and deaths. Based on published sales of portable generators and knowing our transfer switch sales and market share, I know many

applications do not use a transfer switch. We know that back-feeding is a problem and requiring a product that is more expensive to purchase and install because it has to switch the neutral conductor will make this situation worse.

UL is driven to have this change made because they are unhappy with the team of experts they have put together to develop a national portable generator standard. This panel, STP2201, has told them there is nothing unsafe about floating neutral generators, either in stand-alone use or when connected to a premises wiring system. UL disagrees but offers no proof except through misinterpretations of the NEC. They want to get the code changed to persuade the panel they are wrong. As a matter of fact, a senior UL executive was not even aware that floating-neutral generators were being made when in fact it represents 50% of portable generator sales according to the Portable Generator Manufacturers Association (PGMA). If the panel examines past practices and the electrical safety records, you will find that there is no need to make this change. Why put an entire industry in turmoil for no sound reason especially when there are technical arguments supporting current practices?

Panel Meeting Action: Accept

Panel Statement: The panel does not agree with the entire substantiation.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 12 Negative: 4

Explanation of Negative:

BRENDER, D.: See my statement in Comment 5-26.

DOBROWSKY, P.: See my negative ballot comment on 5-26.

MELLO, C.: See my statement on Comment 5-26

WILLIAMS, D.: See my negative vote substantiation written for Comment 5-26

Comment on Affirmative:

HARDING, J.: See My Affirmative with Comment on 5-26.

5-28 Log #1495 NEC-P05 **Final Action: Accept**
(250.34)

Submitter: Jeff Baldwin, JPB Design and Engineering LLC

Comment on Proposal No: 5-95

Recommendation: Please reject this proposal.

Substantiation: When a generator, portable or otherwise, is used as a standby power source it is allowed by article 702 of the NEC to be installed as a non-separately derived system. In a non-separately derived system, the generator cannot have a neutral that is bonded to the frame (Article 702). The bonding is done at the household service entrance. A bond at the generator would create multiple bonding points. Non-separately derived is currently the second most common method of connecting a generator to a residence for standby power. (Back feeding is number one.) Non-separately derived installation is popular because it is simple, safe, and can be done with low-cost commercially available products that are UL-Listed.

A generator with a neutral that is bonded to the frame must be installed as a separately derived system (Article 702). This is a much more complicated installation that requires expensive switches (3-pole instead of 2-pole) that are not currently available at major homecenters. The resulting separately derived installation with a bonded generator is no safer than a non-separately derived system with an unbonded generator. Both these installation methods are allowed by the NEC, and both bonded and unbonded generators are currently available commercially. This should be continued.

Panel Meeting Action: Accept

Number Eligible to Vote: 16

Ballot Results: Affirmative: 12 Negative: 4

Explanation of Negative:

BRENDER, D.: See my Statement in Comment 5-26. Article 702 does not regulate whether a generator is connected as a separately derived or non-separately derived system. This is usually a choice to be made by the installer

DOBROWSKY, P.: See my negative ballot comment on 5-26.

MELLO, C.: See my statement on Comment 5-26

WILLIAMS, D.: See my negative vote substantiation written for Comment 5-26

Comment on Affirmative:

HARDING, J.: See My Affirmative with Comment on 5-26.

5-29 Log #952 NEC-P05 **Final Action: Accept**
(250.34(A), (B), and (C))

Submitter: Richard E. Loyd, Sun Lakes, AZ

Comment on Proposal No: 5-95

Recommendation: This action should be rejected.

Substantiation: I agree with the negative voting comments of Steinman and Harding on proposal 5-95. There has been no substantiation of a safety problem even though both the floating neutral and the bonded types of generators are being used every day in many applications. Based on the ECOA/IBEW study both types can be safe or not so safe based on the conditions of use.

Placing the GFCI nearest to likely fault (tool or personnel) and using double insulated tools provides the greatest safety. Nothing in the study indicates the bonded type is safer.

In 1997 the construction safety association of Ontario (ECAO) in conjunction with the IBEW, with the assistance of Kubota Canada completed a in-depth study on the use of GFCIs on portable generators. They tested both types the following are the analysis and conclusions of that study:

Analysis: It is clear that when generators of the floating-neutral or bonded-neutral type sit on dry surfaces in dry environments, they behave similarly In both cases, the GFCIs failed to trip In addition, the reading of little or no current on the multimeter indicated that there was not enough electricity leaking to ground to constitute a hazard In both cases, the GFCI did not trip when there was only one ground fault in the system. When effective grounding was established, GFCIs performed as expected Testing also proved that wet surfaces can create grounding for bonded-neutral generators When a bonded-neutral generator was placed on wet ground, the GFCI tripped under the prescribed current leakage

However, testing also showed that grounding can vary from one place to another, even when both are relatively close In one test, a variation in ground elevation yielded different results When the screwdriver was inserted in wet ground, the GFCI tripped When the screwdriver was moved 100 feet to a slope that had better drainage, the GFCI did not trip

The second series of tests showed that the placement of the GFCI in the circuit is critical to a floating-neutral system.

When the GFCI was plugged directly to the generator, the GFCI failed to detect any imbalance in the current As a result, it did not trip even when the current leak reached a higher than acceptable level When the GFCI was placed at the tool, however, it tripped at the prescribed level

Conclusions: Since the GFCI test button functioned regardless of the generator's grounding property, GFCI test buttons cannot and should not be used to test the effectiveness of GFCIs as personnel protection or the grounding of portable generators The test button should only be used to test GFCIs after grounding has been established

Portable generators with established ground must be treated the same way as any grounded utility system Workers must be protected by GFCIs to prevent electrocution by ground fault Ground should be established and verified only by competent workers trained to do so and using specialized instruments

Generators with established ground allow a GFCI mounted at the generator outlet to work effectively When there is a current leak, the current goes to ground to complete the circuit This creates an imbalance, causing the GFCI to trip When generators with established ground are being used, GFCIs should be located closest to the generator, protecting all workers from ground faults, not just the generator user

Construction people complain that GFCIs trip unnecessarily, especially with extension cords As a result, personnel often consider GFCIs a nuisance and don't use them But GFCIs trip for a reason These trips should be treated as a warning that there is a ground fault in the system When a GFCI trips, tools, cords, and plugs should be inspected for defects and, where necessary, replaced before work continues

When the electrical system does not have reference to ground, GFCIs mounted on the generator do not work With one fault, not enough current leaks to ground to be considered a hazard

Thus, in a floating-neutral circuit, workers are not endangered by electrocution from current going to ground as long as there is only ONE fault in the system

However, with two faults in the system, one on the neutral and one on the hot side, it is possible that the floating-neutral system can become grounded In that case, workers without properly located GFCIs can be electrocuted Two faults can be produced by a defective generator, poorly insulated or defective extension cord, defective tool, or defective plug, to name just a few causes Other conditions such as wet ground, rain, or high humidity can increase the risk that the electrical system will become grounded

Testing showed that in a two-fault system, the placement of the GFCI is critical The GFCI must be placed between the two faults in order to function Since the likely locations for faults are tool cord, tool plug, and extension cord, the GFCI should be placed closest to the tool

Last but not least, the hazards of electrocution can be minimized by using only double-insulated tools in good working order and well-insulated cords

Panel Meeting Action: Accept

Number Eligible to Vote: 16

Ballot Results: Affirmative: 12 Negative: 4
Explanation of Negative:
BRENDER, D.: See my statement in Comment 5-26. It seems the proposer is making a case for requiring the frame of portable and vehicle-mounted generators to be connected to a grounding electrode prior to energizing the generator. While doing so may or may not be practicable, installing a grounding electrode will allow GFCIs to recognize an imbalance of load current caused by leakage current returning to the source outside the detector circuit.
DOBROWSKY, P.: See my negative ballot comment on 5-26.
MELLO, C.: See my statement on Comment 5-26
WILLIAMS, D.: See my negative vote substantiation written for Comment 5-26
Comment on Affirmative:
HARDING, J.: See My Affirmative with Comment on 5-26.

5-30 Log #1294 NEC-P05 **Final Action: Accept**
(250.34(A), (B), and (C))

Submitter: Joseph Harding, Portable Generator Manufacturers Association
Comment on Proposal No: 5-95
Recommendation: The text in 250.34 in NEC 2014 should remain the same as it is in NEC 2011.
Substantiation: Proposal 5-95 should have been rejected since it introduces an electrical shock hazard that currently does not exist.
According to a recent PGMA survey, approximately 50% of all portable generators sold in the U.S. are the isolated output type, with no connection of the neutral conductor to the generator frame. Portable generators that are used in “stand alone” mode are not normally connected to a grounding electrode (as allowed in 250.34(A)). In this configuration, isolated output generators pose no risk of a shock hazard because there is no path back to the source (please refer to the presentation and videos associated with this comment). It is also the experience of the portable generator industry that because of this, there have been no reported incidents of electrical shock associated with these generators over at least the last five years for which data is readily available. Requiring the neutral conductor to be connected to the portable generator frame only serves to increase the risk of electrical shock (again please refer to the presentation and videos associated with this comment).
Additionally, if isolated output generators are no longer allowed, then all generators used for backup power during power outages would need to be connected as separately derived systems. This is required because not doing so would result in the system having two points where the neutral is bonded to the grounding electrode (the main bonding jumper and the generator). The dual bonding points allow neutral current to flow on equipment bonding conductors under normal conditions, resulting in nuisance tripping of GFCIs, etc. Connecting a generator as a separately derived system requires the use of an extra pole in the transfer switch in order to switch the neutral conductor. According to industry sources, 99% or more of portable generators used for home backup power are connected as non-separately derived systems by using single or dual pole transfer switches. If this proposal is accepted, it will then force those owners who subsequently replace their portable generator to also replace their current transfer switch at considerable expense and without any real-world safety benefit. If the owner chooses to operate a new portable generator with the existing transfer switch, the system will not be in compliance with the NEC. Considering the significant expense of replacing a transfer switch, it is the belief of PGMA members that some owners would then attempt to modity their new generator or their existing transfer switch and this would then pose significant safety risks where one would not otherwise exist. It is finally noted that the Code currently has a provision for connecting generators as non-separately derived systems (250.30 Informational Note 1).
PGMA members represent a significant majority of the portable generator industry. Our member companies include:
- American Honda Motor Co.
- Briggs & Stratton Home Power Products
- Champion Power Equipment
- Generac Power Systems
- Pramac America
- Subaru Industrial Power
- Techtronic Industries North America
- Wacker Neuson Production
- Yamaha Motor Corp USA

Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 12 Negative: 4
Explanation of Negative:
BRENDER, D.: See my Statement in Comment 5-26. Connecting the grounded conductor to the frame of the generator as presently required in 250.34(C) will not create a shock hazard but will allow overcurrent devices to clear a ground-fault.
Manufacturers of portable and vehicle-mounted generators produce them with and without the neutral bonded to the frame. Undoubtedly, manufacturers of these generators that produce the generator with the neutral being bonded to the frame conclude that doing so does not create an unsafe product.
DOBROWSKY, P.: See my negative ballot comment on 5-26.
MELLO, C.: See my statement on Comment 5-26
WILLIAMS, D.: See my negative vote substantiation written for Comment 5-26
Comment on Affirmative:
HARDING, J.: See My Affirmative with Comment on 5-26.

5-31 Log #1385 NEC-P05 **Final Action: Accept**
(250.34(A), (B), and (C))

Submitter: Greg Marchand, Briggs & Stratton
Comment on Proposal No: 5-95
Recommendation: The text in 250.34 in NEC 2014 should remain the same as it is in the NEC 2011.
Substantiation: Proposal 5-95 should have been rejected since it introduces an electrical shock hazard that currently does not exist.
We are in full support of the more complete substantiation presented by the Portable Generator Manufacturers Association authored by Joseph Harding and John Loud of Exponent, Inc.
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 12 Negative: 4
Explanation of Negative:
BRENDER, D.: See my Statement in Comment 5-26. Connecting the grounded conductor to the frame of the generator as presently required in 250.34(C) will not create a shock hazard but will allow overcurrent devices to clear a ground-fault.
Manufacturers of portable and vehicle-mounted generators produce them with and without the neutral bonded to the frame. Undoubtedly, manufacturers of these generators that produce the generator with the neutral being bonded to the frame conclude that doing so does not create an unsafe product.
DOBROWSKY, P.: See my negative ballot comment on 5-26.
MELLO, C.: See my statement on Comment 5-26
WILLIAMS, D.: See my negative vote substantiation written for Comment 5-26
Comment on Affirmative:
HARDING, J.: See My Affirmative with Comment on 5-26.

5-32 Log #1481 NEC-P05 **Final Action: Accept**
(250.34(A), (B), and (C))

Submitter: Richard Torine, BR Forbes
Comment on Proposal No: 5-95
Recommendation: Do not include this proposal in the NEC.
Substantiation: This proposal has far-reaching and dangerous consequences for most common users of portable generators. Nearly all the small generators (2500 watts and less) currently produced (by Honda and many others) are not bonded. These small generators are extremely popular for camping and many other applications, (Just visit a campground in the summer and count the Honda 2000 watt generators,) The electrical safety record of these generators is perfect, because they are not bonded, Bonding of the neutral and ground allows ground faults that are not possible in an unbonded circuit.
A portable generator is not the same as a household circuit where the neutral is always grounded at the service entrance, Bonding a portable generator will create safety problems that otherwise do not exist because it is not required to be grounded. A household service entrance is. Allowing a small generator to remain unbonded is the safest scenario, and the lack of any known electrical safety issues with the generators that are currently available supports this.
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 12 Negative: 4
Explanation of Negative:
BRENDER, D.: See my Statement in Comment 5-26.
DOBROWSKY, P.: See my negative ballot comment on 5-26.
MELLO, C.: See my statement on Comment 5-26
WILLIAMS, D.: See my negative vote substantiation written for Comment 5-26
Comment on Affirmative:
HARDING, J.: See My Affirmative with Comment on 5-26.

5-33 Log #1151 NEC-P05 **Final Action: Reject**
(250.36(F))

Submitter: Paul Dobrowsky, American Chemistry Council
Comment on Proposal No: 5-100
Recommendation: The proposal should have been accepted.
Substantiation: The term Equipment Grounding Conductor needs to be replaced. Those opposed have no technical reason for their opposition or any other valid reason. It is not worth the effort and everyone understands what is meant are common responses.
It is very simple: Grounding electrode conductors are the connection to the earth and accomplish grounding. In the present NEC, Equipment Grounding Conductors and bonding jumpers provide a “path back” to the source. Both are always performing a bonding function. If the Grounding Electrode connection

is removed or broken, the bonding function remains intact.

Section 250.4 does not permit the earth (ground) to be used as an effective ground fault current path but the term equipment grounding conductor inherently incorrectly contains the word "ground".

Visualize equipment supplied by a portable generator. The generator frame is not required to be connected to the earth. The "green" wire in the flexible cord is not performing a grounding function but is performing a bonding function.

Visualize building one supplied by a service, having the grounded conductor connected to the grounding electrode system by a grounding electrode conductor. A feeder supplies a second building and a grounding electrode conductor is required for grounding any equipment in the second building. An equipment grounding conductor is required to be installed from building 1 to building 2. Not for grounding, but for bonding, providing an effective fault current path.

Making this change has the added benefit of being more harmonized with other international standards and usage of terminology.

Experienced NEC users have to ignore other concepts in other definitions and requirements to use the existing term. This does not help the future NEC user or provide clarity in the existing NEC. Changing the term is the right thing to do and should be supported.

Panel Meeting Action: Reject

Panel Statement: See panel action and statement on Comment 5-1.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 13 Negative: 3

Explanation of Negative:

DOBROWSKY, P.: See my negative ballot comment on 5-26.

MOHLA, D.: See my explanation of negative vote on Comment 5-1.

WILLIAMS, D.: See my negative vote substantiation written for Comment 5-1

Comment on Affirmative:

PORTER, C.: See my statement in comment 5-1.

2-119d Log #878 NEC-P02 **Final Action: Reject**
(250.50)

Submitter: David Filipiak, Sky Electric, Inc.

Comment on Proposal No: 2-239

Recommendation: Revise text to read as follows:

"...in accordance with 430.24, 430.25 and 430.26 and with 440.6 for hermetic refrigerant motor compressors. <u>If two or more motors and or hermetic compressors are present, then the full load current of the larger shall be used in conjunction with 430.25 and 440.7 to determine the volt-ampere load.</u>

Substantiation: When calculating a feeder or service, 220.50 as currently stated, does not clarify if the largest motor's full load amperes per the tables of Artlcle 430 must be used and increased to 125% as well as if the largest hermetic refrigerant compressor's amperage or horsepower equivalent must be used and increased 125% or if only the larger of the two must be used and increased 125% or if only the larger of the two must be used.

Clarification would be accomplished by adding the new text. Please see example provided.

Note: Supporting material is available for review at NFPA Headquarters.

Panel Meeting Action: Reject

Panel Statement: Section 220.60 covers noncoincident loads. If the motor and hermetic compressor cannot operate simultaneously, the largest load should be used.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

Comment on Affirmative:

KING, D.: See my comments on 2-119C.

5-35 Log #1129 NEC-P05 **Final Action: Reject**
(250.52(A)(2))

Submitter: Phil Simmons, Copper Development Association, Inc.

Comment on Proposal No: 5-105

Recommendation: Revise the existing text of the 2011 NEC as follows:

(2) Metal Frame of the Building or Structure. The metal frame of the building or structure that is connected to the earth by <u>having</u> ~~one or more of the following methods:~~

~~(1) A~~ at least one structural metal member that is in direct contact with the earth for 3.0 m (10 ft) or more, with or without concrete encasement.

~~(2) Hold-down bolts securing the structural steel column that are connected to a concrete-encased electrode that complies with 250.52(A)(3) and is located in the support footing or foundation. The hold-down bolts shall be connected to the concrete-encased electrode by welding, exothermic welding, the usual steel tie wires, or other approved means.~~

Substantiation: This proposed change, if accepted, would bring the description of a grounding electrode consisting of the metal frame of a building or structure into harmony with the definition of "Grounding Electrode" in Article 100. As defined by CMP-5, the grounding electrode is the conductive object that makes direct connection to the earth.

The present provision for making connection to earth through the concrete-encased grounding electrode creates a conflict in this section with the definition of "Grounding Electrode" as approved by CMP-5. The Panel improved the definition from the previous editions by revisions made to this section in the 2011 NEC. However, the present provision of creating a metal structure grounding electrode by connection to a concrete encased electrode should be deleted. If this is done, the definition of a metal frame grounding electrode will stand alone like the other descriptions of grounding electrodes in 250.52(A).

In reality, if the metal frame of a building or structure does not itself make an earth connection, it is acting as a grounding electrode conductor or a bonding conductor but not a grounding electrode.

Panel Meeting Action: Reject

Panel Statement: The hold down bolts embedded in the concrete meeting the specified requirements for connection to the rebar in the concrete footing are a grounding electrode. That is what is being defined by this part of the section. If this comment is accepted then the only electrode that can be created under this section is a driven piling or casing without any technical justification. The structural metal above the slab, that is connected to these hold down bolts, now extends the earth grounding connection above the slab which is correct per 250.68(C). For a vast majority of structural metal installations, the hold down bolts installed as specified are the earth connection and there has been no technical substantiation provided that this has been inadequate. To disallow this long standing means of achieving a very suitable grounding electrode or part of a grounding electrode system due to semantics is not acceptable.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 15 Negative: 1

Explanation of Negative:

BRENDER, D.: This Comment should have been Accepted. This proposed change, if accepted, would bring the description of a grounding electrode consisting of the metal frame of a building or structure into harmony with the definition of "Grounding Electrode" in Article 100.

5-36 Log #533 NEC-P05 **Final Action: Accept**
(250.52(A)(3)(2))

Submitter: James F. Williams, Fairmont, WV

Comment on Proposal No: 5-107

Recommendation: Revise text to read as follows:

250.52 Grounding Electrodes.

(A)(3)(2) Bare copper conductor not smaller than 4 AWG

Metallic components shall be encased by at least 50 mm (2 in.) of concrete and shall be located horizontally within that portion of a concrete foundation or footing that is in direct contact with the earth or wi-thin vertical foundation or structural components or members that are in direct contact with the earth.

Substantiation: Delete the space in the word "within".

Panel Meeting Action: Accept

Panel Statement: This corrects an error in the ROP draft. The panel action as documented in proposal 5-107 is correct.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-37 Log #1130 NEC-P05 **Final Action: Accept**
(250.52(A)(3)(2))

Submitter: Phil Simmons, Copper Development Association, Inc.

Comment on Proposal No: 5-108

Recommendation: Continue to Reject the Proposal.

Substantiation: The submitter has failed to provide sufficient technical justification for the Proposal. A fact finding report that demonstrates that this product is suitable for the proposed application has not been provided. There is no indication how one would determine whether the conductor is 30% or 40% conductivity material. In addition, there is no indication that terminals on equipment are designed, tested and suitable for terminating copper-clad steel conductors.

Panel Meeting Action: Accept

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-38 Log #872 NEC-P05 **Final Action: Reject**
(250.52(A)(9))

Submitter: C. Douglas White, Center Point Energy / Rep. Edison Electric Institute/Electric Light & Power Group

Comment on Proposal No: 5-111

Recommendation: This Proposal should have been Accepted in Principle. The text should be relocated to 250.52(A)(8) and modified as follows:

250.52(A)(8) Other Local Metal Underground Systems or Structures.

Other local metal underground systems or structures such as <u>engineered grounding grids,</u> piping systems, underground tanks, and underground metal well casings that are not bonded to a metal water pipe.

<u>Informational note: Refer to IEEE 80-2000 for information on the design and installation of engineered grounding grids.</u>

Substantiation: The increased use of grounding grids necessitates a change in the NEC to establish requirements that promote their safe and consistent application. While all agree that engineering supervision and the use of IEEE

80 works well for this application, it is not always followed. Adding the grounding grid as an acceptable ground electrode in 250.52(A)(8) will meet this need and increase the safety of substations and similar installations.
Panel Meeting Action: Reject
Panel Statement: No substantiation was provided to require all grounding grids to be engineered; other grounding electrodes in 250.52 are not required to be engineered. Also see the panel statement on Comment 5-39.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-39 Log #1338 NEC-P05 **Final Action: Reject**
(250.52(A)(9) (New))

Submitter: Paul Dobrowsky, Holley, NY
Comment on Proposal No: 5-111
Recommendation: Revise text to read as follows:
250.52(A)(9) Grounding Grid
A system of horizontal interconnected bare copper conductors, a minimum 2 AWG, buried in the earth a minimum depth of 30 inches. The grid shall have an area not less than 3 m (10 feet) square and shall extend a minimum of 1 m (36 in) horizontally in all directions beyond the outer perimeter of the equipment served. The minimum spacing between parallel conductors shall be 2 feet and the conductors shall be bonded at each crossover point. Alternate designs shall be permitted under engineering supervision.

Informational Note. A grounding grid might not provide protection from step and touch potentials unless specifically designed for that purpose. See IEEE 80-2000 for information on the design and installation of grounding grids.
Substantiation: The proposal should have been accepted in principle. Ground Rings are presently permitted as grounding electrodes if they encircle a building or structure with much less detail than is provided in the proposed new "grounding grid" electrode. A grounding grid should be an optional method as it will not exist unless installed.
Panel Meeting Action: Reject
Panel Statement: No substantiation was provided for the specific details proposed for grounding grids, such as the 2 ft spacing and for the grid to extend 3 ft beyond the equipment served. A "square" ring is presently permitted by 250.52(A)(4) with or without cross members.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-40 Log #1131 NEC-P05 **Final Action: Accept**
(250.53(E))

Submitter: Phil Simmons, Copper Development Association, Inc.
Comment on Proposal No: 5-112
Recommendation: Continue to Reject the Proposal.
Substantiation: The submitter has failed to provide sufficient technical justification for the Proposal. A fact finding report that demonstrates that this product is suitable for the proposed application has not been provided. There is no indication how one would determine whether the conductor is 30% or 40% conductivity material. In addition, there is no indication that terminals on equipment are designed, tested and suitable for terminating copper-clad steel conductors.
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-41 Log #1132 NEC-P05 **Final Action: Accept**
(250.62)

Submitter: Phil Simmons, Copper Development Association, Inc.
Comment on Proposal No: 5-115
Recommendation: Continue to Reject the Proposal.
Substantiation: The submitter has failed to provide sufficient technical justification for the Proposal. A fact finding report that demonstrates that this product is suitable for the proposed application has not been provided. There is no indication how one would determine whether the conductor is 30% or 40% conductivity material. In addition, there is no indication that terminals on equipment are designed, tested and suitable for terminating copper-clad steel conductors.
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-42 Log #1323 NEC-P05 **Final Action: Reject**
(250.64(B))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 5-118
Recommendation: Revise text to read as follows:
250.64 Grounding Electrode Conductor Installation.

(B) Securing and Protection Against Physical Damage. Where exposed, a grounding electrode conductor or its enclosure shall be securely fastened to the surface on which it is carried. Grounding electrode conductors shall be permitted to be installed on or through framing members. A 4 AWG or larger copper or aluminum grounding electrode conductor shall be protected if exposed to physical damage. A 6 AWG grounding electrode conductor that is free from exposure to physical damage shall be permitted to be run along the surface of the building construction without metal covering or protection if it is securely fastened to the construction; otherwise, it shall be protected in rigid metal conduit (RMC), intermediate metal conduit (IMC), rigid polyvinyl chloride conduit (PVC), reinforced thermosetting resin conduit (RTRC), electrical metallic tubing (EMT), or cable armor. Grounding electrode conductors smaller than 6 AWG shall be protected in ~~(~~RMC~~)~~, IMC, PVC, RTRC, ~~(~~EMT~~)~~, or cable armor.
Substantiation: Parens are incorrectly used. Add parens around first *RMC* and *EMT*, remove parens around second *RMC* and *EMT*.
Panel Meeting Action: Reject
Panel Statement: The panel intends to have the language in 250.64(B) remain as it is published in the 2011 NEC.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-43 Log #1089 NEC-P05 **Final Action: Accept**
(250.64(C))

Submitter: Gregory J. Steinman, Thomas & Betts Corporation
Comment on Proposal No: 5-119
Recommendation: Continue to reject this proposal.
Substantiation: This proposal reduces the integrity of the grounding electrode conductor by allowing mechanical connections in a splicing application. Mechanical connectors
can loosen due to environmental conditions such as vibration. When these mechanical connectors are used at the termination points, they are easily inspected. This explains why the existing installation is busbars is allowed. If these mechanical connections are used anywhere along the GEC as a splice, it will be impossible to inspect these and detect a loosened connection. There is a reason why we specify the description "irreversible" as an adjective to describe the compression connectors allowed. Mechanical connectors are not irreversible.
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-44 Log #998 NEC-P05 **Final Action: Accept in Principle**
(250.64(E) (New))

Submitter: Richard A. Janoski, Finleyville, PA
Comment on Proposal No: 5-123
Recommendation: Accept this Proposal.
Substantiation: Although the opening paragraph of Section 250.64 is clear that this Section intends to cover grounding electrode conductors at services, buildings or structures where supplied by a feeder, or branch circuits, this Section does not address the installation of grounding electrode conductors in separate buildings or structures with multiple disconnecting means, supplied by feeders.

Sub-section (D) is specific to its use in Services not Feeders. To have rules that apply for feeders, the user is left to modify or interpret this specific code language according to his or her own knowledge base.

I would like to direct your attention to Section 260.64 (D)(2) Individual Grounding Electrode Conductors. If I am installing multiple feeders to a separate building or structure as allowed in Section 225.30, and looking to Section 250.64 for direction, this Code Section is instructing me to size my grounding electrode conductor to the service entrance conductors and to connect my grounding electrode conductor to the grounded conductor in each service disconnect.

No disrespect is meant by pointing this out, I know that the code making panel members know that this would be an 'incorrect installation, I am only highlighting this to point out that the language is missing and is needed.
Panel Meeting Action: Accept in Principle
Revise 250.64(D) from ROP draft as follows:

(D) ~~Service~~Building or Structure with Multiple Disconnecting Means in Separate Enclosures.
For a service or feeder with two or more disconnecting means in separate enclosures supplying a building or structure, ~~If a service consists of more than a single enclosure as permitted in 230.71(A),~~ the grounding electrode connections shall be made in accordance with 250.64(D)(1), (D)(2), or (D)(3).
(1) Common Grounding Electrode Conductor and Taps. A common grounding electrode conductor and grounding electrode conductor taps shall be installed. The common grounding electrode conductor shall be sized in accordance with 250.66, based on the sum of the circular mil area of the largest ungrounded ~~service-entrance~~ conductor(s) of each set of conductors that supply the disconnecting means. If the service-entrance conductors connect directly to overhead service conductors, service drop, underground service conductors, or service lateral, the common grounding electrode conductor shall be sized in accordance with Table 250.66, Note 1.

A grounding electrode conductor tap shall extend to the inside of each ~~service~~ disconnecting means enclosure. The grounding electrode conductor taps shall be sized in accordance with 250.66 for the largest service-entrance or feeder conductor serving the individual enclosure. The tap conductors shall be

connected to the common grounding electrode conductor by one of the following methods in such a manner that the common grounding electrode conductor remains without a splice or joint:
(1) Exothermic welding.
(2) Connectors listed as grounding and bonding equipment.
(3) Connections to an aluminum or copper busbar not less than 6 mm thick × 50 mm wide (1/4 in. × 2 in.) and of sufficient length to accommodate the number of terminations necessary for the installation. The busbar shall be securely fastened and shall be installed in an accessible location. Connections shall be made by a listed connector or by the exothermic welding process. If aluminum busbars are used, the installation shall comply with 250.64(A).

(2) Individual Grounding Electrode Conductors. A grounding electrode conductor shall be connected between the grounding electrode system and one or more of the following as applicable:
(1) grounded conductor in each service equipment disconnecting means enclosure
(2) equipment grounding conductor installed with the feeder
(3) supply side bonding jumper
~~and the grounding electrode system.~~ Each grounding electrode conductor shall be sized in accordance with 250.66 based on the service-entrance or feeder conductor(s) supplying the individual ~~service~~ disconnecting means.

(3) Common Location. A grounding electrode conductor shall be connected in a wireway or other accessible enclosure on the supply side of the service disconnecting means to one or more of the following as applicable:
(1) grounded service conductor(s)
(2) equipment grounding conductor installed with the feeder
(3) supply side bonding jumper
~~in a wireway or other accessible enclosure on the supply side of the service disconnecting means.~~

The connection shall be made with exothermic welding or a connector listed as grounding and bonding equipment. The grounding electrode conductor shall be sized in accordance with 250.66 based on the service-entrance or feeder conductor(s) at the common location where the connection is made.

Panel Statement: The revised text incorporates the necessary clarifying language to ensure that this section can be applied to both services and to buildings served by one or more feeders. The panel concludes this meets the intent of the submitter.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-45 Log #1054 NEC-P05 **Final Action: Accept in Principle**
(250.64(F)(4))

Submitter: George M. Stolz, II, Quicksilver Electrical Training
Comment on Proposal No: 5-125
Recommendation: Accept the proposal.
Substantiation: If the panel believes that the items listed are grounding electrode conductors or bonding jumpers, then we have more headaches in the field than I could have imagined. All steel water lines, steel structural metal, and now in the 2014 rebar embedded in concrete are no longer viable connection points, as they are not made of copper, aluminum, or copper-clad aluminum as required by 250.62. By accepting the proposal, we can pretend that these items are not grounding electrodes, grounding electrode conductors or bonding jumpers yet still viable connection points; and thereby save a heap of editing in Article 250. It will be our little secret.
Panel Meeting Action: Accept in Principle
Revise existing 2011 text as follows:

250.62 Grounding Electrode Conductor Material. The grounding electrode conductor shall be of copper, aluminum, ~~or~~ copper-clad aluminum or the items as permitted in 250.68(C). The material selected shall be resistant to any corrosive condition existing at the installation or shall be protected against corrosion. ~~The c~~Conductors of the wire type shall be solid or stranded, insulated, covered or bare.

Panel Statement: The panel concludes that the concern of the submitter is met by revising 250.62 as shown in the panel action text.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-46 Log #1133 NEC-P05 **Final Action: Accept**
(Table 250.66)

Submitter: Phil Simmons, Copper Development Association, Inc.
Comment on Proposal No: 5-126
Recommendation: Continue to Reject the Proposal.
Substantiation: The submitter has failed to provide sufficient technical justification for the Proposal. A fact finding report that demonstrates that this product is suitable for the proposed application has not been provided. There is no indication how one would determine whether the conductor is 30% or 40% conductivity material. In addition, there is no indication that terminals on equipment are designed, tested and suitable for terminating copper-clad steel conductors.
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-47 Log #1134 NEC-P05 **Final Action: Accept**
(250.66(A))

Submitter: Phil Simmons, Copper Development Association, Inc.
Comment on Proposal No: 5-133
Recommendation: Continue to Reject the Proposal.
Substantiation: The submitter has failed to provide sufficient technical justification for the Proposal. A fact finding report that demonstrates that this product is suitable for the proposed application has not been provided. There is no indication how one would determine whether the conductor is 30% or 40% conductivity material. In addition, there is no indication that terminals on equipment are designed, tested and suitable for terminating copper-clad steel conductors.
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-48 Log #1135 NEC-P05 **Final Action: Accept**
(250.66(B))

Submitter: Phil Simmons, Copper Development Association, Inc.
Comment on Proposal No: 5-136
Recommendation: Continue to Reject the Proposal.
Substantiation: The submitter has failed to provide sufficient technical justification for the Proposal. A fact finding report that demonstrates that this product is suitable for the proposed application has not been provided. There is no indication how one would determine whether the conductor is 30% or 40% conductivity material. In addition, there is no indication that terminals on equipment are designed, tested and suitable for terminating copper-clad steel conductors.
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-49 Log #1055 NEC-P05 **Final Action: Accept in Principle**
(250.68(C)(2))

Submitter: George M. Stolz, II, Quicksilver Electrical Training
Comment on Proposal No: 5-141
Recommendation: Accept the proposal.
Substantiation: Mr. Mello gets it. Building steel is a good conductor, whether it is in contact with the earth or not. Let 250.52 deal with what is an electrode, and allow 250.68(C) deal with non-wire-type conductors that are sensible to use for interconnecting grounding electrodes. It simplifies and separates concepts. I don't have to earth a copper conductor between a pair of electrodes, there's no reason to require earthing of steel to use it as a conductor. This section also creates a bit of a paradox; if I connect the electrodes to the steel, then suddenly it complies as a conductor to interconnect electrodes. Why have all the extra language, topped off with the proposed "(c) By other approved means of establishing a connection to earth."? It is so wide open as to restrict nothing, so why have all the extra unecessary language?

Less is more!

Panel Meeting Action: Accept in Principle
Revise the text from the 2013 ROP Draft as follows:
(2) The metal structural frame of a building ~~that is directly connected to a grounding electrode as specified in 250.52(A)(2) or 250.68(C)(2)(a), (b), or (c)~~ shall be permitted to be used as a ~~bonding~~ conductor to interconnect electrodes that are part of the grounding electrode system, or as a grounding electrode conductor.
~~a. By connecting the structural metal frame to the reinforcing bars of a concrete-encased electrode, as provided in 250.52(A)(3), or ground ring as provided in 250.52(A)(4)~~
~~b. By bonding the structural metal frame to one or more of the grounding electrodes, as specified in 250.52(A)(5) or (A)(7), that comply with 250.53(A)(2)~~
~~c. By other approved means of establishing a connection to earth~~
Panel Statement: The revised text clarifies that the structural metal is treated the same as the metallic water system. The application from the charging paragraph of 250.68(C) makes it clear that structural metal can be used to connect wire type bonding jumpers or grounding electrode conductors to the structural metal as an extension of the wire type bonding conductor or grounding electrode conductor.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-50 Log #1522 NEC-P05 **Final Action: Reject**
(250.84)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 5-144
Recommendation: Revise text to read as follows:
250.84 Underground Service Cable or Raceway.
(A) Underground Service Cable. The sheath or armor of a continuous underground metal-sheathed or armored service cable system (MC, MI, MV, or

TC) that is connected to the grounded system conductor on the supply side shall not be required to be connected to the grounded system conductor at the building or structure. The sheath or armor shall be permitted to be insulated from the interior metal raceway or piping.

(B) Underground Service Raceway Containing Cable. An underground metal service raceway that contains a metal-sheathed or armored cable (MC, MI, MV, or TC) connected to the grounded system conductor shall not be required to be connected to the grounded system conductor at the building or structure. The sheath or armor shall be permitted to be insulated from the interior metal raceway or piping.

Substantiation: Original proposal had a typographic error referencing 250.80 rather than 250.84.

The list of metal-sheathed or armored cables suggested above may include cables not suitable for service entrance conductors. If that is the case, then it should be pruned. The fact that AC cable is not suitable although it is an armored cable demonstrates the need of a precise list.

Panel Meeting Action: Reject

Panel Statement: The parenthetical list of acronyms of types of cables is not necessary. The wiring methods permitted to be used for services is included in 230.43.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-51 Log #1056 NEC-P05 **Final Action: Reject**

(250.92(B)(1))

Submitter: George M. Stolz, II, Quicksilver Electrical Training

Comment on Proposal No: 5-147

Recommendation: Accept the proposal.

Substantiation: While the entire section deals with equipment, raceways are mentioned by name. It is an appropriate location for a raceway-specific permission.

Allowing installers explicit permission to install a bonding connection on either end of a service raceway will alleviate conductor fill in the service equipment as well.

I see no harm in allowing this sentence to be added, especially since I personally have been ordered to move a bonding connection for no good electrical reason. It does add clarity to the NEC.

Panel Meeting Action: Reject

Panel Statement: The bonding of the service raceway must be accomplished in accordance with 250.92. There is no reference to which end of the raceway to bond and the submitter is correct that it can be at either end. The proposed added sentence is unnecessary.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-52 Log #269 NEC-P05 **Final Action: Reject**

(250.100)

Submitter: Code-Making Panel 14,

Comment on Proposal No: 5-160

Recommendation: Delete 250.100 entirely.

Substantiation: 250.100 is specific to bonding in hazardous (classified) locations and these requirements are addressed in 501.30(A), 502.30(A), 503.30(A), 505.25(A) and 506.25(A). See CMP 14 Proposal 14-56a which deletes the Informational Note that references 250.100. CMP 14 has the responsibility for amending bonding requirements in hazardous (classified) locations.

This comment was developed by a CMP-14 Task Group and balloted through the entire panel with the following ballot results:

15 Eligible to vote
14 Affirmative
1 Ballot Not Returned (W.E. McBride)
No Comments on Vote were received

Panel Meeting Action: Reject

Panel Statement: The panel concludes the text should remain in Article 250. Section 250.100 provides the initial requirement that bonding in hazardous locations be completed and that it be completed by one of the specific methods in 250.92(B)(2). Chapter 5 hazardous location articles can amend the base requirement with additional requirements. For example, 501.30 requires wiring and equipment to be "grounded". Section 501.30(A) then goes on to further modify the installation specified in 250.92(B)(2) but does not establish the initial requirement for bonding to start with. Similar lack of initial requirements exist in the other referenced hazardous location sections.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-53 Log #270 NEC-P05 **Final Action: Reject**

(250.100)

Submitter: Code-Making Panel 14,

Comment on Proposal No: 5-160

Recommendation: Proposal 5-160 should be rejected.

Substantiation: In accordance with 90.3 Article 250 applies except as amended by Chapters 5, 6, and 7 for particular conditions. Specific requirements for bonding are addressed in 501.30(A), 502.30(A), 503.30(A), 505.25(A), and 506.25(A). See CMP 14 Proposal 14-56a which deletes the Informational Note that references 250.100.

This comment was developed by a CMP-14 Task Group and balloted through the entire panel with the following ballot results:

15 Eligible to vote
14 Affirmative
1 Ballot Not Returned (W.E. McBride)
No Comments on Vote were received

Panel Meeting Action: Reject

Panel Statement: See panel action and statement on Comment 5-52.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-54 Log #1136 NEC-P05 **Final Action: Accept**

(250.102(A))

Submitter: Phil Simmons, Copper Development Association, Inc.

Comment on Proposal No: 5-161

Recommendation: Continue to Reject the Proposal.

Substantiation: The submitter has failed to provide sufficient technical justification for the Proposal. A fact finding report that demonstrates that this product is suitable for the proposed application has not been provided. There is no indication how one would determine whether the conductor is 30% or 40% conductivity material. In addition, there is no indication that terminals on equipment are designed, tested and suitable for terminating copper-clad steel conductors.

Panel Meeting Action: Accept

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-55 Log #248 NEC-P05 **Final Action: Reject**

(Table 250.102(C))

Submitter: Edward G. Kroth, Verona, WI

Comment on Proposal No: 5-42

Recommendation: Revise table title as follows:

Grounded Service or System Conductor.

Substantiation: Having taught code courses for the past 13 years and in particular Grounding and Bonding for the past 8 years, I can really appreciate how this proposal can enhance the usability of the Code. Table 250.66 with its title for sizing Grounding Electrode Conductors was often a stumbling block for both apprentices and JWs when it was referred to for sizing Grounded Service Conductors, Separately Derived System Grounded Conductors, Main Bonding Jumpers, System Bonding Jumpers and Supply Side Bonding Jumpers. In particular the idea of the 12 1/2 % is often times lost on the students by the time they read the rule and then looked at the table. Hopefully with this new separation, different titles and the additional notes on Table 250.102(C) some of the confusion as to how and when to apply the rules for these various grounded and/or bonding items will be lessened. I am not usually in favor of repeating tables, but in this case it does seem justified. Furthermore it might be appropriate to add the phrase "Service or System" in the title where the table heading refers to Grounded conductor. For example: often times there is a grounded conductor installed with branch or feeder circuits and clearly we are not to size these using this new table.

Panel Meeting Action: Reject

Panel Statement: The term "Grounded Conductor" is correct and would be applicable to service grounded conductors and feeder grounded conductors such as supplied from a separately derived system.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-56 Log #1534 NEC-P05 **Final Action: Accept in Principle**

(250.102(C))

Submitter: Phil Simmons, Copper Development Association, Inc.

Comment on Proposal No: 5-42

Recommendation: Revise the text of the 2014 NEC ROP Draft as follows:

Add an Informational Note after 250.102(C)(2) to read as follows:

Informational Note: The term "supply conductors" includes ungrounded conductors that do not have overcurrent protection on their supply side and terminate at service equipment or the first disconnecting means of a separately derived system.

Delete 250.102(C)(3).

Revise the Informational Note that follows Table 250.102(C) to read:

"Informational Note: See Chapter 9, Table 8 for the circular mil area of conductors 18 AWG through to 4/0 AWG."

Substantiation: The Informational Note should be added to inform the user of the NEC what is intended by the term "supply conductors" as this term is not defined in Article 100 or in 250.2.

250.102(C)(3) should be deleted since the exact text is included as Note 2 in new Table 250.102(C).

The Informational Note that follows new Table 250.102(C) should be changed to be inclusive of 4/0 AWG conductors.

Panel Meeting Action: Accept in Principle

Revise the Informational Note that follows Table 250.102(C) to read:

Informational Note: See Chapter 9, Table 8 for the circular mil area of conductors 18 AWG through 4/0 AWG.

Panel Statement: The word "to" was removed from the recommendation in the informational note to Table 250.102(C).

The remainder of the recommendation is accepted unchanged.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-57 Log #91 NEC-P05 **Final Action: Accept**
(250.104(A)(2))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 5-167

Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the panel action on Proposal 9-15c that modified the definition of "Metal Enclosed Power Switchgear" to "Switchgear".

This action will be considered as a public comment.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Revise the text of 250.104(A)(2) from the 2012 ROP Draft to read as follows:

(2) Buildings of Multiple Occupancy. In buildings of multiple occupancy where the metal water piping system(s) installed in or attached to a building or structure for the individual occupancies is metallically isolated from all other occupancies by use of nonmetallic water piping, the metal water piping system(s) for each occupancy shall be permitted to be bonded to the equipment grounding terminal of the switchgear, switchboard or panelboard, ~~switchboard, or metal-enclosed switchgear~~ enclosure (other than service equipment) supplying that occupancy. The bonding jumper shall be sized in accordance with Table 250.122, based on the rating of the overcurrent protective device for the circuit supplying the occupancy.

Panel Statement: The panel accepts the direction of the Correlating Committee. The panel has revised the text to be consistent with the actions taken by CMP-9, consistent with other sections in Article 250 and the modification in the definitions.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-58 Log #140 NEC-P05 **Final Action: Accept in Principle**
(250.104(A)(2))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 9-15c

Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7.

It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 5 for action.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept in Principle

Panel Statement: See panel action and statement Comment 5-57. The panel has revised the text to be consistent with the actions taken by CMP-9 and the modification in the definitions.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-59 Log #345 NEC-P05 **Final Action: Accept in Principle**
(250.104(B))

Submitter: Christine T. Porter, Seattle, WA

Comment on Proposal No: 5-171

Recommendation: Revise text to read as follows:

(B) Other Metal Piping. If installed in, or attached to, a building or structure, a metal piping system(s), including gas piping, that is likely to become energized shall be bonded to ~~the service equipment enclosure; the grounded conductor at the service; the grounding electrode conductor, if of sufficient size; or to one or more grounding electrodes used~~ any of the following:1) the equipment grounding conductor of the circuit that is likely to energize the piping system(s);2) the service equipment enclosure;3) the grounded conductor at the service;4) the grounding electrode conductor if of sufficient size;5) to one or more grounding electrodes used: The bonding conductor(s) or jumper(s) shall be sized in accordance with 250.122, using the rating of the circuit that is likely to energize the piping system(s). ~~The equipment grounding conductor for the circuit that is likely to energize the piping shall be permitted to serve as the bonding means~~. The points of attachment of ~~the~~ any bonding jumper(s) shall be accessible.

Substantiation: The current order of the requirement seems to be creating confusion for the submitter. Certainly other users of the code have also been confused by this section as evidenced by the continued revisions to this section for reasons of clarity. The reordering of this section should make it easier to understand the requirements by using a list format, and also by changing to order of the requirements. The first choice should be a connection to the equipment grounding conductor of the circuit that is likely to energize the piping in order to ensure a low impedance path back to the source without relying on the continuity of any gas piping throughout a structure. Maintaining the other possible methods allows for options to accomplish the goal of clearing any faults on the piping systems.

Panel Meeting Action: Accept in Principle

Revise 250.104(B) to read as follows:

(B) Other Metal Piping. If installed in, or attached to, a building or structure, a metal piping system(s), including gas piping, that is likely to become energized shall be bonded to any of the following:

1. The equipment grounding conductor for the circuit that is likely to energize the piping system.
2. The service equipment enclosure.
3. The grounded conductor at the service.
4. The grounding electrode conductor, if of sufficient size.
5. One or more grounding electrodes used.

The bonding conductor(s) or jumpers(s) shall be sized in accordance with 250.122, using the rating of the circuit that is likely to energize the piping system(s). The points of attachment of bonding jumper(s) shall be accessible.

Informational Note No. 1: Bonding all piping and metal air ducts within the premises will provide additional safety.

Informational Note No. 2: Additional information for gas piping systems can be found in Section 7.13 of NFPA 54-2009, National Fuel Gas Code.

Panel Statement: Editorial changes were made to better show the list form and the final wording from the submitter's comment. The panel removed the word "any" from the last sentence in the proposed comment text. The panel does not agree that the equipment grounding conductor is the first choice as the point of connection.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

Comment on Affirmative:

PORTER, C.: The title of 250.104 clearly states that the section is dealing with bonding. Section 240.4 clearly gives the purpose of bonding is to provide an effective ground-fault path. I disagree that utilizing gas piping or the grounding electrode system back to the location where it is bonded to the service is always an effective ground-fault return path for clearing faults on piping likely to be energized by an electrical circuit.

5-60 Log #1576 NEC-P05 **Final Action: Reject**
(250.104(B))

Submitter: Robert Torbin, Omega Flex Inc.

Comment on Proposal No: 5-172

Recommendation: Add new (B) and Informational Note to read as follows:

(B) Metal Gas Piping. Metal gas piping installed in or attached to a building or structure shall be bonded in accordance with (A)(1) and (A)(3). The bonding conductor or jumper shall be connected in an accessible location to rigid pipe downstream of the point of delivery of the fuel gas.

Informational Note: Additional information for gas piping systems can be found in Section 7.13 of the National Fuel Gas Code/NFPA 54-2009.

~~**(B)**~~**(C) Other Metal Piping.** If installed in or attached to a building or structure, a metal piping system(s)~~, including gas piping,~~ that is likely to become energized shall be bonded to the service equipment enclosure, the grounded conductor at the service, the grounding electrode conductor if of sufficient size, or to one or more grounding electrodes used. The bonding conductor(s) or jumper(s) shall be sized in accordance with 250.122, using the rating of the circuit that is likely to energize the piping system(s). The equipment grounding conductor for the circuit that is likely to energize the piping shall be permitted to serve as the bonding means. The points of attachment of the bonding jumper(s) shall be accessible.

Informational Note: Bonding all piping and metal air ducts within the premises will provide additional safety.

Renumber existing 250.104(C) as (D) and 250.104(D) as (E).

Substantiation: The requirement to bond to a fitting has been removed as the UL 467 Standard for bonding clamps addresses clamps for round pipe.

The Panel Statement raises the issue of lightning protection. However, I am confused by this statement as my original proposal was submitted to address consumer safety from electrical insults that originate from the electrical system within the premises or from surges from the local power company distribution system. Surely the same electrical faults imposed on structural steel or the copper water pipe may be imposed on the metallic gas piping with equal impact.

Bonding of gas piping has been performed in the prescribed manner within the United States for many years prior to the 2002 NEC and is performed in this fashion around the industrialized world today. Technical substantiation is hardly necessary to validate such a common, yet essential, element of electrical safety as bonding.

Panel Meeting Action: Reject

Panel Statement: No technical substantiation for increasing the level of bonding required has been provided.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-61 Log #344 NEC-P05 **Final Action: Reject**
(250.106)

Submitter: David E. Shapiro, Safety First Electric
Comment on Proposal No: 5-180
Recommendation: Revise text to read as follows:
The bonding connection to the building or structure grounding electrode system shall be located outside the building or structure served where the grounding electrode system is available outside the building or structure.
Substantiation: I believe that the action on this proposal should be changed to "Accept in Principle." The panel made two valid objections to the proposal as stated. The panel did not, however, disagree with the principle behind the proposal. The first objection is that we should not demand that (to spell out the most absurd case) installers run conductors outside from totally interior grounding electrodes to bond them with conductors run outside from totally interior lightning down conductors. No AHJ with a head on this shoulders would require this. However, the objection remains that the proposed wording could be interpreted in such ways. Surely no one believes that Mr. Johnston intended such a tortuous requirement, if only because lightning conductors must not be put through tortuitous bends. Therefore, the phrase I suggest adding to deal with your first objection is simply clarification, not modification. Your second objection is that the required intersystem bonding means may be installed either indoors or out, and this proposal requires bonding outdoors in some cases. There are two responses. First, not all structures incorporate lightning protection systems, and also, as you note, not all grounding electrodes incorporate outdoor components. In every such case, the proposal does not apply, and so the bonding means can be indoors or out. Second, the requirement states that the accessible bonding means must be made available; but I see no requirement that this busbar must serve as the sole bonding means. Even if you interpret the proposal as requiring the intersystem bonding electrode to be mounted on the outsides of structures when 250.106 applies, this becomes a case of a specific rule narrowing the application of a more general rule in keeping with special circumstances. There is nothing unusual about that.
Panel Meeting Action: Reject
Panel Statement: Connection of the lightning protection system to the building or structure grounding system is not intended to provide a path for lightning current to ground. It is intended to minimize a difference in potential between the lightning protection conductors and metallic grounded equipment in or on the building or structure.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-62 Log #1152 NEC-P05 **Final Action: Reject**
(250, Part VI)

Submitter: Paul Dobrowsky, American Chemistry Council
Comment on Proposal No: 5-181
Recommendation: The proposal should have been accepted.
Substantiation: The term Equipment Grounding Conductor needs to be replaced. Those opposed have no technical reason for their opposition or any other valid reason. It is not worth the effort and everyone understands what is meant are common responses.
It is very simple: Grounding electrode conductors are the connection to the earth and accomplish grounding. In the present NEC, Equipment Grounding Conductors and bonding jumpers provide a "path back" to the source. Both are always performing a bonding function. If the Grounding Electrode connection is removed or broken, the bonding function remains intact.
Section 250.4 does not permit the earth (ground) to be used as an effective ground fault current path but the term equipment grounding conductor inherently incorrectly contains the word "ground".
Visualize equipment supplied by a portable generator. The generator frame is not required to be connected to the earth. The "green" wire in the flexible cord is not performing a grounding function but is performing a bonding function.
Visualize building one supplied by a service, having the grounded conductor connected to the grounding electrode system by a grounding electrode conductor. A feeder supplies a second building and a grounding electrode conductor is required for grounding any equipment in the second building. An equipment grounding conductor is required to be installed from building 1 to building 2. Not for grounding, but for bonding, providing an effective fault current path.
Making this change has the added benefit of being more harmonized with other international standards and usage of terminology.
Experienced NEC users have to ignore other concepts in other definitions and requirements to use the existing term. This does not help the future NEC user or provide clarity in the existing NEC. Changing the term is the right thing to do and should be supported.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 5-1.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 13 Negative: 3
Explanation of Negative:
DOBROWSKY, P.: See my negative ballot comment on 5-1.
MOHLA, D.: See my explanation of negative vote on Comment 5-1.
WILLIAMS, D.: See my negative vote substantiation written for Comment 5-1
Comment on Affirmative:
PORTER, C.: See my statement in comment 5-1.

5-63 Log #141 NEC-P05 **Final Action: Accept**
(250.112(A))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-15d
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7.
It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 5 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise the text from the 2011 NEC Section 250.112(A) to read as follows:
(A) Switchgear and Switchboard Frames and Structures. Switchgear or ~~S~~switchboard frames and structures supporting switching equipment, except frames of 2-wire dc switchgear or switchboards where effectively insulated from ground.
Panel Statement: The panel accepts the direction of the Correlating Committee. The revised text is consistent with the revisions to incorporate the term "switchgear" and to be consistent with other sections in Article 250.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-64 Log #939 NEC-P05 **Final Action: Reject**
(250.112(B))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 5-199
Recommendation: Revise text to read as follows:
250.122 Size of Equipment Grounding Conductors.
~~**(B) Increased in Size.** Where ungrounded conductors are increased in size from the minimum size that has sufficient ampacity for the intended installation, wire type equipment grounding conductors, where installed, shall be increased in size proportionately according to the circular mil area of the ungrounded conductors.~~
(B) Increased in Size. If wire type equipment grounding conductor(s) are present, where ungrounded conductors are increased in size from the minimum size that has sufficient ampacity before any adjustments f250.112Bor derating for (1) ambient temperature correction factors, (2) exposure to sunlight on a rooftop, (3) adjustments for more than three current carrying conductors, or (4) for reduction in voltage drop, then the required grounding conductor size shall be calculated using the following equation:
Agnew = Agorg × (Aunew ÷ Auorg)
where:
Agnew = new area required for grounding conductorAgorg = original area of grounding conductorAunew = new area for ungrounded conductor after all adjustments & deratingsAuorg = original area for ungrounded conductor before any adjustments or deratingsall areas in circular mils or mm^2
The new required size of the equipment grounding conductor(s) shall be the next standard size that is equal or greater to the *Agnew* area.
Informational Note: Increases in size for the grounded conductor alone do not require the equipment grounding conductor to be increased in size.
Substantiation: The original text is so chopped up that just displaying the new text is clearer. Suggest that the reasons for increasing size be explicit and that calculation be expressed as a usable formula rather than suggested by the wording. Parens not needed.
Informational note indicates larger grounded conductor (for harmonics for instance) does not trigger larger EGC.
Panel Meeting Action: Reject
Panel Statement: The panel recognizes that the section is 250.122(B). Insufficient technical substitution was provided to support adding the revised text and including a formula. The proposed text does not make this section clearer. The informational note is not needed since the current NEC text refers only to ungrounded conductors.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-65 Log #1137 NEC-P05 **Final Action: Accept**
(250.118(1))

Submitter: Phil Simmons, Copper Development Association, Inc.
Comment on Proposal No: 5-185
Recommendation: Continue to Reject the Proposal.
Substantiation: The submitter has failed to provide sufficient technical justification for the Proposal. A fact finding report that demonstrates that this product is suitable for the proposed application has not been provided. There is no indication how one would determine whether the conductor is 30% or 40%

conductivity material. In addition, there is no indication that terminals on equipment are designed, tested and suitable for terminating copper-clad steel conductors.
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-66 Log #1535 NEC-P05 **Final Action: Accept in Principle**
(250.119 Exception No. 2)

Submitter: Phil Simmons, Copper Development Association, Inc.
Comment on Proposal No: 5-188
Recommendation: Revise the text of the 2014 NEC ROP Draft as follows:
Exception No. 2: Flexible cords having an integral ~~that do not have an equipment grounding conductor, where the~~ insulation and jacket ~~are integral with each other,~~ shall be permitted to have a continuous outer finish that is green.
Substantiation: It seems the qualification that the flexible cord not contain an equipment grounding conductor for the exception to be operative is unnecessary. It also seems an unnecessary limitation on design of flexible cords is being imposed by including the phrase, "that do not have an equipment grounding conductor." Would a flexible cord that has an equipment grounding conductor with integral green insulation and jacket be unsafe?
Panel Meeting Action: Accept in Principle
Revise exception No. 2 as follows:
Exception No. 2: Flexible cords having an integral insulation and jacket without an equipment grounding conductor ~~that do not have an equipment grounding conductor, where the insulation and jacket are integral with each other,~~ shall be permitted to have a continuous outer finish that is green.
Panel Statement: Editorial changes where made for clarity.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-66a Log #CC500 NEC-P05 **Final Action: Accept**
(250.121)

Submitter: Code-Making Panel 5,
Comment on Proposal No: 5-190
Recommendation: Add new exception to 250.121 to read as follows:
Exception. A wire-type equipment grounding conductor installed in compliance with 250.6(A) and the applicable requirements for both the equipment grounding conductor and the grounding electrode conductor in Parts II, III and VI of this article shall be permitted to serve as both an equipment grounding conductor and a grounding electrode conductor.
Substantiation: Section 250.121 restricts all equipment grounding conductors provided in 250.118 from being used as a grounding electrode conductor. This is appropriate for all of the fourteen types with the exception of a wire type, per 250.118(1), if the wire type satisfies all applicable requirements for both the equipment grounding conductor and the grounding electrode conductor simultaneously. Equipment grounding conductors installed in accordance with this restrictive exception that do not carry current during normal operating conditions can comply with 250.6(A).
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 14 Negative: 2
Explanation of Negative:
BRENDER, D.: This Comment should have been rejected. It was developed at the Panel meeting in response to Comment 5-68. That Comment (5-68) requested that Section 250.121 be deleted and did not provide suggested text for an exception. As a result, this Comment is outside the parameters of the NFPA Regulations Governing Committee Projects.
WILLIAMS, D.: The equipment grounding conductor should not be used as a grounding electrode conductor. The previous wording in the code was correct and the addition of the exception was not needed, and will cause complications in the field. Installations in the field where the equipment grounding conductor was attempted to be utilized as a grounding electrode conductor as well created more violations. The exception should be more explicit on all the requirements that are needed in order to have a code compliant installation.

5-67 Log #1138 NEC-P05 **Final Action: Accept in Principle**
(250.121)

Submitter: Phil Simmons, Copper Development Association, Inc.
Comment on Proposal No: 5-190
Recommendation: Continue to reject the proposal and retain the existing text of the 2011 NEC.
Substantiation: Many applications that justify the requirement for individual grounding electrode and equipment grounding conductors come to mind. These include:
1. A separately derived system located in a building or structure where the equipment grounding conductor is supplied to the transformer with or containing the feeder and the grounding electrode conductor is required to be connected where the transformer is located. It would be a violation of the rules in 250.30(A)(4) to connect the grounding electrode conductor at some location remote to the transformer.
2. A generator or transformer is located outdoors. Section 250.30(C) requires the grounding electrode connection to be located at the outdoor source. An equipment grounding conductor or supply-side bonding jumper or conductor is then required to be run to the building or structure supplied or from which the source is supplied as to a transformer.
3. The purpose for the conductors as well as the sizing and installation requirements differ.
4. Let's assume a feeder panelboard that is located in a building or structure supplies a transformer that is located outdoors. Let's also assume a common equipment grounding/grounding electrode conductor is sized properly. Where does it connect in the panelboard. An equipment grounding conductor is required to connect to the equipment grounding terminal bar. The grounding electrode conductor is required to be connected to the grounding electrode. The grounding electrode conductor is generally not permitted to be spliced by 250.64(C).
Using one conductor for both an equipment grounding conductor and a grounding electrode conductor is generally a bad idea.
This section continues to contain a valuable safety requirement and should be retained without Exception. It seems an exception cannot be considered at the Comment meeting as no exception was submitted for action by the Code Panel at the proposal stage. Thus, CMP-5 did not take any action that would be subject to public review and reaction. Submitting a proposed exception at the ROC meeting is in violation of the NFPA Regulations Governing Committee Projects.
Code Making Panels that have jurisdiction over Articles in Chapters 5, 6, 7 and 8 can rightfully craft an exception to the general requirement in 250.121 as provided in 90.3. This section recognizes that the rules in Chapters 1 through 4 apply generally unless amended by the requirements in Chapters 5, 6, 7 or 8. An example of this organization of the Code is found in 690.47(C)(3) where a common grounding electrode conductor and equipment grounding conductor is permitted under the rules and conditions that are applicable.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and statement on Committee Comment 5-66a (Log #CC-500).
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16
Comment on Affirmative:
BRENDER, D.: This Comment should have been Accepted in full, not APR. The Comment sought to Accept the original Proposal and retain existing 2011 NEC language.

5-68 Log #1598 NEC-P05 **Final Action: Reject**
(250.121)

Submitter: Scott Cline, Monterey Park, CA
Comment on Proposal No: 5-190
Recommendation: Delete the still totally unsubstantiated Section 250.121.
Substantiation: I believe that it is not possible to give a single example of an installation, meeting the requirements of the 2008 NEC, and presenting a hazard of any kind. NFPA standards for technical substantiation for this Section have not been met.
CMP actions should be based on evidentiary technical substantiation showing a hazard.
Not even a single example of hazard under the rules of the 2008 NEC has been given.
There is quite simply no proper justification for the rule.
2014 cycle Proposal 5-190 both addresses and shows the original 2011 Proposals' "Substantiations" to be flawed and inadequate, and as such should be reviewed. It especially includes the 2011 cycle 5-259 Substantiation statement "Equipment grounding conductors do not normally carry current while a grounding electrode conductor may normally carry current since it is often in parallel with the neutral conductor." Other than a service supplied by a separately grounded utility transformer, please give an example of a neutral being in parallel with the GEC. Even if an EGC was intended in that logic statement: 250.24(A)(5) only very rarely allows the neutral to be in parallel with an EGC. It is also fact that even if a single conductor were carrying some stray current because of its GEC function, it would still be able to carry the rare ground-fault circuit-clearing current needed for its EGC function.
In addition to the Proposal's Substantiation, I submit the following added Substantiation for this Comment. It will address the points of the Panel's Proposal Rejection Statement logic (presented in Bold Italics) from the ROP.
Panel Statement: The panel re-affirms the position that the GEC and EGC's have different functions and shall not be used as both. The substantiation for the proposal contains some of the reasons this proposal is not acceptable. This includes the fact that the two conductors are installed for different purposes, are sized differently and have different installation requirements.
Like the original Proposal, this re-affirmation is made without the required technical facts. The GEC and EGC do not have mutually exclusive functions. They both must be able to carry sufficient electrons from one point to another point - Period. There are many circumstances where the termination points of the GEC and EGC are the same. There are many circumstances where both sets of installation requirements can be satisfied. Where an installation allows compliance with all of the 2008 NEC GEC and EGC requirements, there is no safety/hazard reason to install parallel conductors.

Here are a few illustrations of why the rule needs to remain in the NEC:

(1) An equipment grounding conductor is required to be installed with the circuit conductors to the transformer enclosure. 250.30(A)(4) requires the grounding electrode to be "as near as practicable to, and preferably in the same area as the grounding electrode conductor connection". These locations could and often are widely separated.

They can also be directly adjacent to one another. An example is the very common one of a main service/distribution with an adjacent transformer. It is extremely easy to construct a single conductor GEC-EGC for this circumstance which is both safe and effective AND which satisfies all 2008 NEC requirements. (1) is a futile effort of logic, presenting only a single negative example, and not proving the fact which must be proven: that a conductor satisfying all requirements of the 2008 Code presents a hazard.

(2) A feeder is installed from a source in a building to a transformer that is located outdoors. 250.30(C) requires the grounding electrode connection to be at the transformer that is the source of a separately derived system. A combination grounding electrode conductor/equipment grounding conductor run to the source location would not be acceptable.

Again, a simple negative example, and a flawed one at that. An insultingly poor quality statement is made here – the great deal of time which I have spent to present the issues here, deserves enough time on your part to be accurate with your rebuttals. Section 250.30(C) applies to a system where the source is outside the building. In a correct 250.30(C) example, since any required GEC of the source must be bonded to the structure's GES, then it is a possible situation that a 2008 compliant GEC-EGC connection may be made from the transformer to the same connection point of the source. In your response example of the transformer outside with the source inside, again a 2008 compliant GEC-EGC connection might be made to the GES connection point at the source. Again, (2) is a futile effort.

(3) A supply to a transformer-type separately derived system is installed from a sub-panel (feeder panelboard). Where would a combination grounding electrode conductor/equipment grounding conductor be connected? To the neutral terminal bar? A clear violation of 250.24(A)(5). To the equipment grounding terminal bar? The equipment grounding conductor supplying the panelboard may not be large enough.

Another of the infinitely available negative examples, none of which prove the point which you have the responsibility to prove. The fact which must be proven: that a conductor satisfying all requirements of the 2008 NEC presents a hazard.

And there is a Code compliant answer to the question of (3): Under the right circumstances of location and conduits, the larger of the two sizes would be bonded at the transformer as required for both the GEC and the EGC, then its un-spliced length would be bonded to the panelboard as it passed through the panelboard to do the EGC's task, and would then run to its connection point on the structure's Ground Electrode System. A hazard-free and 2008 NEC compliant installation.

Again: Evidentiary technical substantiation is a standard we as CMP members should always strive to meet. From the original Proposal forward, there has not been a single proper example given of a hazard present in the 2008 NEC. I do not believe that this satisfies your responsibilities as a Code Panel. There is quite simply no proper justification for the rule.

If you can't give the necessary technical example, please take the responsibility required of a CMP to recognize the flawed logic of Section 250.121, and delete it.

Panel Meeting Action: Reject

Panel Statement: Section 250.121 restricts all equipment grounding conductors provided in 250.118 from being used as a grounding electrode conductor. This is appropriate for all of the fourteen types with the exception of a wire type, per 250.118(1), if the wire type satisfies all applicable requirements for both the equipment grounding conductor and the grounding electrode conductor simultaneously. Equipment grounding conductors installed in accordance with this restrictive exception that do not carry current during normal operating conditions can comply with 250.6(A).

See panel action and statement on Committee Comment 5-66a (Log #CC-500).

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

Comment on Affirmative:

MELLO, C.: The last sentence in the panel statement should be relocated as the first sentence. As now organized the panel statement discusses an exception and possible allowance before the reader has been directed to where that new exception and allowance was created.

5-69 Log #1139 NEC-P05 **Final Action: Accept**

(Table 250.122)

Submitter: Phil Simmons, Copper Development Association, Inc.

Comment on Proposal No: 5-193

Recommendation: Continue to Reject the Proposal.

Substantiation: The submitter has failed to provide sufficient technical justification for the Proposal. A fact finding report that demonstrates that this product is suitable for the proposed application has not been provided. There is no indication how one would determine whether the conductor is 30% or 40% conductivity material. In addition, there is no indication that terminals on equipment are designed, tested and suitable for terminating copper-clad steel conductors.

Panel Meeting Action: Accept

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-70 Log #1140 NEC-P05 **Final Action: Accept**

(250.122(A))

Submitter: Phil Simmons, Copper Development Association, Inc.

Comment on Proposal No: 5-196

Recommendation: Continue to Reject the Proposal.

Substantiation: The submitter has failed to provide sufficient technical justification for the Proposal. A fact finding report that demonstrates that this product is suitable for the proposed application has not been provided. There is no indication how one would determine whether the conductor is 30% or 40% conductivity material. In addition, there is no indication that terminals on equipment are designed, tested and suitable for terminating copper-clad steel conductors.

Panel Meeting Action: Accept

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-71 Log #286 NEC-P05 **Final Action: Reject**

(250.122(B))

Submitter: Abel Lampa, Innovative Engineering Inc.

Comment on Proposal No: 5-200

Recommendation: Add new Exception as follows:

Exception No. 1: As specified on Article 690.45(A), the equipment grounding conductor does not need to increase in size, if the DC conductors increases in size due to voltage drop consideration.

Substantiation: My inspector in Somerset County, NJ, referring to article 250.122(B) asked me to increase the size of my equipment grounding conductor because my DC conductors feeding my solar panels increases in size to satisfy the voltage drop requirement of 2%.

Panel Meeting Action: Reject

Panel Statement: In accordance with NEC 90.3, Article 690 can modify base requirements of Chapters 1 to 4. This comment should be directed as a new proposal to CMP-4 to modify Article 690 since the comment only applies to photovoltaic installations.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-72 Log #254 NEC-P05 **Final Action: Accept**

(250.122(D)(2))

Submitter: Code-Making Panel 11,

Comment on Proposal No: 5-201

Recommendation: Continue to Reject Proposal 5-201.

Substantiation: The TCC directed CMP11 to appoint a Task Group to consider its original position regarding the introduction of the acronym "MCP". This Task Group consisted of Jim Wright, Stan Folz, Terry Cole and Luis Bas. Background and the position of the Task Group is as follows.

Proposal 5-201 was rejected by CMP5, and had companion proposals to CMP-11. The first of these was 11-23, Log# 762, These companion proposals were for 430.2, 430.52 and 430.62. Each of these proposals was rejected by CMP-11 with the statement shown below. The circuit breakers being addressed are Instantaneous Trip Circuit Breakers, which are informally referred to as Mag Only Breakers, or Motor Circuit Protectors (MCP). CMP 11 does not see value in documenting all of the informal terms associated with an Instantaneous Trip Circuit Breaker. It is also the position of CMP11 that the introduction of "MCP" will create additional confusion with the already established fused based Motor Short-Circuit Protectors.

CMP11 Panel Action – Reject

CMP11 Panel Statement - The proposed definition is not presently utilized within Article 430. It refers to "magnetic-only" and "thermal trip elements" which ignores the fact that the instantaneous trip and overload functions in circuit breakers may be electronic or magnetic-hydraulic. The additional text of "listed and tested" is redundant. If the device has been listed, then it has been tested.

This comment was developed by a CMP-11 Task Group and balloted through the entire panel with the following ballot results:

14 Eligible to Vote

14 Affirmative

No Voting Comments were received

Panel Meeting Action: Accept

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-73 Log #1311 NEC-P05 **Final Action: Reject**
(250.122(D)(2))

Submitter: Mike Weitzel, Bechtel
Comment on Proposal No: 5-201
Recommendation: Revise text to read as follows:
Section 250.122(D)
(2) Instantaneous-Trip Circuit Breaker (MCP) and Motor Short-Circuit Protector. Where the overcurrent device is an instantaneous-trip circuit breaker **(MCP)** or a motor short-circuit protector, the equipment grounding conductor shall be seized not smaller than that given by Section 250.122(A) using the maximum permitted rating of a dual element time-delay fuse selected for branch-circuit short-circuit and ground-fault protection in accordance with Section 430.52(C)(I), Exception No. 1.
Substantiation: This proposal recommends adding the acronym **"MCP"** after Instantaneous Trip Circuit Breaker found in Section 250.122(D)(2), and correlates with a comment to Section 430.2, Definitions. Panel statements from both CMP 5 and CMP 11 were considered.
Motor Circuit Protector. An instantaneous trip type circuit breaker designed to be used as part of a listed motor controller assembly, containing electronic or magnetic-hydraulic instantaneous trip and overload functions, no thermal trip elements, and short circuit protection.
I believe that clarity and a clear definition of a Motor Circuit Protector is needed.
I'm trying to clarify what a Motor Circuit Protector is and how it should be used. It seems that there is some confusion in the field as to how these breakers are used and because they are being used incorrectly, safety is compromised.
They are intended to provide only branch-circuit, short-circuit, and ground-fault protection for individual motor branch circuits.
They may not be used to provide main, motor feeder, motor overload, and general branch-circuit or group motor protection...
NEC 430.52 requires that they shall only be used as part of a listed combination motor controller. MCP's are short-circuit tested only in combination with a motor controller and overload device.
Because of this, they are not labeled with an interrupting rating by themselves.
Per NEC 430.109, they may be used as a motor branch-circuit and controller disconnect, or "at the motor" disconnect only when part of a listed combination motor controller.
Companion proposals have been re-submitted to Section 430.2 to add a new definition for Motor Circuit Protector (MCP) 430.62, everywhere found in Section 430.52, and at the top of Table 430.52, to coincide with the use of the term in the *Code* text of 430.52.
Panel Meeting Action: Reject
Panel Statement: Panel 11 has jurisdiction over the types and descriptions of motor protection devices and has acted to reject the concept. See Comment 5-72.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-74 Log #976 NEC-P05 **Final Action: Reject**
(250.122(F))

Submitter: David Brender, Copper Development Assn. Inc.
Comment on Proposal No: 5-201a
Recommendation: Retain original text.
Substantiation: The original Proposal (5-204), re-crafted by the Panel as Panel Proposal 5-201a, was submitted with no substantiation, and should have been disallowed. The Panel requires every Proposal to be accompanied with technical substantiation and exceptions should not be made. Existing language of Section 250-122 has existed for years and is based on unequal current flow under fault conditions. The NEC Handbook discusses unequal current under certain fault conditions. The submitter of Proposal 5-204, re-crafted as 5-201a, has not submitted a Fact Finding Report or other documentation that the proposed change does not run contrary to the safety issues raised in the Handbook discussion, or is safe.
Further, it is not clear whether "the total sum of equipment grounding conductor" applies to number of conductors or circular mil area. The Panel should not be crafting technical substantiation for the submitter.
Panel Meeting Action: Reject
Panel Statement: The panel concludes removal of all of the changes in Proposal 5-201a is not warranted. The list format and requirements for the largest conductor should remain to improve usability. The panel removed the exception, see panel action on Comment 5-79.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 14 Negative: 2
Explanation of Negative:
BRETT, JR., M.: There was no substantiation provided to support this change. This proposed idea to allow a reduced EGC has been before this committee for several cycles and each time the committee has requested supporting data, none has been provided from the proponents. The EGC provides fire & life safety functions important to the entire electrical system integrity and the safety of the occupants of the installation. This comment and proposal 201a should be rejected until data to support this proposals has been supplied.
PICARD, P.: The exception should be retained. The substantiation is that there are are numerous Underwriters Laboratories Standards (UL 1277 Power and Control Cable, UL 1569 Metal-Clad Cable, UL 1072 Medium Voltage cable) that permit Equipment Grounding Conductors to be sectioned within a cable. The sectioning of an Equipment Grounding Conductor is equivalent to running multiple parallel Equipment Grounding Conductors and joining them together.
Experience in Canada has proven that oversized equipment grounding conductors are unnecessary in parallel installations, and further consideration should be given to this proposal.

5-75 Log #1062 NEC-P05 **Final Action: Reject**
(250.122(F))

Submitter: Michael J. Johnston, National Electrical Contractors Association
Comment on Proposal No: 5-201a
Recommendation: Reject the proposal for lack of technical substantiation.
Substantiation: This proposal should be rejected to remain consistent with the panel actions on similar previous proposals in past NEC development cycles. The same type of proposal was submitted in the 2011 NEC development cycle and was rejected by the panel due to lack of testing or any other type of technical substantiation. During that process the panel indicated that technical substantiation would be needed to accept this type of change. No appartent or additional technical substantiation has been provided to warrant this change that would lessen current sizing requirements. See the negative ballot statements of Williams, Brett and Brender.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 5-74.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 14 Negative: 2
Explanation of Negative:
BRETT, JR., M.: See my explanation of Negative vote on Comment 5-74.
PICARD, P.: See my explanation of negative vote on Comment 5-74.

5-76 Log #1141 NEC-P05 **Final Action: Reject**
(250.122(F))

Submitter: Phil Simmons, Copper Development Association, Inc.
Comment on Proposal No: 5-201a
Recommendation: Reject the Proposal.
Substantiation: This proposal should be rejected. Inadequate substantiation was provided for the new exception. The exception does not require the engineer to be qualified as an electrical engineer. Nor does it require the people who will install, service and maintain the wire with a reduced size equipment grounding conductor to be qualified in any way.
This section has required for decades that the minimum size equipment grounding conductor must be determined by Table 250.122 based upon the rating of the overcurrent protective device. Now, without any substantiation, the exception will allow an unqualified engineer to select a smaller equipment grounding conductor without restriction so long as the equipment grounding conductor is not smaller than 6 AWG copper or 4 AWG aluminum. This permission applies to wire pulled into raceways as well as to wire installed in cable. The exception should require the cable be listed to ensure proper construction.
The electrical inspector will have his or her hands tied and be required to accept an installation that does not satisfy this long-standing rule.
The Panel should have required a Fact-Finding Study to prove the validity of such a significant change and radical departure from the long-standing rule. Nothing has been provided to prove that safety will not be diminished by the proposed change.
The issue of equipment grounding conductors installed in parallel has long been addressed in the National Electrical Code Handbook. Here are two paragraphs from the 2011 NEC Handbook that apply to this proposed change,
"The full-sized equipment grounding conductor is required to prevent overloading and possible burnout of the conductor should a ground fault occur along one of the parallel branches. The installation conditions for paralleled conductors prescribed in 310.10(H) result in proportional distribution of the current-time duty among the several paralleled grounding conductors only for overcurrent conditions downstream of the paralleled set of circuit conductors. Exhibit 250.51 shows a parallel arrangement with two nonmetallic conduits installed underground. For clarity, a one-line diagram with equipment grounding conductors is shown. A ground fault at the enclosure will cause the equipment grounding conductor in the top conduit to carry more than its proportionate share of fault current. The fault is fed by two different conductors of the same phase, one from the left and one from the right. The shortest and lowest-impedance path to ground from the fault to the supply panelboard is through the equipment grounding conductor in the top conduit. The grounding path from the fault through the bottom conduit is longer and of higher impedance. Therefore, the equipment grounding conductor in each raceway must be capable of carrying a major portion of the fault current without burning open.
The substantiation for the proposal does not address or disprove the theory on unequal loading of the equipment grounding conductors as explained in the NEC Handbook.

Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 5-74.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 14 Negative: 2
Explanation of Negative:
BRETT, JR., M.: See my explanation of Negative vote on Comment 5-74.
PICARD, P.: See my explanation of negative vote on Comment 5-74.

5-77 Log #1337 NEC-P05 **Final Action: Hold**
(250.122(F))

Submitter: Paul Dobrowsky, Holley, NY
Comment on Proposal No: 5-201a
Recommendation: Revise text to read as follows:
(1) If conductors are installed in multiple raceways or cables as permitted in 310.10(H), wire type equipment grounding conductors, if installed, shall be in parallel in each raceway or cable and shall not be required to be larger than the largest ungrounded conductor installed in each raceway or cable. <u>Alternatively the equipment grounding conductor shall be permitted to be sized based on 250.102(C) based on the largest ungrounded conductor in the raceway.</u>
Substantiation: Continue to accept the proposal in concept but add the provided option. Admittedly the proposed sentence does not blend well with the other language but I want to put the concept before the panel. Base on the 2011 NEC a parallel conductor installation in multiple raceways requires a full size equipment grounding conductor in each raceway. The Equipment grounding conductor is sized based on the overcurrent device protecting the ungrounded conductors. But if the ungrounded conductors are not protected on their supply side, such as the secondary conductors of a transformer with no overcurrent protection at the supply, the supply side bonding jumper is sized based on the largest ungrounded conductor in the raceway using. So without overcurrent protection the “fault carrying conductor” in the raceway is considerably smaller than the equipment grounding conductor as presently required with overcurrent protection. The reason for this proposal it to provide this concept to the panel for discussion.
Panel Meeting Action: Hold
Panel Statement: This comment introduces a concept that has not had public review.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 14 Negative: 2
Explanation of Negative:
BRETT, JR., M.: See my explanation of Negative vote on Comment 5-74. The submitter did not provide any substantiation but only presented the concept for panel discussion.
PICARD, P.: See my explanation of negative vote on Comment 5-74.

5-78 Log #1423 NEC-P05 **Final Action: Reject**
(250.122(F))

Submitter: Keith Fager, Bayer CropScience
Comment on Proposal No: 5-201a
Recommendation: Revise the Exception in the proposal.
Exception: Under engineering supervision in industrial locations the total area of the combined equipment grounding conductors of the wire type shall not be less than the circular mill area specified in Table 250.122, <u>provided that the wire type equipment grounding conductors are not the only ground fault path for the circuit.</u> The individual equipment grounding conductors shall not be smaller than 6 AWG copper or 4 AWG aluminum.
Substantiation: The added text addresses the concerns in the Explanation of Negative comments relative to the example in the NEC Handbook. The Handbook example uses nonmetallic conduit which is a worst case scenario. Metallic conduit with a wire type equipment grounding conductor in parallel with the conduit provides a very effective ground fault path (IEEE Std 142 – 1991, 2.2.3). In industrial installations, it is not unusual to find paralleled cables installed in tray with a single external ground cable, connected in parallel with the cable tray. Concern that there is no requirement that the engineer be qualified was stated in the Explanation of Negative comments also. A search of the NEC found only one instance that requires qualified engineering supervision and that is Section 110.71 for manhole and vault design. State registration laws address engineering qualifications, licensing, and areas of practice.
Panel Meeting Action: Reject
Panel Statement: The panel removed the exception therefore the modifications are not applicable. See panel action on Comment 5-79.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 15 Negative: 1
Explanation of Negative:
PICARD, P.: See my explanation of negative vote on Comment 5-74.

5-79 Log #1331 NEC-P05 **Final Action: Reject**
(250.122(F)(1) Exception)

TCC Action: The Correlating Committee directs that Comment 5-79 and Proposal 5-201a be reported as “Reject” because less than two-thirds of the members eligible to vote have voted in the affirmative on the comment and the proposed revision no longer has consensusSubmitter: David Williams, Delta Township
Comment on Proposal No: 5-201a
Recommendation: Delete the following text:
~~Exception: Under engineering supervision in industrial locations the total area of the combined equipment grounding conductors of the wire type shall not be less than the circular mill area specified in Table 250.122. The individual equipment grounding conductors shall not be smaller than 6 AWG copper or 4 AWG aluminum.~~
Substantiation: Delete the proposed exception to section 250.122(F)(1). The code panel agreed that there was not sufficient substantiation to reduce the requirements for equipment grounding conductors installed in parallel and then made two changes to do just that. The present wording in the exception would allow an installation supervised by a sanitation engineer to reduce the equipment grounding conductor below safe limits without proper approval.
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 7 Negative: 9
Explanation of Negative:
BOWMER, T.: The Comment 5-79 should have been rejected and the proposed exception to 250.122(F)(1) should be retained. The proposed exception to 250.122(F)(1) helps to make the code more practical and usable by providing the necessary flexibility in industrial installations that are designed under engineering supervision to utilize standard cables. The text of the exception developed in Panel Proposal 201a provides sufficient and adequate safeguards to help ensure appropriate conductor sizing for the proper operation of overcurrent devices during fault conditions.
DOBROWSKY, P.: Reject the comment and keep the exception as it was accepted at the ROP stage. The physics behind parallel conductors used as ungrounded and grounded conductors is the same as for those used as equipment grounding conductors (EGC). Current will take all paths available and divide inversely based on the impedance. If a given EGC size is necessary then permitting multiple conductors, one in each cable, to provide the equivalent area of that size should also be acceptable. This concept is presently permitted when parallel EGC’s are provided as segmented conductors in multi-conductor cables. Without this allowance standard cables cannot to be used in parallel configurations.
HARDING, G.: The proposed exception to 250.122(F)(1) should be retained. The proper safeguarding of persons will be ensured due to the requirement of engineering supervision in these installations.
HARDING, J.: Engineering analysis shows that the proposed exception provides adequate protection for the equipment grounding conductor. The exception should be allowed under engineering supervision in industrial locations.
HELFRICH, W.: After reviewing the many places in the code where the phrase “under engineering supervision” is used, I believe the panel vote to remove the exception was incorrect. The term (under engineering supervision) is used extensively in the code for determining conductor ampacities, which is critical in protecting equipment from fires and shock hazards. The rationale that a “sanitation engineer” could reduce equipment grounding conductors below safe limits, if true, then he could increase ampacities of conductors beyond safe limits, which has not been the case.
MOHLA, D.: The comment should have been rejected.
The text adopted by the Panel in Panel Proposal 201a provides the necessary safeguards to ensure adequate conductor sizing for operation of overcurrent devices during fault conditions without damage to the conductor insulation. The substantiation provided in the Comment, if realistic, would negate all of the exceptions given for engineering supervision and that have not been shown to result in increased hazard.
Any conductor must be large enough to carry the fault current for a sufficient length of time to permit the overcurrent device to open before the conductor is heated to a point where it damages the insulation. The attachment Cable Short Circuit Current Capacity chart shows the maximum current to which various size copper conductors can be subjected for various times without injuring the insulation. It is based on 90 degree C insulation and a maximum temperature of 250 degrees C during fault conditions. It is illogical to believe that phase conductors connected on both ends can be paralleled and will share the current but equipment grounding when paralleled will not. Multiple equipment grounding conductors connected together at both ends will share the fault current the same as phase conductors do. Sections 310.10(H)(5) and 250.122 already permit sectioned equipment grounding conductors in multiconductor cables.
Consider a circuit supplied by two (2) 1/0AWG copper conductors in different raceways. A standard UL listed 1/0 AWG cable has a 6AWG ground wire. A circuit protected by a 300 A circuit breaker would requires two 1/0 AWG in parallel (1/0 AWG is the smallest size permitted for parallel operation). Using Table 250.122 would require a #4 AWG equipment grounding conductor which is 41,740 circular mills in area based on Table in Chapter 9. Paralleling two 1/0

AWG cables in different raceways would allow each to contain # 6AWG (minimum size permitted by the exception). Two #6AWG in parallel would be 52,480 circular mills in area which is 25% greater than one #4 AWG so it is large enough for operation of overcurrent device.

The Instantaneous setting for a 300 A circuit breaker is normally 10 times or less (3000 A). Circuit breaker at this setting will trip in 1 cycle. A 6AWG conductor can withstand almost 9,000 A for 2 cycles and 15,000 A for one cycle. This is 500% of the 3000 A trip set point of the breaker for one cycle operation and 300% for 2 cycles so the concern of conductor burning up is not valid.

Similarly three 500 kcmil with an EGC of 1 AWG would be required for a 1000 A circuit if a standard UL listed multi-conductor cable with ground cable is used. Table 250.122 would require a 2/0 AWG in each cable on the load side of 1000 A circuit breaker. A 2/0 AWG has an area of 133,100 circular mills.

Alternatively, three #1 AWG have a combined area of 3x 83,690= 251,070 circular mills which is 1.9 times the effective area of 2/0 AWG conductor. So the combined area is large enough for circuit breaker to operate. A #1 AWG conductor can handle 40,000 A for one cycle and 30,000 A for 2 cycles. Trip setting for a 1000 A breaker would be 10,000 A max

It is doubtful that any cable supplier will make a 500 kcmil with 2/0 AWG ground wire except in very large quantities. This means essentially a multi-conductor cable with ground cannot be used in a parallel configuration and still meet the code. Allowing this exception would permit utilization of standard UL listed cables under engineering supervision.

The following documents have been supplied with this comment:
Cable Maximum Short Circuit Capacity chart (from Okonite Technical Information Book)
Table 250.122 from National Electrical Code 2011
Chapter 9, Table 8 from National Electrical Code 2011

PICARD, P.: See my explanation of negative vote on Comment 5-74.

PORTER, C.: This comment should have been rejected. This is an important exception that allows the use of an equipment grounding that has been verified by qualified engineers to both be able to carry the maximum fault-current and be able to open the overcurrent device in a safe manner.

STEINMAN, G.: The panel action should have been “reject.” The exception provides the necessary safeguards to ensure adequate conductor sizing for operation of overcurrent devices during fault conditions without damage to the conductor insulation.

Comment on Affirmative:

BRETT, JR., M.: I agree with the submitter, no substantiation has been provided to support the introduction of this major change. Continue to accept this comment to delete the exception.

LEVASSEUR, P.: For many code cycles the panel has determined that a full-sized equipment grounding conductor is needed in each raceway, or cable, if conductors are installed in multiple raceways or cables as permitted in 310.10(H).

The consensus reason for this requirement is that a ground fault may cause a disproportionate share of fault current to be carried on one of the paralleled equipment grounding conductors. It now appears consensus, for the theory of unequal loading of the equipment grounding conductors, is diminishing. For example; 310.10(H)(5) and 250.122 (A) allow sectioned equipment grounding conductors in multiple conductor cables a s long as total area in circular mills of all sectioned conductors meets Table 250.122.

It is logical to assume that fault current on conductors bonded at both ends will be shared by all conductors. What I do not know, with any certainty, is how it will be shared. Because a fault can happen anywhere in an installation I am less certain that a single conductor, of the paralleled set of equipment grounding conductors, will be large enough to carry the fault current for, a sufficient length of time, to permit the overcurrent device to open before the conductor is heated to a point where it will damaged.

WILLIAMS, D.: The panel accepted the proposal without adequate substantiation to reduce the size of the equipment grounding conductor in parallel installations during the ROP Meetings. It was noted and comments submitted and the panel corrected their actions by removing the exception that was inappropriately added during the ROP Meetings.

5-80 Log #1332 NEC-P05 **Final Action: Reject**
(250.122(F)(1) Exception)

Submitter: David Williams, Delta Township
Comment on Proposal No: 5-201a
Recommendation: Revise text to read as follows:
Exception: Under qualified engineering supervision, acceptable to the authority having jurisdiction, in industrial locations the total area of the combined equipment grounding conductors of the wire type shall not be less than the circular mill area specified in Table 250.122. The individual equipment grounding conductors shall not be smaller than 6 AWG copper or 4 AWG aluminum.
Substantiation: The exception should be deleted. The code panel agreed that there was not sufficient substantiation to reduce the requirements for equipment grounding conductors installed in parallel and then made two changes to do just that. The present wording in the exception would allow an installation supervised by a sanitation engineer to reduce the equipment grounding conductor below safe limits without proper approval.
Panel Meeting Action: Reject
Panel Statement: The panel removed the exception therefore the modifications are not applicable. See panel action on Comment 5-79.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 15 Negative: 1
Explanation of Negative:

PICARD, P.: See my explanation of negative vote on Comment 5-74.

Comment on Affirmative:

WILLIAMS, D.: The panel accepted the proposal without adequate substantiation to reduce the size of the equipment grounding conductor in parallel installations during the ROP Meetings. It was noted and comments submitted and the panel corrected their actions by removing the exception that was inappropriately added during the ROP Meetings.

5-81 Log #1153 NEC-P05 **Final Action: Reject**
(250.126)

Submitter: Paul Dobrowsky, American Chemistry Council
Comment on Proposal No: 5-206
Recommendation: The proposal should have been accepted.
Substantiation: The term Equipment Grounding Conductor needs to be replaced. Those opposed have no technical reason for their opposition or any other valid reason. It is not worth the effort and everyone understands what is meant are common responses.

It is very simple: Grounding electrode conductors are the connection to the earth and accomplish grounding. In the present NEC, Equipment Grounding Conductors and bonding jumpers provide a “path back” to the source. Both are always performing a bonding function. If the Grounding Electrode connection is removed or broken, the bonding function remains intact.

Section 250.4 does not permit the earth (ground) to be used as an effective ground fault current path but the term equipment grounding conductor inherently incorrectly contains the word “ground”.

Visualize equipment supplied by a portable generator. The generator frame is not required to be connected to the earth. The “green” wire in the flexible cord is not performing a grounding function but is performing a bonding function.

Visualize building one supplied by a service, having the grounded conductor connected to the grounding electrode system by a grounding electrode conductor. A feeder supplies a second building and a grounding electrode conductor is required for grounding any equipment in the second building. An equipment grounding conductor is required to be installed from building 1 to building 2. Not for grounding, but for bonding, providing an effective fault current path.

Making this change has the added benefit of being more harmonized with other international standards and usage of terminology.

Experienced NEC users have to ignore other concepts in other definitions and requirements to use the existing term. This does not help the future NEC user or provide clarity in the existing NEC. Changing the term is the right thing to do and should be supported.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 5-1.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 13 Negative: 3
Explanation of Negative:

DOBROWSKY, P.: See my negative ballot comment on 5-1.

MOHLA, D.: See my explanation of negative vote on Comment 5-1.

WILLIAMS, D.: See my negative vote substantiation written for Comment 5-1

Comment on Affirmative:

PORTER, C.: See my statement in comment 5-1.

5-82 Log #1154 NEC-P05 **Final Action: Reject**
(250, Parts VII and VIII)

Submitter: Paul Dobrowsky, American Chemistry Council
Comment on Proposal No: 5-208
Recommendation: The proposal should have been accepted.
Substantiation: The term Equipment Grounding Conductor needs to be replaced. Those opposed have no technical reason for their opposition or any other valid reason. It is not worth the effort and everyone understands what is meant are common responses.

It is very simple: Grounding electrode conductors are the connection to the earth and accomplish grounding. In the present NEC, Equipment Grounding Conductors and bonding jumpers provide a “path back” to the source. Both are always performing a bonding function. If the Grounding Electrode connection is removed or broken, the bonding function remains intact.

Section 250.4 does not permit the earth (ground) to be used as an effective ground fault current path but the term equipment grounding conductor inherently incorrectly contains the word “ground”.

Visualize equipment supplied by a portable generator. The generator frame is not required to be connected to the earth. The “green” wire in the flexible cord is not performing a grounding function but is performing a bonding function.

Visualize building one supplied by a service, having the grounded conductor connected to the grounding electrode system by a grounding electrode conductor. A feeder supplies a second building and a grounding electrode conductor is required for grounding any equipment in the second building. An equipment grounding conductor is required to be installed from building 1 to building 2. Not for grounding, but for bonding, providing an effective fault current path.

Making this change has the added benefit of being more harmonized with other international standards and usage of terminology.

Experienced NEC users have to ignore other concepts in other definitions and requirements to use the existing term. This does not help the future NEC user or provide clarity in the existing NEC. Changing the term is the right thing to do and should be supported.

Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 5-1.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 13 Negative: 3
Explanation of Negative:
DOBROWSKY, P.: See my negative ballot comment on 5-1.
MOHLA, D.: See my explanation of negative vote on Comment 5-1.
WILLIAMS, D.: See my negative vote substantiation written for Comment 5-1
Comment on Affirmative:
PORTER, C.: See my statement in comment 5-1.

5-83 Log #1155 NEC-P05 **Final Action: Reject**
(250.142(B))

Submitter: Paul Dobrowsky, American Chemistry Council
Comment on Proposal No: 5-210
Recommendation: The proposal should have been accepted.
Substantiation: The term Equipment Grounding Conductor needs to be replaced. Those opposed have no technical reason for their opposition or any other valid reason. It is not worth the effort and everyone understands what is meant are common responses.

It is very simple: Grounding electrode conductors are the connection to the earth and accomplish grounding. In the present NEC, Equipment Grounding Conductors and bonding jumpers provide a “path back” to the source. Both are always performing a bonding function. If the Grounding Electrode connection is removed or broken, the bonding function remains intact.

Section 250.4 does not permit the earth (ground) to be used as an effective ground fault current path but the term equipment grounding conductor inherently incorrectly contains the word “ground”.

Visualize equipment supplied by a portable generator. The generator frame is not required to be connected to the earth. The “green” wire in the flexible cord is not performing a grounding function but is performing a bonding function.

Visualize building one supplied by a service, having the grounded conductor connected to the grounding electrode system by a grounding electrode conductor. A feeder supplies a second building and a grounding electrode conductor is required for grounding any equipment in the second building. An equipment grounding conductor is required to be installed from building 1 to building 2. Not for grounding, but for bonding, providing an effective fault current path.

Making this change has the added benefit of being more harmonized with other international standards and usage of terminology.

Experienced NEC users have to ignore other concepts in other definitions and requirements to use the existing term. This does not help the future NEC user or provide clarity in the existing NEC. Changing the term is the right thing to do and should be supported.

Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 5-1.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 13 Negative: 3
Explanation of Negative:
DOBROWSKY, P.: See my negative ballot comment on 5-1.
MOHLA, D.: See my explanation of negative vote on Comment 5-1.
WILLIAMS, D.: See my negative vote substantiation written for Comment 5-1
Comment on Affirmative:
PORTER, C.: See my statement in comment 5-1.

5-84 Log #283 NEC-P05 **Final Action: Accept**
(250.142(B) Exception No. 4)

Submitter: Code-Making Panel 9,
Comment on Proposal No: 5-212
Recommendation: Continue to “Accept in Principle”.
Substantiation: This change correlates with the action taken by CMP-9 on Proposal 9-153.
12 Eligible to vote
11 Affirmative
1 Ballot Not Returned (J.M. Ferrara, Voting Alternate)
No Comments on Vote were received.
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-85 Log #714 NEC-P05 **Final Action: Accept**
(250.142(B) Exception No. 4)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 5-212
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-86 Log #1250 NEC-P05 **Final Action: Reject**
(250.142(B) Exception No. 4)

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 5-212
Recommendation: Reject this proposal which would change 600 volts to 1000 volts.
Substantiation: Replacing 600 volts with 1000 volts will have a major impact on installers, component manufacturers, and industry standards. Increased spacing must be considered when going from 600 volts to 1000 volts. Personal safety must also be considered.
Because the proposer has not provided enough information to the public to justify and understand all the ramifications of the proposal, the committee should reject the submitter’s proposal.
Panel Meeting Action: Reject
Panel Statement: The change from 600 Volts to 1000 Volts is consistent with the demarcation point set by CMP-5 for the rest of Article 250 and there is no technical reason this exception should remain at 600 Volts. Electrode type boilers that are manufactured and listed at 240 Volts, 480 Volts, 600 Volts can

only be applied at those voltages. If a manufacturer were to create an electrode type boiler at some voltage greater than 600 Volts and were to get it listed then the Code should not become the stumbling block for the technological innovation. The applicable product safety standards and Code installation requirements would address the submitter's concerns for this equipment at the higher voltage.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-87 Log #355 NEC-P05 **Final Action: Accept**
(250.146(B))

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 5-214
Recommendation: Revise text to read as follows:
(B) Contact Devices or Yokes. Contact devices or yokes designed and listed as self-grounding shall be permitted in conjunction with the supporting screws to establish equipment bonding ~~the grounding circuit~~ between the device yoke and flush-type boxes.
Substantiation: The term bonding alone does not accurately describe what is being established. The word equipment should be added to article 250-146(B) in order to provide a more accurate description. This connection is serving the purpose of an "Equipment Bonding Jumper" as defined in article 100. This would be in keeping with CMP 6 accept action to proposal 6-13. "The fundamentals of these proposals are to clearly state that "systems" are "grounded" and "equipment" is "bonded"." This will also help to provide consistent language throughout the Code.
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-88 Log #1156 NEC-P05 **Final Action: Reject**
(250, Parts VIII, IX, and X)

Submitter: Paul Dobrowsky, American Chemistry Council
Comment on Proposal No: 5-219
Recommendation: The proposal should have been accepted.
Substantiation: The term Equipment Grounding Conductor needs to be replaced. Those opposed have no technical reason for their opposition or any other valid reason. It is not worth the effort and everyone understands what is meant are common responses.

It is very simple: Grounding electrode conductors are the connection to the earth and accomplish grounding. In the present NEC, Equipment Grounding Conductors and bonding jumpers provide a "path back" to the source. Both are always performing a bonding function. If the Grounding Electrode connection is removed or broken, the bonding function remains intact.

Section 250.4 does not permit the earth (ground) to be used as an effective ground fault current path but the term equipment grounding conductor inherently incorrectly contains the word "ground".

Visualize equipment supplied by a portable generator. The generator frame is not required to be connected to the earth. The "green" wire in the flexible cord is not performing a grounding function but is performing a bonding function.

Visualize building one supplied by a service, having the grounded conductor connected to the grounding electrode system by a grounding electrode conductor. A feeder supplies a second building and a grounding electrode conductor is required for grounding any equipment in the second building. An equipment grounding conductor is required to be installed from building 1 to building 2. Not for grounding, but for bonding, providing an effective fault current path.

Making this change has the added benefit of being more harmonized with other international standards and usage of terminology.

Experienced NEC users have to ignore other concepts in other definitions and requirements to use the existing term. This does not help the future NEC user or provide clarity in the existing NEC. Changing the term is the right thing to do and should be supported.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 5-1.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 13 Negative: 3
Explanation of Negative:
DOBROWSKY, P.: See my negative ballot comment on 5-1.
MOHLA, D.: See my explanation of negative vote on Comment 5-1.
WILLIAMS, D.: See my negative vote substantiation written for Comment 5-1
Comment on Affirmative:
PORTER, C.: See my statement in comment 5-1.

5-89 Log #1013 NEC-P05 **Final Action: Reject**
(250.166)

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 5-222
Recommendation: Revise the text as follows:
250.166 Size of the Direct-Current Grounding Electrode Conductor. The size of the grounding electrode conductor for a dc system shall be as specified in 250.66. ~~250.166(A) and (B), except as permitted by 250.166(C) through (E).~~
~~**(A) Not Smaller Than the Neutral Conductor.** Where the dc system consists of a 3-wire balancer set or a balancer winding with overcurrent protection as provided in 445.12(D), the grounding electrode conductor shall not be smaller than the neutral conductor and not smaller than 8 AWG copper or 6 AWG aluminum.~~
~~**(B) Not Smaller Than the Largest Conductor.** Where the dc system is other than as in 250.166(A), the grounding electrode conductor shall not be smaller than the largest conductor supplied by the system, and not smaller than 8 AWG copper or 6 AWG aluminum.~~
~~**(C) Connected to Rod, Pipe, or Plate Electrodes.** Where connected to rod, pipe, or plate electrodes as in 250.52(A)(5) or (A)(7), that portion of the grounding electrode conductor that is the sole connection to the grounding electrode shall not be required to be larger than 6 AWG copper wire or 4 AWG aluminum wire.~~
~~**(D) Connected to a Concrete-Encased Electrode.** Where connected to a concrete-encased electrode as in 250.52(A)(3), that portion of the grounding electrode conductor that is the sole connection to the grounding electrode shall not be required to be larger than 4 AWG copper wire.~~
~~**(E) Connected to a Ground Ring.** Where connected to a ground ring as in 250.52(A)(4), that portion of the grounding electrode conductor that is the sole connection to the grounding electrode shall not be required to be larger than the conductor used for the ground ring.~~
Substantiation: As is often the case, there is wisdom to be found in the Soares book on grounding (page 133). "Special considerations are required to be given if a direct-current circuit is to be properly protected against transient currents such as are produced by lightning. It is necessary to treat the selection of the grounding electrode conductor as would be done for an alternating-current circuit."

I agree with statement, and see no reason that the GEC for a dc system would have different sizing provisions than a GEC in an ac system. With that said, most of this section can be deleted.

Subsection (A) does not seem defensible from an electrical theory perspective, and (B) through (E) do not give any allowances or requirements that are not already found in 250.66. It seems that perhaps the requirements of (A) were intended to apply to a conductor that carries fault current, not a conductor that connects the system and equipment to earth. Perhaps this rule is a remnant of previous Code editions that used grounding related terms improperly.

While deleting Section 250.166 and letting Section 250.160 is certainly an option, it would require changing many Code rules that refer to it, and would also make manufacturers change product literature that might already refer to Section 250.166.
Panel Meeting Action: Reject
Panel Statement: The reference to Soares was with regard to the physical protection of the grounding electrode conductor and the use of ferrous metal or nonferrous conduit as a means of protection. Table 250.66 is titled "Grounding Electrode Conductor for Alternating Current System" and to reference DC systems to this Table would likely lead to questions and confusion. There was no technical substantiation provided where the sizing in accordance with 250.166(A) and (B) are incorrect and that sizing per Table 250.66 would be adequate. The requirements in 250.166 are clear with the added change to limit the maximum size as was accepted by the panel in Proposal 5-222.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-90 Log #534 NEC-P05 **Final Action: Reject**
(250.167(B))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 5-223
Recommendation: Revise text to read as follows:
250.167 Direct-Current Ground Fault Detection. [ROP 5–223]
(A) Ungrounded Systems. Ground fault detection systems shall be required for ungrounded systems.**[ROP 5–223]**
(B) ~~**Grounded Systems.** Ground fault detection shall be permitted for grounded systems.~~ ~~**[ROP 5–223]**~~
~~**(C)**~~ **Marking.** Direct-current systems shall be legibly marked to indicate the grounding type at the dc source or the first disconnecting means of the system. The marking shall be of sufficient durability to withstand the environment involved. **[ROP 5–223]**
Substantiation: The NEC is a permissive Code things not forbidden are permitted. (B) is therefore unnecessary.
Panel Meeting Action: Reject
Panel Statement: The panel concludes that for this new provision having both the "grounded" and "ungrounded" system references provides clarity to the

user. This is similar to having 250.20 and 250.21 which require grounding and permit grounding of systems respectively.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-91 Log #92 NEC-P05 **Final Action: Accept**
(250.170)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 5-224
Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the panel action on Proposal 9-15e that modified the definition of “Metal Enclosed Power Switchgear” to “Switchgear”.

This action will be considered as a public comment.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise the text from the 2011 NEC section 250.170 to read as follows:

250.170 Instrument Transformer Circuits. Secondary circuits of current and potential instrument transformers shall be grounded where the primary windings are connected to circuits of 300 volts or more to ground and, where installed on or in switchgear and on switchboards, shall be grounded irrespective of voltage.
Panel Statement: The panel accepts the direction of the Correlating Committee. The revised text brings this section into alignment with the new definition change by CMP-9 and consistency with other sections of Article 250.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-92 Log #142 NEC-P05 **Final Action: Accept in Principle**
(250.170)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-15e
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of “Metal Enclosed Power Switchgear” to “Switchgear” in Proposal 9-7.

It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 5 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept in Principle
Panel Statement: The panel accepts the direction of the Correlating committee. See panel action and statement Comment 5-91 where the text has been revised.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-93 Log #143 NEC-P05 **Final Action: Accept in Principle**
(250.174(A), (B))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-15f
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of “Metal Enclosed Power Switchgear” to “Switchgear” in Proposal 9-7.

It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 5 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept in Principle
Panel Statement: The panel accepts the direction of the Correlating committee. See panel action and statement Comment 5-95 where the text has been revised.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-94 Log #93 NEC-P05 **Final Action: Accept in Principle**
(250.174(B))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 5-227
Recommendation: The Correlating Committee directs that the panel clarify the panel action since Proposal 9-15f has modified the definition of “Metal Enclosed Power Switchgear” to “Switchgear” and this action must be correlated by Code-Making Panel 5.

It was the action of the Correlating Committee that further consideration be given to the comments expressed in the voting since “Dead Front” was not deleted.

The Correlating Committee directs that this proposal be forwarded to Code-Making Panel 9 for comment.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept in Principle
Panel Statement: The panel accepts the direction of the Correlating committee. See panel action and statement Comment 5-95 where the text has been revised.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-95 Log #284 NEC-P05 **Final Action: Accept in Principle**
(250.174(B))

Submitter: Code-Making Panel 9,
Comment on Proposal No: 5-227
Recommendation: The action on the proposal should have been: Accept in Principle and in Part to correlate with action on Proposals 9-7 and 9-15f. Reject the deletion of the words “Dead Front” from the title of 250.174(B). Revise the remaining text to read as follows:

(A) Not on Switchboards or Switchgear. Instruments, meters, and relays not located on switchboards or switchgear operating with windings or working parts at 300 volts or more to ground, and accessible to other than qualified persons, shall have the cases and other exposed metal parts connected to the equipment grounding conductor.
(B) On Dead-Front Switchboards or Switchgear. Instruments, meters, and relays (whether operated from current and potential transformers or connected directly in the circuit) on switchboards or switchgear having no live parts on the front of the panels shall have the cases connected to the equipment grounding conductor.
Substantiation: This change correlates this provision with action taken by CMP 9 to place a revised definition of what used to be “Metal-Enclosed Power Switchgear” in Article 100. The change will rename the defined term as “Switchgear”and make editorial changes to the content accordingly, including adding an informational note.

There was no technical substantiation provided for the removal of “Dead-front Switchboards from this requirement.

12 Eligible to vote
11 Affirmative
1 Ballot Not Returned (J.M. Ferrara, Voting Alternate)
No Comments on Vote were received.
Panel Meeting Action: Accept in Principle
Revise the full text of 250.174 from the 2011 NEC to read as follows:

250.174 **Cases of Instruments, Meters, and Relays, Operating at ~~Less Than~~ 1000 Volts or Less.** Instruments, meters, and relays operating with windings or working parts at less than 1000 Volts or less shall be connected to the equipment grounding conductor as specified in 250.174(A), (B), or (C).
(A) **Not on Switchgear or Switchboards**. Instruments, meters, and relays not located on switchgear or switchboards operating with windings or working parts at 300 volts or more to ground, and accessible to other than qualified persons, shall have the cases and other exposed metal parts connected to the equipment grounding conductor.
(B) **On Switchgear or Dead-Front Switchboards**. Instruments, meters, and relays (whether operated from current and potential transformers or connected directly in the circuit) on switchgear or switchboards having no live parts on the front of the panels shall have the cases connected to the equipment grounding conductor.
(C) **On Live-Front Switchboards**. Instruments, meters, and relays (whether operated from current and potential transformers or connected directly in the circuit) on switchboards having exposed live parts on the front of panels shall not have their cases connected to the equipment grounding conductor. Mats of insulating rubber or other suitable floor insulation shall be provided for the operator where the voltage to ground exceeds 150.
Panel Statement: The revised text incorporates direction from the Correlating Committee for the change in definition from CMP-9 on “Switchgear” as well as confirms the panel action from the 2012 ROP relative to the term “Dead Front” remaining in the title of 250.174(B). The sequence of terms was revised for consistency with other section of Article 250. The added editorial revision of “1000 Volts or less” in the main text was for consistency with the title that did not get changed at the ROP.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-96 Log #94 NEC-P05 **Final Action: Accept**
(250.178)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 5-229
Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the panel action on Proposal 9-15g that modified the definition of “Metal Enclosed Power Switchgear” to “Switchgear.”
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept

Revise the text of 250.178 from the 2011 NEC to read as follows:

250.178 Instrument Equipment Grounding Conductor. The equipment grounding conductor for secondary circuits of instrument transformers and for instrument cases shall not be smaller than 12 AWG copper or 10 AWG aluminum. Cases of instrument transformers, instruments, meters, and relays that are mounted directly on grounded metal surfaces of enclosures or grounded metal of switchgear or switchboard panels shall be considered to be grounded, and no additional equipment grounding conductor shall be required.

Panel Statement: The panel accepts the direction of the Correlating Committee and has confirmed the revised text of 250.178 is as stated in the panel action. The sequence of terms was revised for consistency with other sections of Article 250.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-97 Log #144 NEC-P05 **Final Action: Accept in Principle**
(250.178)

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 9-15g

Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of “Metal Enclosed Power Switchgear” to “Switchgear” in Proposal 9-7.

It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 5 for action.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept in Principle

Panel Statement: See panel action and statement Comment 5-96.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-98 Log #1279 NEC-P05 **Final Action: Reject**
(250.184 and 250.184(C))

Submitter: Elliot Rappaport, Electro Technology Consultants

Comment on Proposal No: 5-232

Recommendation: Accept proposal.

Substantiation: The present text of 250.184 is in direct contradiction to 250.24(A)(5). If it is safe for systems and circuits of over 1kV, it should be safe for lower voltages also. But is it? Is there anyone that is ready to permit regrounding of the grounded conductor within a residence or an office building?

The Panel has stated that an advantage of this method is that it permits currents to flow out of the neutral (grounded conductor) into the ground and then back into the neutral. Thus the earth becomes a part of the distribution system in contradiction to 250.4(A)(5) unless these currents are not considered to be ground-faults but, rather, intended currents. Is that the Panel’s intent?

The Panel has indicated that this regrounding effectively reduces the impedance of the neutral to ground. It does so due to the earth, as a conductor, being in parallel with the neutral conductor. This certainly is advantageous if an energized conductor breaks and contacts the earth (downed conductor). However, within a premise where, generally, conductors are contained within a raceway, wireway, cable tray or similar, there is an equipment grounding conductor, in accordance with Part V of Article 250, in close proximity to provide for fault current return to the source and fault clearing. Regrounding is then not necessary for safety.

Regrounding of the grounded conductor is a standard practice for utilities and is understood to provide safety for employees working on poles and in manholes. As written, a medium voltage system within an industrial plant could also use the provisions of this section. Instead of the ground currents flowing in the ground, they would be flowing through the structural steel!

This proposal is not intended to prevent the application of regrounding of the grounded conductor where appropriate. It is intended to prohibit it as a general rule rather than permitting it as a general rule. The initial paragraph of the proposal permits regrounding “provided that the system is supervised and maintained by qualified personnel acceptable to the authority having jurisdiction”. That should satisfy the engineer designing a large campus facility where regrounding might be considered advantageous to the maintenance personnel at the facility. Subparagraph (C) provides for grandfathering existing systems – if there are any. The remainder of Section 250.184 remains consistent with 250.4(A)(5)

Panel Meeting Action: Reject

Panel Statement: The submitter has provided no field evidence that this method for grounding installations over 1000 volts has or is causing any problems. The method has many positive characteristics as noted in the panel statement for Proposal 5-232.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 15 Negative: 1

Explanation of Negative:

MOHLA, D.: The panel action should have been “Accept in Principle” with the simple addition, by the Panel, of an exception: “multi grounded systems shall be permitted if approved by the authority having jurisdiction”. The Panel Comment did not respond to the substantiation provided. As stated, there is no evidence that this method has or is causing any problems. There is also no evidence that this method has been used at all in the short time that this provision has been in the Code.

The benefits of this multi-grounding system, as identified in the Panel’s proposal comment, are inconsistent with safe wiring practices within buildings and structures. That this method “provides a low impedance path for ground currents to flow back into the neutral” does not consider that it also provides a low impedance path for ground currents to flow OUT of the neutral to ground. Is this something that we want to promote within buildings and structures? If it “enables lightning protection to be applied more effectively”, then its application should apply only to outdoor installations.

It is not permissible to reground the grounded conductor if the installation is for under 1000 Volts. It is inconsistent and indefensible to have a rule for 1000 Volts and over that is in conflict with a rule for under 1000 Volts. If it is safe for 1000 Volts and over, it should also be safe for under 1000 Volts. Are we saying shock hazard is less for over 1000 Volts installations than it is for below 1000 Volts installations? Do we really want to permit a 4160 volt multi-grounded system within a metal frame factory?

There was no intention of prohibiting multi-grounded systems where it is appropriate, but not as a general rule. Multi-grounded systems should only be permitted if an engineer can show that a particular design is safer by virtue of multi grounding the neutral.

5-99 Log #95 NEC-P05 **Final Action: Accept**
(250.186 (New))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 5-234

Recommendation: The Correlating Committee directs that the panel clarify the panel action by replacing the word “through” in 250.186(B) in the last line before the Exception with the word “and”, since there is only (B)(1) or (B)(2).

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Panel Statement: The panel accepts the direction of the TCC. See panel action and statement on Comment 5-101. The modifications made to 250.186 as a result of other comments addressed the issue raised by the correlating committee.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-100 Log #971 NEC-P05 **Final Action: Reject**
(250.186)

Submitter: Daleep C. Mohla, DCM Electrical Consulting Services, Inc.

Comment on Proposal No: 5-234

Recommendation: Continue to accept 5-234 and Revise title of 250.186 (A) as below

(A)Solidly Ground Systems with a Grounded Conductor at the Service Point.

Substantiation: The requirements detailed in this section only apply to solidly grounded systems as ungrounded systems and impedance grounded systems either do not have grounded conductors or follow the requirements of 250.187. Revision of the title will clarify the application. A separate comment has also been submitted for addition requirements for Impedance Grounded systems.

Panel Meeting Action: Reject

Panel Statement: See panel action and statement on Comment 5-101. The premise for this section is a service supplied at over 1000 volts from the utility which the NEC does not have jurisdiction over until the service point is reached. Section 250.186(A) is based on where the utility has a supply system and a grounded (neutral) conductor is provided to the service point where the NEC begins to apply. This system may or may not be solidly grounded based on utility practices and the NEC cannot assume what the utility practices are in all cases. If the premise in the substantiation is correct, that there is no grounded conductor, then 250.186(B) applies where the utility supply system does not have a grounded (neutral) conductor at the service point. In both cases the requirements are to provide a permanent low impedance ground fault return path.

Number Eligible to Vote: 16

Ballot Results: Affirmative: 16

5-101 Log #972 NEC-P05 **Final Action: Accept in Principle**
(250.186)

Submitter: Daleep C. Mohla, DCM Electrical Consulting Services, Inc.

Comment on Proposal No: 5-234

Recommendation: Continue to accept and Add a new section

(C) **Impedance Grounded Neutral Systems.** The impedance grounded neutral system shall be installed in accordance with 250.187.

Substantiation: Impedance grounded systems cannot be grounded as detailed in 250.186 (A) or 250.186 (B). The addition of new section will provide clarity and prescriptive language for methods to be used for systems with an impedance grounded neutral.

Panel Meeting Action: Accept in Principle
Revise 250.186 from the ROP to read as follows:
250.186 Ground Fault Circuit Conductor Brought to Service Equipment.
(A) Systems with a ~~solidly~~ Grounded Conductor at the Service Point.
Where an ac system operating at over 1000 volts is grounded at any point and is provided with a grounded conductor at the service point, grounded conductor(s) shall be installed and routed with the ungrounded conductors to each service disconnecting means and shall be connected to each disconnecting means grounded conductor(s) terminal or bus. A main bonding jumper shall connect the grounded conductor(s) to each service disconnecting means enclosure. The grounded conductor(s) shall be installed in accordance with 250.186(A)(1) through (A)(~~3~~4). The size of the solidly grounded circuit conductor(s) shall be the larger of that determined by 250.184 or 250.186(A)(1) or (2).
Exception: Where two or more service disconnecting means are located in a single assembly listed for use as service equipment, it shall be permitted to connect the grounded conductor(s) to the assembly common grounded conductor(s) terminal or bus. The assembly shall include a main bonding jumper for connecting the grounded conductor(s) to the assembly enclosure.
(1) Sizing for a Single Raceway or Overhead Conductor. The grounded conductor shall not be smaller than the required grounding electrode conductor specified in Table 250.66 but shall not be required to be larger than the largest ungrounded service entrance conductor(s). In addition, for sets of ungrounded service-entrance conductors larger than 1100 kcmil copper or 1750 kcmil aluminum, the grounded conductor shall not be smaller than 121/2 percent of the circular mil area of the largest set of service-entrance ungrounded conductor(s).
(2) Parallel Conductors in Two or More Raceways or Overhead Conductors. If the ungrounded service-entrance conductors are installed in parallel in two or more raceways or as overhead parallel conductors, the grounded conductors shall also be installed in parallel. The size of the grounded conductor in each raceway or overhead shall be based on the total circular mil area of the parallel ungrounded conductors in the raceway or overhead, as indicated in 250.186(A)(1), but not smaller than 1/0 AWG.
Informational Note: See 310.10(H) for grounded conductors connected in parallel.
(3) Delta-Connected Service. The grounded conductor of a 3-phase, 3-wire delta service shall have an ampacity not less than that of the ungrounded conductors.
(4) Impedance Grounded Neutral Systems. Impedance grounded neutral systems shall be installed in accordance with 250.187.
(B) Systems without a Grounded Conductor at the Service Point
Where an ac system operating at greater than 1000 volts is grounded at any point and is not provided with a grounded conductor at the service point, a supply side bonding jumper shall be installed and routed with the ungrounded conductors to each service disconnecting means and shall be connected to each disconnecting means equipment grounding conductor terminal or bus. The supply side bonding jumper shall be installed in accordance with 250.186(B)(1) through (B)(~~2~~3).
Exception: Where two or more service disconnecting means are located in a single assembly listed for use as service equipment, it shall be permitted to connect the supply side bonding jumper to the assembly common equipment grounding terminal or bus.
(1) Sizing for a Single Raceway or Overhead Conductor. The supply side bonding jumper shall not be smaller than the required grounding electrode conductor specified in Table 250.66 but shall not be required to be larger than the largest ungrounded service entrance conductor(s). In addition, for sets of ungrounded service-entrance conductors larger than 1100 kcmil copper or 1750 kcmil aluminum, the supply side bonding jumper shall not be smaller than 121/2 percent of the circular mil area of the largest set of service-entrance ungrounded conductor(s).
(2) Parallel Conductors in Two or More Raceways or Overhead Conductors. If the ungrounded service-entrance conductors are installed in parallel in two or more raceways or overhead conductors, the supply side bonding jumper shall also be installed in parallel. The size of the supply side bonding jumper in each raceway or overhead shall be based on the total circular mil area of the parallel ungrounded conductors in the raceway or overhead, as indicated in 250.186(A)(1), but not smaller than 1/0 AWG.
(3) Impedance Grounded Neutral Systems. Impedance grounded neutral system shall be installed in accordance with 250.187.
Panel Statement: The Panel incorporated modifications into the new proposed 250.186 that incorporate Impedance Grounded Neutrals into this section. The panel concludes that this meets the intent of the submitter.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16
Comment on Affirmative:
WHITE, C.: While we agree with the Panel intent, we want to express a concern that this action may be misinterpreted to require a connection to a utility ground. If the utility is providing an ungrounded service, then the utility ground cannot be used as a fault current return path. To do so would possibly bypass the protection for premises wiring. This also is a violation of 250.4(A)(5) which states that "The earth shall not be considered as an effective ground-fault current path."

5-102 Log #1359 NEC-P05 **Final Action: Reject**
(250.186 (New))

Submitter: Sergio Panetta, I-Gard Corp.
Comment on Proposal No: 5-234
Recommendation: This new clause should be limited to Solidly grounded systems only. Please add a sentence to revise the text.
Substantiation: This new clause should be removed. In principal it will work for simple single source systems. There will be a great deal of confusion and problems when multiple connected sources are present. For example multiple generators acting as prime or buck up power. It will be very difficult and erroneous to all generators grounded conductors together.
Panel Meeting Action: Reject
Panel Statement: This comment was rejected because it was not submitted in accordance with Paragraph 4.4.5 (c) of the Regulations Governing Committee Projects. The submitter's proposed changes did not include the specific text being requested. The panel concludes that the submitter's intent was satisfied by the panel action taken on Comment 5-101.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-103 Log #1460 NEC-P05 **Final Action: Accept in Principle in Part**
(250.186)

Submitter: Amit Patel, GE
Comment on Proposal No: 5-234
Recommendation: Revise text to read as follows:
250.186 Ground Fault Circuit Conductor (Neutral) Brought to Service Entrance Equipment. [ROP 5–234]
(A) Solidly grounded neutral Systems with a Grounded Conductor (Neutral) at the Service Point. Where an ac system operating at over 1000 volts is grounded at any point and is provided with a grounded conductor (Neutral) at the service point, grounded conductor(s) shall be…
Add a new section 250.186 (C) High Impedance Grounded Neutral Systems. The high impedance grounded neutral system shall be installed in accordance with section 250.187
Substantiation: Section 250.186(A) requirements are only applicable to solidly grounded neutral systems and not applicable to Impedance grounded systems. Ungrounded systems and impedance grounded systems either do not have grounded conductors or neutral. Revision of the title will clarify the application. A separate section(C) is required for clarification for High Impedance Grounded systems. Need to consider effect on residual ground fault relaying scheme that may require neutral CT and zero sequence ground fault relaying schemes already in field.
High Impedance grounded systems cannot be grounded as described in section 250.186 (A) or 250.186 (B). The addition of new section will clarify improved actions to be taken for systems with high impedance grounded neutral.
Panel Meeting Action: Accept in Principle in Part
Panel Statement: The panel accepted in principle the addition of the impedance grounding requirements. See panel action and statement on Comment 5-101.
The panel did not accept the addition of the words "solidly grounded", "neutral", "entrance" and "high" for impedance grounding.
The section title includes two possible installations, one where a utility grounded conductor is present and one where it is not. To add the word "neutral" into the section title would be incorrect. The term "service equipment" is correct and is defined in Article 100 whereas the term "service entrance equipment" is not defined. Section 250.186 is for installation of the service when supplied directly by a utility at over 1000 Volts under two conditions, that the utility either supplied a grounded (neutral) conductor to the service point or they did not. The term "high" was not accepted because 250.187 covers both high and low impedance systems.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-104 Log #1518 NEC-P05 **Final Action: Reject**
(250.186)

Submitter: Peter Sutherland, GE
Comment on Proposal No: 5-234
Recommendation: Add text to read as follows:
250.186 Ground Fault Circuit Conductor Brought to Service Equipment.
(A) An effective ground-fault current path shall be established by grounding and bonding of electrical equipment and bonding of electrically conductive materials and other equipment in accordance with Section 250.4 (A). In order to prevent false operation of ground fault protection systems, the grounded, grounding or bonding conductors shall not be routed with the current-carrying conductors.
Substantiation: Ground fault protection in medium voltage power systems usually utilizes either the residually connected ground relay or the core-balance CT. (IEEE Std. 242-2001, pp. 249-252.) Problems in can occur when a grounded shield is used in the cables with a core-balance CT, requiring special wiring. Use of a grounded conductor in a cable with the phase conductors

would result in even greater wiring problems than are created by grounded shields. With residually connected systems, in four wire systems where a neutral conductor is used, a fourth CT is required. If the fourth conductor could instead be a grounded conductor, confusion between neutral and ground could result in a CT being placed on the grounded conductor, which would prevent the ground fault protection from operating.
Panel Meeting Action: Reject
Panel Statement: The proposed text does not provide the requirements for sizing and other factors that were included in the accepted proposal. Section 250.186 is for the installation of the service when supplied directly by a utility at over 1000 volts under two conditions that utility either supplied a grounded (neutral) conductor to the service point or they did not. The provisions for how to route conductors for ground fault protection is a design issue dependent on specific installation conditions.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-105 Log #587 NEC-P05 **Final Action: Accept**
(250.188(D))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 5-237
Recommendation: Revise text to read as follows:
250.188 **Grounding of Systems Supplying Portable or Mobile Equipment. (D) Ground-Fault Detection and Relaying.** Ground-fault detection and relaying shall be provided to automatically de-energize any component of a system over 1000 volts that has developed a ground fault. The continuity of the equipment grounding conductor shall be continuously monitored so as to ~~de-energize~~ automatically de-energize the circuit of the system over 1000 volts to the portable or mobile equipment upon loss of continuity of the equipment grounding conductor.
Substantiation: 250.188(D) contains "automatically de-energize" and "de-energize automatically" The first form is better English and should be used for the second instance. Consistency reduces confusion.
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-106 Log #1157 NEC-P05 **Final Action: Reject**
(250.190(A))

Submitter: Paul Dobrowsky, American Chemistry Council
Comment on Proposal No: 5-239
Recommendation: The proposal should have been accepted.
Substantiation: The term Equipment Grounding Conductor needs to be replaced. Those opposed have no technical reason for their opposition or any other valid reason. It is not worth the effort and everyone understands what is meant are common responses.
It is very simple: Grounding electrode conductors are the connection to the earth and accomplish grounding. In the present NEC, Equipment Grounding Conductors and bonding jumpers provide a "path back" to the source. Both are always performing a bonding function. If the Grounding Electrode connection is removed or broken, the bonding function remains intact.
Section 250.4 does not permit the earth (ground) to be used as an effective ground fault current path but the term equipment grounding conductor inherently incorrectly contains the word "ground".
Visualize equipment supplied by a portable generator. The generator frame is not required to be connected to the earth. The "green" wire in the flexible cord is not performing a grounding function but is performing a bonding function.
Visualize building one supplied by a service, having the grounded conductor connected to the grounding electrode system by a grounding electrode conductor. A feeder supplies a second building and a grounding electrode conductor is required for grounding any equipment in the second building. An equipment grounding conductor is required to be installed from building 1 to building 2. Not for grounding, but for bonding, providing an effective fault current path.
Making this change has the added benefit of being more harmonized with other international standards and usage of terminology.
Experienced NEC users have to ignore other concepts in other definitions and requirements to use the existing term. This does not help the future NEC user or provide clarity in the existing NEC. Changing the term is the right thing to do and should be supported.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 5-1.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 13 Negative: 3
Explanation of Negative:
DOBROWSKY, P.: See my negative ballot comment on 5-1.
MOHLA, D.: See my explanation of negative vote on Comment 5-1.
WILLIAMS, D.: See my negative vote substantiation written for Comment 5-1
Comment on Affirmative:
PORTER, C.: See my statement in comment 5-1.

5-107 Log #873 NEC-P05 **Final Action: Reject**
(250.191)

Submitter: C. Douglas White, Center Point Energy / Rep. Edison Electric Institute/Electric Light & Power Group
Comment on Proposal No: 5-240
Recommendation: This Proposal should have been Accepted in Part. Accept the proposed new text but do not modify any existing text so that it reads as follows:
250.191 Grounding System at Alternating-Current Substations
For ac substations, the grounding system shall be in accordance with Part III of Article 250. Where a grounding grid is installed, the grounding grid shall be designed and installed under engineering supervision.
Informational Note: For further information on outdoor ac substation grounding, see ANSI/IEEE 80-2000, IEEE Guide for Safety in AC Substation Grounding.
Note to staff: It is recommended this section be renumbered to 250.192 and to renumber all succeeding sections accordingly.
Substantiation: The grounding grid, when properly designed and installed under engineering supervision will limit the overall resistance with respect to earth and will help to mitigate step and touch potentials in substation applications. This is an increased safety item that is intended for the protection of personnel and equipment and is widely recognized as the proper grounding method for substation applications.
This is a companion comment to my comment on Proposal 5-111.
Panel Meeting Action: Reject
Panel Statement: Mitigation and acceptable limits of step and touch potentials are not presently provided or required by the NEC. Specifically requiring engineering supervision such as for grounding grids implies that other methods do not require engineering supervision.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 15 Negative: 1
Explanation of Negative:
MELLO, C.: See my statement for Comment 5-108.

5-108 Log #1303 NEC-P05 **Final Action: Reject**
(250.191)

Submitter: James M. Imlah, Hillsboro, OR
Comment on Proposal No: 5-240
Recommendation: Revise text to read as follows:
250.191 Grounding System at Alternating-Current Substations.
~~For ac substations, the grounding system shall be in accordance with Part III of Article~~ 250.
Where a grounding grid is installed, the grounding grid shall be installed under engineering supervision.
Substantiation: Please reconsider the CMP action on this proposal to accept or accept in principle. With larger facilities installing their own substations, the current responsibility to assure the grounding system is based upon Part III of Article 250 and the local jurisdiction. Most all jurisdictional inspectors do not have the skills or training to determine a design of the special nature (over 1kV) of the hazards and understanding of a design to determine if touch potential situation could exist. By requiring engineering supervision and responsibility of the desired installation back to the engineer there should be a safer installation to persons. Under the current situation a substation can be installed, inspected, and energized without engineering supervision as a bidder design and the local AHJ unaware of the medium voltage potential hazards.
Panel Meeting Action: Reject
Panel Statement: See the panel action and statement on Comment 5-107.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 15 Negative: 1
Explanation of Negative:
MELLO, C.: The comment should have been accepted. There are two items to consider. First the present text is totally unnecessary since section 250.180 already requires all the provisions in Article 250 to apply except as modified by the requirements stated Part X of Article 250. So the original proposer and commenter are correct in deleting the text as indicated. Second, the Commenter, as an Authority Having Jurisdiction involved with large complex manufacturing facilities with their own substations and plant buildings that are installing ground grids, he makes a valid point that AHJs do not have the expertise and do not have present Code language to require that ground grids to be designed and installed under some sort of qualified engineering supervision. This is no different than the new provisions in the 2011 NEC from CMP-4 for some qualified engineering entity to design and oversee the installation of other medium voltage systems in Article 399. The panel cannot ignore the fact that ground grids are being installed on private property and are part of the installation falling under the NEC. The panel should have accepted making it a requirement that when a ground grid is installed, for whatever purposes intended, that it be designed and installed under proper qualified electrical engineering supervision and that having the informational note that references NFPA 80 for guidance on the design, application and construction.

ARTICLE 285 — SURGE-PROTECTIVE DEVICES (SPDs), 1000 VOLTS OR LESS

5-109 Log #1503 NEC-P05 **Final Action: Accept**
(285.3)

Submitter: Alan Manche, Schneider Electric
Comment on Proposal No: 5-244a
Recommendation: Revise text to read as follows:
The panel should continue to accept the proposed language revision and also delete the informational note found in 285.3.
285.3 Uses Not Permitted.
~~Informational Note: For further information on SPDs (TVSSs), see NEMA LS-1-1992, *Standard for Low Voltage Surge Suppression Devices*. The selection of a properly rated SPD (TVSS) is based on criteria such as maximum continuous operating voltage, the magnitude and duration of overvoltages at the suppressor location as affected by phase-to-ground faults, system grounding techniques, and switching surges.~~
Substantiation: The Informational note in 285.3 should be deleted as that NEMA document has been rescinded and is no longer applicable.
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-110 Log #1504 NEC-P05 **Final Action: Accept**
(285.3)

TCC Action: The Correlating Committee advises that article scope statements are the responsibility of the Correlating Committee and the Correlating Committee Accepts the panel action.
Submitter: Alan Manche, Schneider Electric
Comment on Proposal No: 5-244a
Recommendation: The panel should continue to accept the proposed language revision and also remove the reference to surge arresters and TVSS. The existing language from the 2011 NEC is shown for reference purposes only and the proposed changes are shown in the strike-through text.
285.1 Scope. This article covers general requirements, installation requirements, and connection requirements for SPDs ~~[surge arresters and transient voltage surge suppressors (TVSSs)]~~ permanently installed on …
~~Informational Note No. 2: Transient voltage surge suppressors (TVSSs) are also known as Type 2 and Type 3 SPDs.~~
285.3 Uses Not Permitted. An SPD ~~(surge arrester or TVSS)~~ device shall not be installed in the following:
(3) Where the rating of the SPD ~~(surge arrester or TVSS)~~ is less than the …
285.4 Number Required. Where used at a point on a circuit, the SPD ~~(surge arrester or TVSS)~~ shall be …
285.5 Listing. An SPD ~~(surge arrester or TVSS)~~ shall be alisted device.
285.6 Short-Circuit Current Rating. The SPD ~~(surge arrester or TVSS)~~ shall be …
II. Installation
285.11 Location. SPDs ~~(surge arresters or TVSSs)~~ shall be permitted to...
285.12 Routing of Connections. The conductors used to connect the SPD ~~(surge arrester or TVSS)~~ to the …
III. Connecting SPDs
285.21 Connection. Where an SPD ~~(surge arrester or TVSS)~~ device is …
285.23 Type 1 SPDs ~~(Surge Arresters)~~. Type 1 SPDs shall be installed in accordance with 285.23(A) and (B).
(A) Installation. Type 1 SPDs ~~(surge arresters)~~ shall be installed as follows:
(1) Type 1 SPDs ~~(surge arresters)~~ shall be permitted to …
(2) Type 1 SPDs ~~(surge arresters)~~ shall be permitted to be connected as specified in 285.24.
285.24 Type 2 SPDs ~~(TVSSs)~~. Type 2 SPDs ~~(TVSSs)~~ shall be installed in accordance with 285.24(A) through (C).
(A) Service-Supplied Building or Structure. Type 2 SPDs ~~(TVSSs)~~ shall be …
(B) Feeder-Supplied Building or Structure. Type 2 SPDs ~~(TVSSs)~~ shall be …
(C) Separately Derived System. The SPD ~~(TVSS)~~ shall be …
285.25 Type 3 SPDs. Type 3 SPDs ~~(TVSSs)~~ shall be …
285.27 Connection Between Conductors. An SPD ~~(surgearrester or TVSS)~~ shall be … only by the normal operation of the SPD ~~(surge arrester or TVSS)~~ during a surge.
Substantiation: The original Article 285 was written when surge protection devices were labeled TVSS. This marking changed due to a change in the product standards as acknowledged in the 2008 NEC revisions. The terminology was retained to support the transition of the terminology. Note that Panel 1 has accepted Proposal 1-186 to eliminate the standard and reference to UL 1449 as covering TVSS. Surge Arresters installations are addressed in Article 280. In order to correlate the actions of the committees and address any confusion in the 2014 NEC, it is time to eliminate "(TVSS)" and "(Arrester)"throughout Article 285 since that terminology is no longer in use across the industry and has not been for many years.
Panel Meeting Action: Accept
Number Eligible to Vote: 16
Ballot Results: Affirmative: 16

5-111 Log #96 NEC-P05 **Final Action: Accept**
(285.13)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 5-244b
Recommendation: The Correlating Committee directs that the panel clarify the panel action on this proposal with respect to the phrase "are only intended for factory installation and" as non-mandatory language is not permitted by the NEC Style Manual.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revised 285.13 from ROP to read as follows:
285.13 Type 4 and Other Component Type SPDs. Type 4 component assemblies and other component type SPDs shall only be installed by the equipment manufacturer.
Panel Statement: The panel accepts the Correlating Committee direction to reconsider the proposed text and has made revisions to ensure the text meets the requirements of the NEC Style Manual.
Number Eligible to Vote: 16
Ballot Results: Affirmative: 15 Negative: 1
Explanation of Negative:
MELLO, C.: This negative ballot is not intended to object to the direction of the Correlating Committee but is intended to be directed to the text revision that resulted from panel action. The text as revised by the panel lost the intent of the original proposal where Type 4 component and other component type SPD's are not to be installed in the "field". The comment acted on was only Correlating Committee direction to revise the text due to some Style Manual issues. The original text provided that these devices are not to be installed by anyone after the final product has been manufactured and shipped from that manufacturer. The revised text implies that the equipment manufacturer can now complete an installation of Type 4 component or other component SPDs anywhere they want. The panel did not have or provide any technical substantiation to make such a technical change. The issue is that these devices need to be further evaluated with the end use product and are not for installation by anyone in the field.

ARTICLE 300 — WIRING METHODS AND MATERIALS

3-5 Log #650 NEC-P03 **Final Action: Accept**
(300.2)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 3-10
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.
The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.
The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally

require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.
Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.
Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.
If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-6 Log #1251 NEC-P03 **Final Action: Reject**
(300.2)

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 3-10
Recommendation: Reject this proposal which would change 600 volts to 1000 volts.
Substantiation: Replacing 600 volts with 1000 volts will have a major impact on installers, component manufacturers, and industry standards. Increased spacing must be considered when going from 600 volts to 1000 volts. Personal safety must also be considered.
Because the proposer has not provided enough information to the public to justify and understand all the ramifications of the proposal, the committee should reject the submitter's proposal.
Panel Meeting Action: Reject
Panel Statement: The change from 600 to 1000 volts permits the higher rating. It does not simply raise the voltage rating on electrical products. The change permits the listing organization to evaluate the electrical products at voltage levels up to 1000 volts.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-7 Log #1319 NEC-P03 **Final Action: Accept**
(300.2(A))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 3-10
Recommendation: Revise text to read as follows:
300.2 Limitations.
(A) Voltage. Wiring methods specified in Chapter 3 shall be used for 1000 volts, nominal, or less where not specifically limited in some section of Chapter 3. They shall be permitted for over ~~600~~ 1000 volts, nominal, where specifically permitted elsewhere in this *Code*. **[ROP 3–10]**
Substantiation: It is unclear if the second 600 in the original text (2011) was not changed on purpose. The published text of ROP 3-100 provides no clue. Double coverage of 601 – 999 Volts in this section appears to serve no purpose.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-8 Log #651 NEC-P03 **Final Action: Accept**
(300.3)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 3-12
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.
The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.
The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.
Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.
Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.
If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-9 Log #1320 NEC-P03 **Final Action: Reject**
(300.3)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 3-12
Recommendation: Revise text to read as follows:
300.3 Conductors.
(C) Conductors of Different Systems.
~~(1) 600~~ 1000 Volts, Nominal, or Less. Conductors of ac and dc circuits, rated ~~600~~ 1000 volts, nominal, or less, shall be permitted to occupy the same equipment wiring enclosure, cable, or raceway. All conductors shall have an insulation rating equal to at least the maximum circuit voltage applied to any conductor within the enclosure, cable, or raceway.
Informational Note No. 1: See 725.136(A) for Class 2 and Class 3 circuit conductors.
Informational Note No. 2: See 690.4(B) for photovoltaic source and output circuits.
(2) Over 600 Volts, Nominal. Conductors of circuits rated over 600 volts, nominal, shall not occupy the same equipment wiring enclosure, cable, or raceway with conductors of circuits rated 600 volts, nominal, or less unless otherwise permitted in (C)(2)(a) through (C)(2)(e).
(a) Secondary wiring to electric-discharge lamps of 1000 volts or less, if insulated for the secondary voltage involved, shall be permitted to occupy the same luminaire, sign, or outline lighting enclosure as the branch-circuit conductors.
(b) Primary leads of electric-discharge lamp ballasts insulated for the primary voltage of the ballast, where contained within the individual wiring enclosure, shall be permitted to occupy the same luminaire, sign, or outline lighting enclosure as the branch-circuit conductors.
(c) Excitation, control, relay, and ammeter conductors used in connection with any individual motor or starter shall be permitted to occupy the same enclosure as the motor-circuit conductors.
(d) In motors, switchgear and control assemblies, and similar equipment, conductors of different voltage ratings shall be permitted.
(e) In manholes, if the conductors of each system are permanently and effectively separated from the conductors of the other systems and securely fastened to racks, insulators, or other approved supports, conductors of different voltage ratings shall be permitted.
Conductors having non-shielded insulation and operating at different voltage levels shall not occupy the same enclosure, cable, or raceway.

(3) Over 1000 Volts, Nominal. Conductors of circuits rated over 1000 volts, nominal, shall not occupy the same equipment wiring enclosure, cable, or raceway with conductors of circuits rated 1000 volts, nominal, or less unless otherwise permitted in (C)(2)(b) through (C)(2)(e).

Substantiation: The ROP 3-12 proposal as modified by the committee has broken a long standing principle from previous editions (2002 – 2011 at least). This principle is that certain conductors energized at voltages exceeding 600 volts are allowed to be installed with conductors insulated for no more than 600 volts.

Suggested rewording supplied above is based on the original 2011 text.

300.3(C)(1) is changed to allow circuits of up to 1000 volts to be comingled provided they are all insulated for the highest voltage present.

300.3(C)(2) is unchanged and permits circuits insulated for 600 volts to comingle with certain higher voltage circuits as before.

300.3(C)(3) applies the 600 Volt rules of 300.3(C)(2) to over 1000 v, nominal conductors. [300.3(C)(2)(a) is omitted here because it is covered by 300.3(C)(1).]

Panel Meeting Action: Reject

Panel Statement: The text suggested in the comment will result in coverage of the same voltages in (1) and (2) and will result in conflicting requirements.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

3-10 Log #1276 NEC-P03 **Final Action: Reject**

(300.3(B), 300.51(I), and 300.20(A))

Submitter: Elliot Rappaport, Electro Technology Consultants

Comment on Proposal No: 3-13

Recommendation: Accept proposal.

Substantiation: Although Code Making Panel 5 has jurisdiction over this definition, it is important that Code Making Panel 3 recognize the importance of this conductor in determining how conductors are installed and protected.

The term “equipment grounding conductor” has a definite purpose that is not uniquely expressed in the term, i.e. “bond the equipment to a terminal at the source of voltage”. As a result, there is a misconception that “grounding”, without bonding to the source, will make a system safe. On the contrary, connecting equipment to ground without providing the bonding connection back to the source can make equipment less safe by increasing the time to clear the fault.

There is generally insufficient significance placed on the importance of bonding over grounding. Bonding provides sufficient ground fault current back to the source of voltage to operate an overcurrent device and clear the fault quickly. Connection to ground limits the voltage to ground on normally non-current-carrying parts during non-fault conditions. During fault conditions, the value of grounding is minimal since the primary safety concern is to remove the fault voltage as quickly as possible. A path to ground for fault current is not necessary since ground fault current must return to the source of voltage, not to ground.

Renaming this conductor as an “Equipment Bonding Conductor (EBC)” will clarify that the primary purpose of this conductor is to bond to the source in order to provide a known path for ground fault current that will facilitate rapid fault clearing.

It is recognized that the term “EGC” has been in use for a long time and that changing it to EBC will cause some concerns including changing written literature that uses the EGC term. After the initial period of understanding, users will correctly understand the purpose of this conductor and this will enhance the safety of personnel.

The fundamental purpose of this and companion proposals is to clearly state that “systems” are “grounded” and “equipment” is “bonded”. The fact that the bonding conductor may be grounded also is secondary to the primary function of bonding.

Panel Meeting Action: Reject

Panel Statement: Panel 3 does not have jurisdiction over the definition or the primary usage of the terms “equipment grounding conductor” or “equipment bonding conductor.” Panel 5 has jurisdiction over these terms and they have rejected any changes.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 12 Negative: 1

Explanation of Negative:

PACE, D.: This Comment should have been accepted. While it is true that CMP-5 has the lead on this issue, we need to support changing the language. The current language can be confusing to those who have to make the installation. What is installed as a equipment grounding conductor is used to bond equipment, not to ground it. Terms should identify what the conductor is actually being used for.

3-11 Log #767 NEC-P03 **Final Action: Reject**

(300.4)

Submitter: James Dorsey, Douglas County Electrical Inspector

Comment on Proposal No: 3-20

Recommendation: Revise text to read as follows:

(A) Cables and Raceways through Metal or Wood Members

(1) **Bored Holes** In both exposed and concealed locations, where a cable- or raceway-type wiring method is installed through either factor y- or field-punched, cut, or drilled slots or holes bored in wood or metal members, bored holes in joists, rafters, metal, or wood members, holes shall be bored so that the edge of the hole is not less than 32 mm (11/4 in.) from the nearest edge of the metal or wood member. Where this distance cannot be maintained, the cable or raceway shall be protected from penetration by screws or nails by a steel plate(s) or bushing(s), at least 1.6 mm (1/16 in.) thick, and of appropriate length and width installed to cover the area of the wiring.

Exception No. 1: Steel plates shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm (1/16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

(2) **Notches in Metal Or Wood** Where there is no objection because of weakening the building structure, in both exposed and concealed locations, cables or raceways shall be permitted to be laid in notches in metal, or wood studs, joists, rafters, or other metal, or wood members where the cable or raceway at those points is protected against nails or screws by a steel plate at least 1.6 mm (1/16 in.) thick, and of appropriate length and width, installed to cover the area of the wiring. The steel plate shall be installed before the building finish is applied.

Exception No. 1: Steel plates shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm (1/16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

Substantiation: 300.4a protects both cables & raceways which would include MC & low volt, though only when installed in wood members. The panel in its rejection refers to 300.4b for protection of NM and ENT which does not include “cables”(AC or MC)when installed in metal framing. The part that appears to be overlooked is that it does not include cables therefore MC or AC would not have to be protected when running horizontally through metal studs within the 11/4” from the edge of the stud but does have to, in wood framing per 300.4a.

If it is the intent of the code for AC, MC & low voltage cables to be protected in both wood and metal studs then either 300.4a needs to include metal studs or 300.4b needs to include AC & MC or just cables. I believe that was the intent of the submitter as I had an identical proposal that did not make it either that I have attached.

Panel Meeting Action: Reject

Panel Statement: Section 300.4(A)(1) covers bored holes in wood framing members and (2) covers notches in wood. There has been no technical data provided in either the proposal or the comment that there is an issue with Types MC or AC cable in a metal framing members since the metal framing member does not restrict the movement of these cables as much as a wood installation. Types NM and ENT installed in a metal framing member have the much greater possibility for damage than the other wiring methods, thus the reason these wiring methods were singled out for additional protection techniques in metal framing members.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

3-12 Log #1604 NEC-P03 **Final Action: Reject**

(300.4(E))

Submitter: Joseph A. Ross, Ross Electrical Assessments

Comment on Proposal No: 3-33

Recommendation: Reconsider and accept Proposal 3-33 (Log No. 2515)

Reconsider Action to unanimously REJECT by a 14 to Zip vote.

Substantiation: What you have done is tell a Big Box store to spend $20,000.00 to $30,000.00 now and in 30 years when you reroof and, if, nail technology has not become obsolete and then should those nails penetrate the wiring systems (Repair cost = $2000.,00); Doesn't make sense, does it??? Spend big bucks now to save peanuts in 30 years???

The cost figures are based on the actual costs of a new Sporting Goods store in NH ($20,000.00/$30,000.00 Extra) (Contractor would not pin-point an actual cost due to competitive bidding). The worst documented damage (Super Market, NH) in New England was 6 nail-hits. There were no injuries or fires; (Cost $2000.00).

Should your ACTION be REJECT, again, I insist that Proposal 3-33 and this comment be submitted into the NFPA process for a COST ANALYSIS.

Panel Meeting Action: Reject

Panel Statement: The original submitter of this proposal for the 2008 NEC process provided pictures of electrical wiring methods that had been damaged from screws designed to penetrate into structural steel but where the structural steel was missed and the screws penetrated rigid metal conduit, EMT, and other wiring. The proposal provided substantial and compelling technical data showing initial metal roof installations, as well as re-roofing installations where these screws penetrated the wiring systems. Cost should not be a factor where safety is compromised.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

9-18 Log #38 NEC-P09 **Final Action: Accept**
(300.4(I) (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 3-93
Recommendation: The Correlating Committee directs this proposal be forwarded to Code-Making Panel 9 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
The panel accepts the Correlating Committee comment and continues to reject the proposal.
Panel Statement: As with the proposal the comment submitter fails to evidence that the outlet box covers are the only method of solving a problem that has failed to have been evidenced to exist. The submitter asserts that actual field practice of Inspectors is such that every box is not inspected yet the outlet box cover would make the box interior more difficult to inspect. It must be noted that possible damage to conductors is not the only code requirement inspected at outlet boxes. The amount of cable sheath in the box, length of free conductor, connection of equipment grounding conductors, grounding of metal boxes etc. are also important inspection items that would be hidden if outlet box covers are installed. Additionally the submitter asserts that routers used by drywall installers and similar tools are causing the purported damage. It would be a simple matter for the covers to be removed, the routers etc. used and the covers reinstalled concealing any damage done and increasing the likelihood that damage to conductors would go undiscovered. See 110.12 which covers this information.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

3-13 Log #276 NEC-P03 **Final Action: Accept**
(Table 300.5)

TCC Action: The Correlating Committee directs that the text "Grounding electrode conductors and grounding electrode bonding jumpers shall not be required to comply with 300.5" be added after the last sentence in 250.64(B).
Submitter: Code-Making Panel 5,
Comment on Proposal No: 3-39
Recommendation: Code-Making Panel 5 recommends continuing to reject the change to Table 300.5. However, Code-Making Panel 5 agrees with the submitter that the requirements are unclear, but that 250.64(B) should be amended by adding the following text:
Grounding electrode conductors and grounding electrode bonding jumpers shall not be required to comply with 300.5.
Substantiation: There is continuing confusion as to whether or not Table 300.5 applies to grounding electrode conductors and grounding electrode bonding jumpers. Code-Making Panel 5 agrees with the submitter that Table 300.5 should not be used because it introduces requirements that may not be appropriate. For example, installing the grounding electrode conductor where it is routed down the exterior wall of a building, offset to the burial depth, and then back up to connect to an electrode that is close to the foundation wall would introduce sharp bends that would decrease its effectiveness. However, Code-Making Panel 5 prefers to include this clarification in 250.64(B) where the other requirements for the installation of Grounding Electrode Conductors are located.
This comment was developed by a CMP-5 Task Group and balloted through the entire panel with the following ballot results:
16 Eligible to Vote
14 Affirmative
1 Negative (P. Simmons)
1 Ballot Note Returned (W.J. Helfrich)
The following AFFIRMATIVE comment on vote was received:
P.J. LeLASSEUR: I do not agree with the example. An installation is just as likely to be made using large-radius bends regardless of the depth at which the grounding electrode is installed at.
The following NEGATIVE comment on vote was received:
P. SIMMONS: It is incorrect to presume CMP-5 would accept the additional text to 250.64(B) until after the panel has had an opportunity to consider and vote on the change. It is also incorrect to presume that all installations of grounding electrode conductors to grounding electrodes would be made with one or more sharp bends that would reduce its effectiveness. What is a sharp bend? This is ambiguous language. It should be noted that there is no requirement in Article 250 for "non-sharp" bend installations. The panel has rejected an attempt to add similar language in the past based on our instructions from NFPA staff that we have to avoid installation requirements that more properly belong in NFPA 780, the Lightning Protection Code. We did agree to add the Informational Note following 250.4(A)(1). Note that the Informational Note does not refer to the radius of a bend.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-14 Log #399 NEC-P03 **Final Action: Reject**
(Table 300.5)

Submitter: Thomas L. Adams, Macomb, IL
Comment on Proposal No: 3-36
Recommendation: This Proposal should be rejected.
Substantiation: The present text of OSHA 1926.403(i) limits the requirements in that paragraph to applications up to 600 Volts. Changing the application of the text in Table 300.5 will create a conflict between the two documents because voltages from 601 to 1000 Volts would be in violation of OSHA requirements. In addition, a Note within the OSHA document states that "If the electrical installation is made in accordance with the National Electrical Code ANSI/NFPA 70-1984, exclusive of Formal Interpretations and Tentative Interim Amendments, it will be deemed to be in compliance with 1926.403 through 1926.408, except for 1926.404(b)(1) and 1926.405(a)(2)(ii)(E), (F), (G), and (J)." This would further conflict with the proposed text without significant amendment.
Panel Meeting Action: Reject
Panel Statement: Rejecting the change of the table reference from "600 volts or less" to "1000 volts or less" based on the OSHA 1926 document and a note provided by the OSHA 1926 document addressing a 1984 NEC requirement is not addressing current issues as appropriately documented and recommended by the NEC Correlating Committee High Voltage Task Group.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-15 Log #652 NEC-P03 **Final Action: Accept**
(300.5)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 3-36
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.
The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.
The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.
Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.
Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to

be upgraded also.
If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-16 Log #1555 NEC-P03 **Final Action: Reject**
(300.5(D))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 3-43
Recommendation: Accept the proposal.
Substantiation: The panel statement is not responsive and more directly applies to Proposal 3-45. If this comment is accepted, Proposal 3-45 becomes redundant, and for that reason no comment is offered to revive Proposal 3-45 at this time. The substantiation that came with Proposal 3-45 is pertinent. The panel statement noted that the parent text of 300.5(D) "still applies only to directly buried cables and conductors". The entire purpose of Proposal 3-43 is to change that limitation, so 300.5(D)(3) can be applied to underground service raceways, as was always intended. For example, the reason for the 12-inch minimum separation between the ribbon and the underground wiring is to provide the maximum warning interval feasible with buried nonmetallic conduit in place at its usual 18-inch minimum cover. As the individual responsible for the placement of what is now 300.5(D)(3) in the NEC, this submitter is uniquely qualified to make this point. The proposed change in the parent text does not interfere with any of the provisions in the four numbered paragraphs that follow it, and is essential to incorporating all the intended applications for (3) within the scope of this subsection.
Panel Meeting Action: Reject
Panel Statement: The enclosure or raceway protection from physical damage in 300.5(D)(4) applies only to the raceway or enclosure application in 300.5(D)(1) for directly buried cables and conductors emerging from grade, not for general installation in a raceway or enclosure. For the application of service conductors in a raceway or an enclosure, the general requirements in 300.5(A) and the appropriate column in Table 300.5 applies.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-17 Log #353 NEC-P03 **Final Action: Accept**
(300.6(A))

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 3-51
Recommendation: Revise text to read as follows:
Field-cut threads are those threads that are cut in conduit, <u>elbows, or nipples</u> anywhere other than at the factory where the product is listed.
Substantiation: This proposal was submitted to address proposals submitted during the 2011 cycle that concerned corrosion protection of threads on elbows and nipples. The text the Panel accepted only addresses conduit and not the products of primary concern.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13
Comment on Affirmative:
CASPARRO, P.: Elbows and nipples could be cut and threaded in a supply house, a Home Depot, or a Lowes. For example, the threads on a manufactured 90 degree elbow are sometimes damaged at the time of purchase, so a new thread would have to be applied.

3-18 Log #454 NEC-P03 **Final Action: Reject**
(300.9)

Submitter: Robert A. Jones, IEC Texas Gulf Coast
Comment on Proposal No: 3-59
Recommendation: Accept proposal 3-59.
Substantiation: I have tried to find a technical paper or report about condensation within a conduit or enclosure and I cannot locate such a document. Since the panel statement refers to condensation I assume there must be a technical report or study to support the statement that "the interior of a raceway is often subject to condensation" and I respectfully request Panel 3 to direct me to that study or report. I do not believe the interior of a raceway is subject to condensation and most of my work in electrical construction for the past 40 years has been in an area subject to high humidity. I do believe that water can accumulate in a raceway due to poor workmanship and the use of material such as couplings and connectors that are not raintight. I am sure the members of Panel 3 are aware of the revision made to EMT raintight fittings as required by a UL study to determine the reliability of "raintight".
This information can be found at http://www.ul.com/regulators/raintight.cfm
I still contend that if the installation is in compliance with all NEC requirements, the interior of a raceway abovegrade cannot be a wet location.
Panel Meeting Action: Reject
Panel Statement: Metallic outlet boxes covered in the 2012 UL White Book in category QCIT provides the following listing requirement for metal boxes installed in a damp or wet location: "Boxes and covers intended for use in wet locations as defined by the NEC are marked "Wet Location." Damp location boxes and covers are intended to be so located or equipped as to prevent water from entering or accumulating in the box and are marked "Damp Location." Boxes with threaded conduit hubs will normally prevent water from entering except for condensation within the box or connected conduit." As can be seen by this listing requirement, metal boxes can receive water from condensation within conduit. This same application can occur with any raceway.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-19 Log #459 NEC-P03 **Final Action: Accept**
(300.11, Informational Note 1)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 3-64
Recommendation: Revise ASTM E119-2011a to read ASTM E119-2012a.
Substantiation: Date update of ASTM E119 standard.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

9-19 Log #39 NEC-P09 **Final Action: Accept**
(300.15)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 3-70
Recommendation: It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 9 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: Panel 9 accepts the direction of the Correlating Committee to take action on this comment. The submitters assertion that electrical connections need not be made in a box only that a box need be located in the vicinity of the connection requires great imagination in order to construe that reasoning to be the intention of section 300.15. Other NEC sections such as 314.17(C) reference type NM and type UF cable requiring the sheaths of such cables to extend ¼" into the box and beyond any cable clamp reinforcing the obvious requirement that the connections, splices etc. themselves be enclosed in the box. See panel action on comment 9-20.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-20 Log #1090 NEC-P09 **Final Action: Accept**
(300.15)

Submitter: Gregory J. Steinman, Thomas & Betts Corporation
Comment on Proposal No: 3-70
Recommendation: Continue to REJECT Proposal 3-70.
Substantiation: The panel's request for a third-party fact finding investigation and report is appropriate since the technology on which the proposal is based contravenes the requirement in Section 300.15(F) which prohibits spicing or terminating conductors in a fitting. This being the case. I respectfully disagree with the panel's request to the TCC that the CMP 9 be given jurisdiction over this issue.
Panel Meeting Action: Accept
Panel Statement: Panel 9 assumes the Correlating Committee has assigned this topic to Panel 9 for comment on comment 9-19. The panel is in agreement to continue to "Reject" the addition of the "Connector Fitting with incorporated Box", noting that using a traditional fitting remains an unacceptable location for a splice or termination. However, Panel 9 does not agree with all of the substantiation from the submitter, as the technology presented in the proposal does not contravene 300.15(F). Specifically, the assembly in question provides more features than a traditional "fitting", and is more analogous to installations described in Sections 300.15(B) and 300.15(E). CMP 9 supports a position where a product evaluated as a Listed assembly (including a terminal) with an integral enclosure is permitted to terminate conductors.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-21 Log #40 NEC-P09 **Final Action: Accept**
(300.15(E))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 3-71
Recommendation: The Correlating Committee directs that this proposal be sent to Code-Making Panel 9 for action in Article 314.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept
Panel Statement: The panel accepts the direction of the Correlating Committee to respond to this proposal. Section 300.15(E) limits the use of a device within an integral enclosure to Non-metallic sheathed cable. No evidence has been provided by the submitter that demonstrates the suitability of this type of integral enclosure for use with metal armored cables. The panel rejects the proposal as it does not improve the clarity.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

3-20 Log #808 NEC-P03 **Final Action: Reject**
(300.17)

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 3-73
Recommendation: Proposal 3-73 should be accepted in part.
Panel 3 should accept the deletion of the Informational Note in 300.17 and continue rejecting the Table 300.17.
Substantiation: The Informational Note is a laundry list and is not needed since the Number of Conductors is clearly identified in the appropriate Articles. In addition, the Information Note is missing NUCC Conduit as stated in Proposal 3-76. Even though NUCC is supplied with preinstalled conductors it still has to meet the requirements of 300.17 and number of conductors as stated in Table 1, Chapter 9.
Panel Meeting Action: Reject
Panel Statement: The informational note provides the user of the NEC a convenient reference to the location within each article covering wiring method fill requirements. There has been insufficient technical substantiation provided by the submitter to delete this informational note.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-21 Log #903 NEC-P03 **Final Action: Reject**
(300.22(B) Exception (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 3-82
Recommendation: Please accept the proposal and add an exception to 300.22 (B) as follows:
<u>*Exception: Wiring that is specifically listed for use within an air-handling space (plenum) shall be permitted to be installed in air ducts, but only if the wiring is directly associated with the air distribution system and the total length of such wiring does not exceed 1.2 m (4 ft).*</u>
Substantiation: Standards Council has stated that NFPA 90A has jurisdiction over products in ducts and plenums, i.e. the areas called "Ducts Not Used for Air Handling, Fabricated Ducts for Environmental Air, and Other Spaces for Environmental Air" in section 300.22 (B) and 300.22 (C).
NFPA 90A allows "plenum cables" to be installed in air ducts under the very extreme limitations indicated above (and as shown below). If this proposal is not accepted there would be a difference in requirements between the NEC and NFPA 90A.
NFPA 90A states, in section 4.3.4 as follows:
4.3.4 Materials for Operation and Control of the Air Distribution System.
4.3.4.1. Wiring shall not be installed in air ducts, except as permitted in 4.3.4.2 through 4.3.4.4.
4.3.4.2 Wiring shall be permitted to be installed in air ducts only if the wiring is directly associated with the air distribution system and does not exceed 1.22 m (4 ft).
4.3.4.3 Wiring permitted by 4.3.4.2 shall be as short as practicable.
4.3.4.4* Electrical wires and cables and optical fiber cables shall consist of wires or cables listed as having a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with NFPA 262, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*, or shall be installed in metal raceways without an overall nonmetallic covering or metal sheathed cable without an overall nonmetallic covering.
There is also an annex note in NFPA 90A, as follows:
A.4.3.4.4 Electrical wires and cables and optical fiber cables installed in metal raceways or metal sheathed cable are not considered to be exposed to the airflow and need not meet the requirements of 4.3.4.4. Electrical wires and cables and optical fiber cables listed to UL Subject 2424, *Outline of Investigation for Cable Marked Limited Combustible*, are considered to be suitable for use wherever cables tested in accordance with NFPA 262, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*, are required.
Panel Meeting Action: Reject
Panel Statement: While the proposed change appears to fall within the provisions of 4.3.4 of NFPA 90A, the panel does not agree with the 4 foot limitation which is considered to be impractical for applications such as the installation of pendant duct smoke detectors. The submitter should consider submitting proposals to NFPA 90A to permit wire lengths more appropriate for such applications.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-22 Log #294 NEC-P03 **Final Action: Accept**
(300.22(C)(1))

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 3-85
Recommendation: Continue to reject proposal 3-85.
Substantiation: The Communications Cable and Connectivity Association supports the panel's action to reject this proposal. Including signaling and communications raceways could give the impression that communications raceways are suitable for use with electric light and power wiring. They are not listed for use with electric light and power wiring.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-23 Log #295 NEC-P03 **Final Action: Accept in Principle**
(300.22(C)(1))

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 3-86
Recommendation: Revise the Panel Action as follows:
Cable ties used to secure cables shall be listed as having ~~adequate fire-resistant and low smoke producing characteristics~~ <u>low smoke and heat release properties</u>.
Informational Note: One method of defining <u>a cable tie with low smoke and heat release properties</u> ~~adequate fire-resistant and low-smoke producing characteristics~~ is <u>that the cable tie exhibits a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a peak heat release rate of 100 kW or less when tested</u> in <u>accordance with</u> ANSI/UL 2043-2008, *Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces.*
Substantiation: The panel action on the proposal changed,
"Cable ties used to secure cables shall be listed as having low smoke and heat release properties."
to
"Cable ties used to secure cables shall be listed as having adequate fire resistant and low smoke producing characteristics."
The panel stated that it changed from "low smoke and heat release properties" to "adequate fire resistant and low smoke producing characteristics" in order to more appropriately match the text throughout the NEC where dealing with low smoke and fire resistance characteristics.
This requirement should not match the text used for plenum cables and raceways because *ANSI/UL 2043, Standard for Safety Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces,* measures heat release rate, while NFPA 262 *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces,* measures flame spread. The tests are different and the text referring to them should be different.
The Panel Action on the informational note removed the reference to the listing requirements in NFPA 90A. Without reference to NFPA 90A it is necessary to cite a least one set of pass/fail criteria as is done in the informational notes for plenum cables in 725.179(A), 760.179(D), 770.179(A), 800.179(A), 820.179(A) and 830.179(B)(1).
Panel Meeting Action: Accept in Principle
Panel Statement: Refer to the panel action and statement on Comment 3-24, which addresses the same issue.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-24 Log #712 NEC-P03 **Final Action: Accept in Principle**
(300.22(C)(1))

TCC Action: The Correlating Committee directs that mandatory text and informational note be revised for correlation as follows:
Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables shall be listed as having low smoke and heat release properties.
Informational Note: One method to determine low smoke and heat release properties is that the nonmetallic cable ties and other nonmetallic cable accessories exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less and a peak heat release rate of 100 kW or less when tested in accordance with ANSI/UL 2043-2008, Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces.
The Correlating Committee understands the mandatory text and the informational note are to be located at the bottom of the existing paragraph in 300.22(C)(1).
Submitter: George Bish, Secure Watch Security
Comment on Proposal No: 3-86
Recommendation: The panel should continue to Accept in Principle in Part but revise the Panel Action as follows:
Mandatory Text: "Cable ties used to secure cables shall be listed as having ~~adequate fire resistant and~~ low smoke and heat release properties ~~producing~~

~~characteristics~~."

Informational Note: One method ~~of defining adequate fire resistant and low-smoke producing characteristics~~ to determine low smoke and heat release properties is ~~in~~ that the cable tie exhibits a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less and a peak heat release rate of 100kW or less when tested in accordance with ANSI/UL 2043-2008, Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces.

Substantiation: The Panel revised the mandatory text to more appropriately match the text throughout the NEC where dealing with low smoke and fire characteristics. The requirement for "Cable Ties" should not "match" text used elsewhere in the NEC dealing with plenum cables and raceways. The standard cited, ANSI/UL 2043-2008, deals with heat release and does not address fire resistance (flame spread).

The Panel Action on the informational note has deleted the reference to NFPA 90A that contains the appropriate listing requirements. Hence, at least one set of listing requirements must be provided in the informational note as is done in the informational notes accompanying 725.179(A), 760.179(D), 770.179(A), 800.179(A), 820.179(A) and 830.179((B)(1).

The proposed changes contained in this comment will correlate requirements addressing the listing of cable ties across Articles 300, 770, 800, 820, and 830

This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to correlate the requirements of Cable Ties in Articles 300, 770, 800, 820, and 830

The Task Group members were:

George Bish, Chair, representing Satellite Broadcasting & Communication Association

Harry Ohde, representing IBEW

James Brunssen, representing Alliance for Telecommunications Industry Solutions

George Straniero, representing National Electrical Manufacturers Association

Robert Walsh, representing International Association of Electrical Inspectors

Wendell Whistler, representing Intertek Testing Services

Panel Meeting Action: Accept in Principle

Revise the comment recommendation to read as follows:

Mandatory Text: Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables shall be listed as having low smoke and heat release properties.

Informational Note: One method to determine low smoke and heat release properties is that the cable tie exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less and a peak heat release rate of 100 kW or less when tested in accordance with ANSI/UL 2043-2008, Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces.

Panel Statement: The panel added mandatory text to recognize the use of nonmetallic cable support accessories other than cable ties. The change to "0.50" provides a level of precision consistent with UL 2043.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

3-25 Log #904 NEC-P03 **Final Action: Accept in Principle**
(300.22(C)(1))

Submitter: Marcelo M. Hirschler, GBH International

Comment on Proposal No: 3-86

Recommendation: Please accept the proposal as written.

Substantiation: The requirements contained in NFPA 90A (and shown in the Informational Note) are the testing of cable ties by means of UL 2043. UL 2043 does not assess "fire resistant and low smoke producing characteristics" but assesses "smoke and heat release characteristics". The UL 2043 determines the heat release rate (and the maximum allowed is 100 kW) and smoke release (as assessed by optical density, peak and average). As the language accepted in articles 770, 800, 820 and 830 contains the terms used by the submitter of this proposal, there needs to be consistency between the requirements. CMP 3 correctly assessed that including the language in 300.22 makes it unnecessary to include the language in articles 725 and 760.

Panel Meeting Action: Accept in Principle

Panel Statement: Refer to the panel action and statement on Comment 3-24.

The revised text includes terminology similar to the original proposal. In addition, text was added to recognize the use of nonmetallic cable supports other than cable ties. The language used was developed by a joint task group (CMP 3 and CMP16).

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

3-26 Log #1086 NEC-P03 **Final Action: Accept in Principle**
(300.22(C)(1))

Submitter: Timothy P. McNeive, Thomas & Betts Corporation

Comment on Proposal No: 3-86

Recommendation: The panel should continue to Accept in Principle in Part but revise the Panel Action as follows:

"Straps, staples, hangers, ~~C~~cable ties or similar fittings used to secure cables shall be listed as having ~~adequate fire resistant and~~ low smoke and heat release properties ~~producing characteristics~~."

Informational Note: One method ~~of defining adequate fire resistant and low-smoke producing characteristics~~ to determine low smoke and heat release properties is ~~in~~ that the strap, staple, hanger, cable tie or similar fitting exhibits a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less and a peak heat release rate of 100kW or less when tested in accordance with ANSI/UL 2043-2008, Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces.

Substantiation: Cable ties are just one means for securing cables referenced under "Mechanical Execution of Work" throughout the Code.

All "discrete combustible components", not only cable ties, used in conjunction with plenum cables and raceways in spaces according to 300.22(C) and (D) such be held to the same standard with regard to low smoke and heat release properties.

The following UL standards all contain optional classifications and associated markings for listing products such thee according to requirements in UL 2043: UL62275, Cable ties for electrical installations; UL 1565, Positioning devices; and UL 2239, Hardware for support of conduit, tubing and cable.

The reference to UL2043 and the specific minimum index values in the Informational Note will be very helpful to enforcement authorities. Often there is an expectation that discrete products must have flame spread characteristics as well as low-smoke producing characteristics the same as for potentially continuously flame propagating products such as cables. The test method and minimum index values for these continuous products are not appropriate for discrete products. Panel members are invited to review a NEMA document published by NEMA cable tie manufacturers at the following link: http://www.nema.org/Products/Documents/Application%20Guide%201Cable%20Ties_Application%20Environment_AH.pdf

Panel Meeting Action: Accept in Principle

Panel Statement: Refer to the committee action and statement on Comment 3-24, which addresses the same issues.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

3-26a Log #CC301 NEC-P03 **Final Action: Accept**
(300.22(C)(3) and Info Note)

TCC Action: The Correlating Committee directs the action on this comment be reported as "Hold" since the corresponding changes to the referenced section and informational note were proposed for 300.22(C)(1), but did not have public review for 300.22(C)(3) and constitutes new material. The text that was used in 300.22(C)(1) applied specifically to cable ties as well as cable tie accessories. However, the proposed revision for 300.22(C)(3)would apply to all equipment referenced in 300.22(C)(3). This expansion has not had public review.

Submitter: Code-Making Panel 3,

Comment on Proposal No: 3-86

Recommendation: Revise 300.22(C)(3) and it's Informational Note to read as follows (the exception is retained and unchanged):

(3) Equipment. Electrical equipment with a metal enclosure, or electrical equipment with a nonmetallic enclosure listed for use within an air-handling space and having low-smoke and heat release properties, and associated wiring material suitable for the ambient temperature shall be permitted to be installed in such other space unless prohibited elsewhere in this Code.

Informational Note: One method to determine low smoke and heat release properties is that the equipment exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less and a peak heat release rate of 100 kW or less when tested in accordance with ANSI/UL 2043-2008, Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces.

Substantiation: The panel revised 300.22(C)(3) to be consistent with the action taken for 300.22(C)(1) in Comment 3.24.

Panel Meeting Action: Accept

Number Eligible to Vote: 13

Ballot Results: Affirmative: 12 Negative: 1

Explanation of Negative:

STENE, S.: The action of this comment on 300.22(C)(3) and its informational note is new material that has not had public review. There wasn't a proposal submitted to make a change in this section for equipment to have low smoke and heat release properties, only for cable ties to have low smoke and heat release properties.

Comment on Affirmative:

WALSH, R.: The corresponding changes to the referenced section and informational note were proposed for 300.22(C)(1), but were not allowed public review for 300.22(C)(3) and could constitute new material. I submit that the comment should be evaluated by the Correlating Committee.

3-27 Log #809 NEC-P03 **Final Action: Reject**
(300.22(C)(3))

Submitter: David H. Kendall, Thomas & Betts Corporation

Comment on Proposal No: 3-87

Recommendation: Proposal 3-87 should be accepted.

Substantiation: Electrical professionals are having difficulty finding where

it states that a standard receptacle is permitted (as stated by Panel 3 in their Panel Statement) to be installed in Other Spaces Used for Environmental Air (Plenum) when used with metal outlet boxes and metal covers in the NEC.
Panel Meeting Action: Reject
Panel Statement: A receptacle installed with a metal faceplate would still expose the receptacle to possible fire with resulting smoke and products of combustion. A receptacle installed in an "other space used for environmental air (plenum)", totally enclosed in a metal cover without exposed nonmetallic parts, except while in use, (such as an attended use cover) would be permitted by the text in existing 300.22(C)(3).
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-28 Log #653 NEC-P03 **Final Action: Accept**
(300, Part II)

TCC Action: The Correlating Committee directs that as a result of the changes in voltage thresholds in Article 300, the range of voltage in the first row in Table 300.50 be revised to read: "Over 1000V through 22 kV."
Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 3-89
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.
The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.
The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.
Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.
Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.
If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-29 Log #810 NEC-P03 **Final Action: Reject**
(300, Part II)

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 3-89
Recommendation: Proposal 3-89 should be rejected.
Substantiation: Panel 3 should reconsider accepting this proposal. Panel Member Burlison is correct in his negative ballot and statement There was not technical substantiation to allow wiring methods over 600 volts to 1000 volts to become a part of 300 Part I. Leaving 300 Part II at 600 volts does not affect unique applications in later articles of the NEC.
Panel Meeting Action: Reject
Panel Statement: Additional substantiation has been provided by Comment 3-28.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-30 Log #555 NEC-P03 **Final Action: Accept**
(300.38 (New))

Submitter: Richard E. Loyd, Sun Lakes, AZ
Comment on Proposal No: 3-92
Recommendation: Reconsider and approve this comment to add a new Section 300.38.
Substantiation: I originally submitted the proposal as I interpreted 300.2(A) to limit Part 1 of Article 300 to less than 600 volt installations and in some cases the limitations are for less than 600 volts, and that Part II only gives specific permission for over 600 volts.
It seems to me that each of the two sentences in 300.2(A) stand alone? For example notice 300.32 in Part II sends the reader back to 300.3(C)(2) which I believe is helpful. This same action could be done for wet locations above ground, or just accept this comment.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Negative: 1
Explanation of Negative:
STENE, S.: This should have been a reject. Duplicating every section in Part I of Article 300 that is not voltage specific and inserting it into Part II is unnecessary. Section 300.9 already requires the interior of raceways in above-ground installations to be considered to be wet locations and is not limited by voltage. Part II of Article 300 is specific to installations over (600 volts)1000 volts (as changed in Proposal 3-89 and Comment 3-28), however, an over (600 volt) 1000 volt application must still comply with Part I where it is not voltage specific.

3-31 Log #1556 NEC-P03 **Final Action: Reject**
(300.45 (New))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 3-94
Recommendation: Accept the proposal.
Substantiation: The panel statement is incorrect. There is no such warning requirement that applies generally to all points of access to conductors, although the sections cited in the panel statement are generally correct. However, it must be remembered that this proposal was a companion to one that deleted 225.70. The proposal (4-88) was effectively accepted by CMP 4. The substation provision will no longer exist in the form it did in the 2011 NEC. It is important to realize that every one of this submitter's companion proposals to the one to delete 225.70 has been accepted by the relevant panels, with the notable exception of this one by CMP 3. If this provision is not accepted in at least some form, the requirement will not carry forward to the 2014 NEC.
Panel Meeting Action: Reject
Panel Statement: The panel's statement in Proposal 3-94 did not make the statement that there was a warning requirement that applied generally, as alleged by the submitter. The deletion of 225.70 requiring warning signs applied only to substations and does not have anything to do with the submitters request to have warning signs placed on all points of access to conductors in all conduit and cable systems for over 1000 volts. There is no technical substantiation to apply the warning sign criteria for all access points in all conduit and cable systems. In addition, the submitter only referenced conduit and cabling, leaving off any references to tubing of any kind, such as EMT.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

ARTICLE 310 — CONDUCTORS FOR GENERAL WIRING

6-1 Log #253 NEC-P06 **Final Action: Reject**
(310.4)

Submitter: Raymond J. Dezik, 400 Hz Repair
Comment on Proposal No: N/A
Recommendation: We ask that the code be changed to allow cables as small as 2 #4 in parallel as that is a practical application and may not fall under the sections Exception 1, a-b &c.
Substantiation: Conductors in parallel even at 400 Hz are not allowed if smaller than 1/0.
We parallel 400 Hz conductors for voltage drop and not ampacity.
2 -#3 cables equal a 1/0 in cross section yet we lower our voltage drop by 50%. A change in the codes for 600 Hz would allow wires as small as 2-#4 in parallel as that is a practical application for 400 Hz.
We would rather use 2#3 rather than 1/0. Therefore we ask that the code be changed to allow cables as small as 2 #4 in parallel as that is a practical application and may not fall under the sections Exception 1, a-b &c.
Panel Meeting Action: Reject
Panel Statement: The comment is incomplete and inadequate in that the submitter has not provided the necessary wording to complete the proposal in accordance with 4.4.5(b) and (c) of the Regulations Governing Committee Projects.
The 310.10(H)(1) Exception No. 1 provides requirements for 360 Hz and higher for systems. The submitter has not provided specific substantiation why Exception 1 is inadequate.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10
Comment on Affirmative:
CLINE, S.: In support of the Panel's action:
The submitter may not realize that Exception No. 1 appears to give permission exactly as he requests. IF (a), (b), and (c) are satisfied, THEN multiple smaller-than-1/0 conductors are allowed to reduce the voltage drop.

6-2 Log #403 NEC-P06 **Final Action: Reject**
(310.10(F))

Submitter: Thomas L. Adams, Macomb, IL
Comment on Proposal No: 6-14
Recommendation: Reject Proposal 6-14.
Substantiation: Although present OSHA requirements do not directly address required burial depth, the present text of OSHA 1926.403 (General Requirements), 1926.404 (Wiring Design and Protection), and 1926.405 (Wiring Methods, Components for General Use) all contain voltage breaks at 600 Volts. Changing the application of the text in 310.10(F) will create a conflict between the two documents causing voltages from 601 to 1000 Volts to possibly be in violation of OSHA requirements. In addition, a Note within the OSHA document states that "If the electrical installation is made in accordance with the National Electrical Code ANSI/NFPA 70-1984, exclusive of Formal Interpretations and Tentative Interim Amendments, it will be deemed to be in compliance with 1926.403 through 1926.408, except for 1926.404(b)(1) and 1926.405(a)(2)(ii)(C), (F), (G), and (J)." This would further conflict with the proposed text without significant amendment.
Panel Meeting Action: Reject
Panel Statement: Proposal 6-14 did not present any safety concerns to the panel.
Although OSHA has certain requirements based on voltage break, the NEC must lead in establishing product voltage requirements.
The proposed changes are necessary to keep up with technological changes in the methods employed to generate power.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

6-3 Log #715 NEC-P06 **Final Action: Accept**
(310.10(F))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 6-14
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.
The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.
The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.
Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.
Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.
If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

6-4 Log #423 NEC-P06 **Final Action: Accept**
(310.10(H)(2)(6))

Submitter: Mark C. Ode, UL LLC
Comment on Proposal No: 6-15
Recommendation: Revise text to read as follows:
(6) ~~When~~ Where paralleled in ~~ferrous metal~~ enclosures or raceways, conductors shall be grouped with all conductors of the same circuit to prevent heating effects from imbalances of current.
Information Note: Where conductors are paralleled in ~~ferrous metal~~ enclosures or raceways, failure to group one conductor from each phase in each raceway or grouping within a wiring method may result in overheating and current imbalance.
Substantiation: "When" was changed to "where" since this is not a condition of time. "Ferrous metal" was deleted since the conductors not being grouped together and the resulting heat, as well as current imbalance, will occur in both ferrous and non-ferrous enclosures and raceways. Limiting this restriction to just ferrous enclosures would still subject non-grouped conductors to large imbalances of current and the heating effects of this imbalance.
Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

6-5 Log #1006 NEC-P06 **Final Action: Accept**
(310.10(H)(2)(6))

Submitter: David Clements, International Association of Electrical Inspectors
Comment on Proposal No: 6-15
Recommendation: Revise text to read as follows:
(6) ~~When~~ Where paralleled in ~~ferrous metal~~ enclosures or raceways, conductors shall be grouped with all conductors of the same circuit to prevent heating effects from imbalances of current.
Information Note: Where conductors are paralleled in ~~ferrous metal~~ enclosures or raceways, failure to group one conductor from each phase in each raceway or grouping within a wiring method may result in overheating and current imbalance.
Substantiation: "When" was changed to "where" since this is not a condition of time. "Ferrous metal" was deleted since the conductors not being grouped together and the resulting heat, as well as current imbalance, will occur in both

ferrous and nonferrous enclosures or raceways. Limiting this restriction to just ferrous enclosures would still subject non-grouped conductors to large imbalances of current and the heating effects of this imbalance.
Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

6-6 Log #559 NEC-P06 **Final Action: Accept in Principle**
(310.10(H)(6) and Informational Note)

Submitter: Richard E. Loyd, Sun Lakes, AZ
Comment on Proposal No: 6-15
Recommendation: Revise text to read as follows:
(6) When paralleled in ~~ferrous metal~~ enclosures or raceways, conductors shall be grouped with all conductors of the same circuit to prevent heating effects from imbalances of current.
Information Note: Where conductors are paralleled in ferrous metal enclosures or raceways, failure to group one conductor from each phase in each raceway or grouping within a wiring method may result in overheating and current imbalance.
Substantiation: "Ferrous metal" should be deleted since the conductors are generally not grouped together enclosures. The large imbalances of current and the heating effects of this imbalance will occur in both ferrous, nonferrous and nonmetallic enclosures. The informational note is helpful but not enforceable.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action on Comment 6-4.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

6-7 Log #1063 NEC-P06 **Final Action: Accept**
(310.10(H)(6))

Submitter: Michael J. Johnston, National Electrical Contractors Association
Comment on Proposal No: 6-15
Recommendation: Continue to accept the proposal but revise as follows:
(6) ~~When~~ <u>Where</u> paralleled in ~~ferrous metal~~ enclosures or raceways, conductors shall be grouped with all conductors of the same circuit to prevent heating effects from imbalances of current.
Information Note: Where conductors are paralleled in ~~ferrous metal~~ enclosures or raceways, failure to group one conductor from each phase in each raceway or grouping within a wiring method may result in overheating and current imbalance.
Substantiation: This comment seeks to build on the concepts presented in the original proposal. The word "where" is more appropriate because the rule should not be related to a point in time. The problem of induction and grouping exists not only with parallel conductor sets installed in magnetic (ferroius) enclosures, but is can also be problematic in nonferrous enclosures, relative to improper grouping. Since the original proposal was related to reducing induction problems by grouping, the expansion of the proposal to nonferrous types of enclosures should not be considered new material as it relates to the same problem presented in the original proposal.
Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

6-8 Log #346 NEC-P06 **Final Action: Reject**
(310.15)

Submitter: Johnnie Miller, Electrical Solutions
Comment on Proposal No: N/A
Recommendation: ASHRAE has complied 10 years of dry-bulb design temperature data in the 2009 ASHRAE Handbook of Fundamentals (The American Society of Heating, Refrigeration and Air-conditioning Engineers).
ASHRAE published a Temperature Table and the calculations shown in the table are based on ASHRAE 2% design temperatures for 10 years of data and CDA research covering over five years of monitoring air temperatures inside rooftop raceways. The result of which can be used to apply the correction factors in Table 310.15(B)(2)(a) and table 310.15(B)(2)(b) of the 2011 NEC.
The table covers most of the US and selected Canadian weather station locations included in the ASHRAE Handbook. The complete Handbook can be ordered from ASHRAE (www.ashrae.org).
Substantiation: The problem with the current code is that personnel in the field including inspectors have to guess at the ambient temperature. Incorporating the ASHRAE table into the 2014 NEC would help to denote the rooftop conductor temperatures for virtually all geographic locations throughout the North American continent. By implementing this new Table into the NEC, it would alleviate the guesswork in estimating ambient temperatures used for derating of conductors due to temperature conditions. Moreover, the NEC has already referenced use of the above noted table in the existing 2011 NEC language (reference 310.15 - Ampacities for Conductors Rated 0-2000 Volts, (3) adjustment Factors (ref. pg 70-152).
Panel Meeting Action: Reject
Panel Statement: The proposal is incomplete and inadequate in that the submitter has not provided the necessary wording to complete the proposal in accordance with 4.4.5(b) and (c) of the Regulations Governing Committee Projects.
CMP-6 points out that as per 90.1(C), the NEC is not a design guide.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

6-9 Log #380 NEC-P06 **Final Action: Hold**
(310.15)

TCC Action: Based on the panel action on this Comment of "Hold", the Correlating Committee directs that Proposal 6-19 also be reported as "Hold."
Submitter: Scott Cline, Monterey Park, CA
Comment on Proposal No: 6-19
Recommendation: Please see the following documentation of suggested reorganization-only of Article 310. There is no intention to change the requirements of the Code, only restructure it. The recommendation expressed here is based on the 2011 NEC, previous to the ROP and ROC, and in no way intends to change any approved Code requirement action of the ROP or ROC for the 2014 edition of the NEC.
Formatting of this beginning portion is as a final-draft with underlining only included
(Starting on the 11th page, is a working-draft complete with legislative text)

Reorganization and Editorial Corrections only of 310

Article 310 Conductors for General Wiring
I. General
310.1 Scope. This article covers general requirements for conductors <u>used in general wiring</u> and their type designations, insulations, markings, mechanical strengths, ampacity ratings, and uses. These requirements do not apply to conductors that form an integral part of equipment, such as motors, motor controllers, and similar equipment, or to conductors specifically provided for elsewhere in this *Code*.
Informational Note: For flexible cords and cables, see Article 400. For fixture wires, see Article 402.
310.2 Definitions.
Electrical Ducts. As used in Article 310, electrical ducts shall include any of the electrical conduits recognized in Chapter 3 as suitable for use underground; other raceways round in cross section, listed for underground use, and embedded in earth or concrete.
Thermal Resistivity. As used in this *Code*, the heat transfer capability through a substance by conduction. It is the reciprocal of thermal conductivity and is designated Rho and expressed in the units °C-cm/watt.
II. Installation
310.10 Uses Permitted. The conductors described in 310.104 shall be permitted for use in any of the wiring methods covered in Chapter 3 and as specified in their respective tables or as permitted elsewhere in this *Code*.
Informational Note: Thermoplastic insulation may stiffen at temperatures lower than −10°C (+14°F). Thermoplastic insulation may also be deformed at normal temperatures where subjected to pressure, such as at points of support. Thermoplastic insulation, where used on dc circuits in wet locations, may result in electroendosmosis between the conductor and insulation.
(A) Dry Locations. Insulated conductors and cables used in dry locations shall be any of the types identified in this *Code*.
(B) Dry and Damp Locations. Insulated conductors and cables used in dry and damp locations shall be Types FEP, FEPB, MTW, PFA, RHH, RHW, RHW-2, SA, THHN, THW, THW-2, THHW, THWN, THWN-2, TW, XHH, XHHW, XHHW-2, Z, or ZW.
(C) Wet Locations. Insulated conductors and cables used in wet locations shall comply with one of the following:
(1) Be moisture-impervious metal-sheathed
(2) Be types MTW, RHW, RHW-2, TW, THW, THW-2, THHW, THWN, THWN-2, XHHW, XHHW-2, ZW
(3) Be of a type listed for use in wet locations
(D) Locations Exposed to Direct Sunlight. Insulated conductors or cables used where exposed to direct rays of the sun shall comply with (D)(1) or (D)(2):
(1) Conductors and cables shall be listed, or listed and marked, as being sunlight resistant
(2) Conductors and cables shall be covered with insulating material, such as tape or sleeving, that is listed, or listed and marked, as being sunlight resistant
(E) Shielding. Non-shielded, ozone-resistant insulated conductors with a maximum phase-to-phase voltage of 5000 volts shall be permitted in Type MC cables in industrial establishments
where the conditions of maintenance and supervision ensure that only qualified persons service the installation. For other establishments, solid dielectric insulated conductors operated above 2000 volts in permanent installations shall have ozone-resistant insulation and shall be shielded. All metallic insulation shields shall be connected to a grounding electrode conductor, a grounding busbar, an equipment grounding conductor, or a grounding electrode.
Informational Note: The primary purposes of shielding are to confine the voltage stresses to the insulation, dissipate insulation leakage current, drain off the capacitive charging current, and carry ground-fault current to facilitate operation of ground-fault protective devices in the event of an electrical cable fault.

Exception No. 1: Nonshielded insulated conductors listed by a qualified testing laboratory shall be permitted for use up to 2400 volts under the following conditions:

(a) Conductors shall have insulation resistant to electric discharge and surface tracking, or the insulated conductor(s) shall be covered with a material resistant to ozone, electric discharge, and surface tracking.

(b) Where used in wet locations, the insulated conductor(s) shall have an overall nonmetallic jacket or a continuous metallic sheath.

(c) Insulation and jacket thicknesses shall be in accordance with Table 310.104(D).

Exception No. 2: Nonshielded insulated conductors listed by a qualified testing laboratory shall be permitted for use up to 5000 volts to replace existing nonshielded conductors, on existing equipment in industrial establishments only, under the following conditions:

(a) Where the condition of maintenance and supervision ensures that only qualified personnel install and service the installation.

(b) Conductors shall have insulation resistant to electric discharge and surface tracking, or the insulated conductor(s) shall be covered with a material resistant to ozone, electric discharge, and surface tracking.

(c) Where used in wet locations, the insulated conductor(s) shall have an overall nonmetallic jacket or a continuous metallic sheath.

(d) Insulation and jacket thicknesses shall be in accordance with Table 310.104(D).

Informational Note: Relocation or replacement of equipment may not comply with the term *existing* as related to this exception.

Exception No. 3: Where permitted in 310.10(F), Exception No. 2.

(F) Direct-Burial Conductors. Conductors used for direct-burial applications shall be of a type identified for such use.

Cables rated above 2000 volts shall be shielded.

Exception No. 1: Nonshielded multiconductor cables rated 2001–2400 volts shall be permitted if the cable has an overall metallic sheath or armor.

The metallic shield, sheath, or armor shall be connected to a grounding electrode conductor, grounding busbar, or a grounding electrode.

Exception No. 2: Airfield lighting cable used in series circuits that are rated up to 5000 volts and are powered by regulators shall be permitted to be nonshielded.

Informational Note to Exception No. 2: Federal Aviation Administration (FAA) Advisory Circulars (ACs) provide additional practices and methods for airport lighting.

Informational Note No. 1: See 300.5 for installation requirements for conductors rated 600 volts or less.

Informational Note No. 2: See 300.50 for installation requirements for conductors rated over 600 volts.

(G) Corrosive Conditions. Conductors exposed to oils, greases, vapors, gases, fumes, liquids, or other substances having a deleterious effect on the conductor or insulation shall be of a type suitable for the application.

(H) Conductors in Parallel.

(1) General. Aluminum, copper-clad aluminum, or copper conductors, for each phase, polarity, neutral, or grounded circuit shall be permitted to be connected in parallel (electrically joined at both ends) only in sizes 1/0 AWG and larger where installed in accordance with 310.10(H)(2) through (H)(6).

Exception No. 1: Conductors in sizes smaller than 1/0 AWG shall be permitted to be run in parallel to supply control power to indicating instruments, contactors, relays, solenoids, and similar control devices, or for frequencies of 360 Hz and higher, provided all of the following apply:

(a) They are contained within the same raceway or cable.

(b) The ampacity of each individual conductor is sufficient to carry the entire load current shared by the parallel conductors.

(c) The overcurrent protection is such that the ampacity of each individual conductor will not be exceeded if one or more of the parallel conductors become inadvertently disconnected.

Exception No. 2: Under engineering supervision, 2 AWG and 1 AWG grounded neutral conductors shall be permitted to be installed in parallel for existing installations.

Informational Note to Exception No. 2: Exception No. 2 can be used to alleviate overheating of neutral conductors in existing installations due to high content of triplen harmonic currents.

(2) Conductor Characteristics. The paralleled conductors in each phase, polarity, neutral, grounded circuit conductor, equipment grounding conductor, or equipment bonding jumper shall comply with all of the following:

(1) Be the same length
(2) Consist of the same conductor material
(3) Be the same size in circular mil area
(4) Have the same insulation type
(5) Be terminated in the same manner

(3) Separate Cables or Raceways. Where run in separate cables or raceways, the cables or raceways with conductors shall have the same number of conductors and shall have the same electrical characteristics. Conductors of one phase, polarity, neutral, grounded circuit conductor, or equipment grounding conductor shall not be required to have the same physical characteristics as those of another phase, polarity, neutral, grounded circuit conductor, or equipment grounding conductor.

(4) Ampacity Adjustment. Conductors installed in parallel shall comply with the provisions of 310.15(B)(3)(a).

(5) Equipment Grounding Conductors. Where parallel equipment grounding conductors are used, they shall be sized in accordance with 250.122. Sectioned equipment grounding conductors smaller than 1/0 AWG shall be permitted in multiconductor cables in accordance with 310.104, provided the combined circular mil area of the sectioned equipment grounding conductors in each cable complies with 250.122.

(6) Equipment Bonding Jumpers. Where parallel equipment bonding jumpers are installed in raceways, they shall be sized and installed in accordance with 250.102.

III. Ampacities for Conductors

310.13 General.

(A) Tables or Engineering Supervision. Ampacities for conductors shall be permitted to be determined by tables as provided in 310.15 or 310.60, or under engineering supervision, as provided in 310.13(F).

Informational Note No. 1: Ampacities provided by this part do not take voltage drop into consideration. See 210.19(A), Informational Note No. 4, for branch circuits and 215.2(A), Informational Note No. 2, for feeders.

Informational Note No. 2: For the allowable ampacities of Type MTW wire, see Table 13.5.1 in NFPA 79-2007, *Electrical Standard for Industrial Machinery*.

(B) Selection of Ampacity. Where more than one ampacity applies for a given circuit length, the lowest value shall be used.

Exception: Where two different ampacities apply to adjacent portions of a circuit, the higher ampacity shall be permitted to be used beyond the point of transition, a distance equal to 3.0 m (10 ft) or 10 percent of the circuit length calculated at the higher ampacity, whichever is less.

Informational Note: See 110.40 for conductor temperature limitations due to termination provisions.

(C) Temperature Limitation of Conductors. No conductor shall be used in such a manner that its operating temperature exceeds that designated for the type of insulated conductor involved. In no case shall conductors be associated together in such a way, with respect to type of circuit, the wiring method employed, or the number of conductors, that the limiting temperature of any conductor is exceeded.

Informational Note No. 1: The temperature rating of a conductor [see Table 310.104(A) and Table 310.104(C)] is the maximum temperature, at any location along its length, that the conductor can withstand over a prolonged time period without serious degradation. The allowable ampacity tables, the ampacity tables of Article 310 and the ampacity tables of Informative Annex B, the ambient temperature correction factors, and the notes to the tables provide guidance for coordinating conductor sizes, types, allowable ampacities, ampacities, ambient temperatures, and number of associated conductors. The principal determinants of operating temperature are as follows:

(1) Ambient temperature — ambient temperature may vary along the conductor length as well as from time to time.

(2) Heat generated internally in the conductor as the result of load current flow, including fundamental and harmonic currents.

(3) The rate at which generated heat dissipates into the ambient medium. Thermal insulation that covers or surrounds conductors affects the rate of heat dissipation.

(4) Adjacent load-carrying conductors — adjacent conductors have the dual effect of raising the ambient temperature and impeding heat dissipation.

Informational Note No. 2: Refer to 110.14(C) for the temperature limitation of terminations.

(D) Tables General. For explanation of type letters used in the tables of 310.15 and 310.60 and for recognized sizes of conductors for the various conductor insulations, see Table 310.104(A) and Table 310.104(B). For installation requirements, see 310.1 through 310.13(C) and the various articles of this *Code*. For flexible cords, see Table 400.4, Table 400.5(A)(1), and Table 400.5(A)(2).

(E) Ambient Temperature Correction Factors. Ampacities for ambient temperatures other than those specified in the ampacity tables shall be corrected in accordance with the Tables of 310.15(B)(2) or 310.60(B)(4), or shall be permitted to be calculated using the following equation:

[Unedited formula]

where:

I' = ampacity corrected for ambient temperature

I = ampacity shown in the table for Tc and Ta

Tc = temperature rating of conductor (°C)

Ta' = new ambient temperature (°C)

Ta = ambient temperature used in the table (°C)

(F) Engineering Supervision. Under engineering supervision, conductor ampacities shall be permitted to be calculated by using the following general equation:

[Unedited formula]

where:

Tc = conductor temperature (°C)

Ta = ambient temperature (°C)

ΔTd = dielectric loss temperature rise, used only for 2001 through 35,000 volts

Rdc = dc resistance of conductor at temperature Tc

Yc = component ac resistance resulting from skin effect and proximity effect

Rca = effective thermal resistance between conductor and surrounding ambient

Informational Note: The dielectric loss temperature rise (ΔTd) is negligible for single circuit extruded dielectric cables rated below 46 kV.

310.15 Conductors rated 0 through 2,000 Volts.

(A) Ampacities of Conductors Rated 0 through 2000 Volts. Ampacities for conductors shall be permitted to be determined by 310.15(B) Tables, or under engineering supervision as provided in 310.13(F).

(B) Tables. Ampacities for conductors rated 0 through 2000 volts shall be as specified in the Allowable Ampacity Table 310.15(B)(16) through Table 310.15(B)(19), and Ampacity Table 310.15(B)(20) and Table 310.15(B)(21) as modified by 310.13(D) and (E), and 310.15(B)(1) through (B)(6).

The temperature correction and adjustment factors shall be permitted to be applied to the ampacity for the temperature rating of the conductor, if the corrected and adjusted ampacity does not exceed the ampacity for the temperature rating of the termination in accordance with the provisions of 110.14(C).

Informational Note: Table 310.15(B)(16) through Table 310.15(B)(19) are application tables for use in determining conductor sizes on loads calculated in accordance with Article 220. Allowable ampacities result from consideration of one or more of the following:

(1) Temperature compatibility with connected equipment, especially the connection points.

(2) Coordination with circuit and system overcurrent protection.

(3) Compliance with the requirements of product listings or certifications. See 110.3(B).

(4) Preservation of the safety benefits of established industry practices and standardized procedures.

(1) Bare or Covered Conductors. Where bare or covered conductors are installed with insulated conductors, the temperature rating of the bare or covered conductor shall be equal to the lowest temperature rating of the insulated conductors for the purpose of determining ampacity.

(2) Ambient Temperature Correction Factors Tables (a) and (b). Tables for 310.13(E) for 0 through 2000 volt conductors.

Table 310.15(B)(2)(a)

[Content unchanged]

Table 310.15(B)(2)(b)

[Content unchanged]

(3) Adjustment Factors.

(a) *More Than Three Current-Carrying Conductors in a. Raceway or Cable.* Where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multiconductor cables are installed without maintaining spacing for a continuous length longer than 600 mm (24 in.) and are not installed in raceways, the allowable ampacity of each conductor shall be reduced as shown in Table 310.15(B)(3)(a). Each current-carrying conductor
of a paralleled set of conductors shall be counted as a current-carrying conductor. Where conductors of different systems, as provided in 300.3, are installed in a common raceway or cable, the adjustment factors shown in Table 310.15(B)(3)(a) shall apply only to the number of power and lighting conductors (Articles 210, 215, 220, and 230).

Informational Note No. 1: See Annex B, Table B.310.15(B)(2)(11), for adjustment factors for more than three current-carrying conductors in a raceway or cable with load diversity.

Informational Note No. 2: See 366.23(A) for adjustment factors for conductors in sheet metal auxiliary gutters and 376.22(B) for adjustment factors for conductors in metal wireways.

(1) Where conductors are installed in cable trays, the provisions of 392.80 shall apply.

(2) Adjustment factors shall not apply to conductors in raceways having a length not exceeding
600 mm (24 in.).

(3) Adjustment factors shall not apply to underground conductors entering or leaving an outdoor trench if those conductors have physical protection in the form of rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit (PVC), or reinforced thermosetting resin conduit (RTRC) having a length not exceeding 3.05 m (10 ft), and if the number of conductors does not exceed four.

(4) Adjustment factors shall not apply to Type AC cable or to Type MC cable under the following conditions:

a. The cables do not have an overall outer jacket.

b. Each cable has not more than three current-carrying conductors.

c. The conductors are 12 AWG copper.

d. Not more than 20 current-carrying conductors are installed without maintaining spacing, are stacked, or are supported on "bridle rings."

(5) An adjustment factor of 60 percent shall be applied to Type AC cable or Type MC cable under the following conditions:

a. The cables do not have an overall outer jacket.

b. The number of current carrying conductors exceeds 20.

c. The cables are stacked or bundled longer that 600 mm (24 in) without spacing being maintained.

[Table 310.15(B)(3)(a) unchanged]

(b) *More Than One Conduit, Tube, or Raceway.* Spacing between conduits, tubing, or raceways shall be maintained.

(c) *Circular Raceways Exposed to Sunlight on Rooftops.* Where conductors or cables are installed in circular raceways exposed to direct sunlight on or above rooftops, the adjustments shown in Table 310.15(B)(3)(c) shall be added to the outdoor temperature to determine the applicable ambient temperature for application of the correction factors in Table 310.15(B)(2)(a) or Table 310.15(B)(2)(b).

Informational Note: One source for the average ambient temperatures in various locations is the ASHRAE *Handbook — Fundamentals*.

[Table 310.15(B)(3)(c) unchanged]

Informational Note to Table 310.15(B)(3)(c): The temperature adders in Table 310.15(B)(3)(c) are based on the results of averaging the ambient temperatures.

(4) Neutral Conductor.

(a) A neutral conductor that carries only the unbalanced current from other conductors of the same circuit shall not be required to be counted when applying the provisions of 310.15(B)(3)(a).

(b) In a 3-wire circuit consisting of two phase conductors and the neutral conductor of a 4-wire, 3-phase, wye-connected system, a common conductor carries approximately the same current as the line-to-neutral load currents of the other conductors and shall be counted when applying the provisions of 310.15(B)(3)(a).

(c) On a 4-wire, 3-phase wye circuit where the major portion of the load consists of nonlinear loads, harmonic currents are present in the neutral conductor; the neutral conductor shall therefore be considered a current-carrying conductor.

(5) Grounding or Bonding Conductor. A grounding or bonding conductor shall not be counted when applying the provisions of 310.15(B)(3)(a).

(6) 120/240-Volt, 3-Wire, Single-Phase Dwelling Services and Feeders. For individual dwelling units of one-family, two-family, and multifamily dwellings, conductors, as listed in Table 310.15(B)(6), shall be permitted as 120/240-volt, 3-wire, single-phase service-entrance conductors, service-lateral conductors, and feeder conductors that serve as the main power feeder to each dwelling unit and are installed in raceway or cable with or without an equipment grounding conductor. For application of this section, the main power feeder shall be the feeder between the main disconnect and the panelboard that supplies, either by branch circuits or by feeders, or both, all loads that are part or associated with the dwelling unit. The feeder conductors to a dwelling unit shall not be required to have an allowable ampacity rating greater than their service-entrance conductors. The grounded conductor shall be permitted to be smaller than the ungrounded conductors, provided the requirements of 215.2, 220.61, and 230.42 are met.

Table 310.15(B)(6)

Tables 310.15(B)(16) through 310.15(B)(21)

310.60 Conductors rated 2001 through 35,000 Volts.

(A) Ampacities of Conductors Rated 2001 through 35,000 Volts. Ampacities for solid dielectric-insulated conductors shall be permitted to be determined by 310.60(B) Tables, or under engineering supervision as~~,~~ provided in 310.13(F).

(B) Tables. Ampacities for conductors rated 2001 through 35,000 volts shall be as specified in Table 310.60(B)(67) through Table 310.60(B)(86) in compliance with 310.60(B)(1), (2), and (3). Ampacities for ambient temperatures other than those specified in the ampacity tables shall be corrected in accordance with 310.13(E).

Informational Note No. 1: For ampacities calculated in accordance with 310.60(A), reference IEEE 835-1994 (IPCEA Pub. No. P-46-426), *Standard Power Cable Ampacity Tables,* and the references therein for availability of all factors and constants.

Informational Note No. 2: Ampacities provided by this section do not take voltage drop into consideration. See 210.19(A), Informational Note No. 4, for branch circuits and 215.2(A), Informational Note No. 2, for feeders.

(1) Grounded Shields. Ampacities shown in Table 310.60(B)(69), Table 310.60(B)(70), Table 310.60(B)(81), and Table 310.60(B)(82) are for cable with shields grounded at one point only. Where shields are grounded at more than one point, ampacities shall be adjusted to take into consideration the heating due to shield currents.

(2) Burial Depth of Underground Circuits. Where the burial depth of direct burial or electrical duct bank circuits is modified from the values shown in a figure or table, ampacities shall be permitted to be modified as indicated in (B)(2)(a) and (B)(2)(b).

(a) Where burial depths are increased in part(s) of an electrical duct run, no decrease in ampacity of the conductors is needed, provided the total length of parts of the duct run increased in depth is less than 25 percent of the total run length.

(b) Where burial depths are deeper than shown in a specific underground ampacity table or figure, an ampacity derating factor of 6 percent per 300-mm (1-ft) increase in depth for all values of rho shall be permitted.

No rating change is needed where the burial depth is decreased.

(3) Electrical Ducts in Figure 310.60. At locations where electrical ducts enter equipment enclosures from under ground, spacing between such ducts, as shown in Figure 310.60, shall be permitted to be reduced without requiring the ampacity of conductors therein to be reduced.

(4) Ambient Temperature Correction Factors Table. Table for 310.13(E) for 2001 through 35,000 volt conductors.

The 310.60(C)(4) table is used as-is, except to correct its title-reference number from (C) to (B).

Table 310.60(B)(4)

The content of **Figure 310.60** is unchanged. The two references to "**(C)**" in the title of Figure 310.60 change to "**(B)**" instead.

The "**(C)**" table title references in Tables 310.60(C)(67) through (86) change to "**(B)**" instead. This is in all the tables. The final parenthetic table number

remains unchanged. IE: "**Table 310.60(C)(4)**" changes to "**Table 310.60(B)(4)**"
The data of the tables (67) through (86) remains unchanged.
Table asterisk * footnote references to "**310.60(C)(4)**" are to be changed to "**310.13(E)**" instead; this is in Tables (67) through (76).

IV. Construction Specifications

[310.104 to the end of Article 310 are unchanged.]

*****

Following is a formatting as a draft with Reasons, Strikethrough, and Underlining

Because of the complexity of this reorganization, an additional type of text has been added to the standard legislative text protocol. The editorial standard of [brackets] in order to add in clarifying text which is not a part of the NEC printing is utilized. Where parts have been moved, the prefix information [within brackets] ahead of the moved part's text has been used, such as:

~~[310.15(A)(1)]~~ [310.13](A) General. To indicate that **[310.15(A)(1)]** is not part of the actual NEC text in the new location, but it is where the relocated part came from, that both the section and the Sub are deleted/changed, that **(1)** is no longer the number, that the new Sub is **(A)** within **310.13**, and that "**General.**" Remains as-is.

Also, explanation for each part's modification is printed above each part, in italics within brackets below asterisks as follows here:

*****

[Explanation]

There is no reproduction of the Tables, Figures, or Formulas here – the data in them is/are unchanged, only some section reference numbers within the titles or footnotes are edited.

Reorganization and Editorial Corrections only of 310

*****

["used in general wiring" was added as editorial clarification of the separation of the subject of this article from the many other specialized conductors addressed in other Code sections, such as raceways, bus bars, and specialty wire conductors. As per the existing title, this article deals with conductors for general wiring.]

Article 310 Conductors for General Wiring

I. General

310.1 Scope. This article covers general requirements for conductors used in general wiring and their type designations, insulations, markings, mechanical strengths, ampacity ratings, and uses. These requirements do not apply to conductors that form an integral part of equipment, such as motors, motor controllers, and similar equipment, or to conductors specifically provided for elsewhere in this *Code*.

Informational Note: For flexible cords and cables, see Article 400. For fixture wires, see Article 402.

*****

[The definitions used in 310 should not be in two places as they are now: 310.2 and 310.60. The Electrical Ducts definition in 310.60 seemed more complete, and the Thermal Resistivity definitions are identical.]

~~[310.60(A)]~~ 310.2 Definitions.

Electrical Ducts. As used in Article 310, electrical ducts shall include any of the electrical conduits recognized in Chapter 3 as suitable for use underground; other raceways round in cross section, listed for underground use, and embedded in earth or concrete.

Thermal Resistivity. As used in this *Code*, the heat transfer capability through a substance by conduction. It is the reciprocal of thermal conductivity and is designated Rho and expressed in the units °C-cm/watt.

*****

[Part II. Installation and all of 310.10 remain unchanged – EXCEPT for an unrelated correction of a table reference error in the 2011 print: in 310.10(E) Ex.No.2(d) " . . . Table 310.~~13~~104(D)."]

II. Installation

310.10 Uses Permitted. The conductors described in 310.104 shall be permitted for use in any of the wiring methods covered in Chapter 3 and as specified in their respective tables or as permitted elsewhere in this *Code*.

Informational Note: Thermoplastic insulation may stiffen at temperatures lower than −10°C (+14°F). Thermoplastic insulation may also be deformed at normal temperatures where subjected to pressure, such as at points of support. Thermoplastic insulation, where used on dc circuits in wet locations, may result in electroendosmosis between the conductor and insulation.

(A) Dry Locations. Insulated conductors and cables used in dry locations shall be any of the types identified in this *Code*.

(B) Dry and Damp Locations. Insulated conductors and cables used in dry and damp locations shall be Types FEP, FEPB, MTW, PFA, RHH, RHW, RHW-2, SA, THHN, THW, THW-2, THHW, THWN, THWN-2, TW, XHH, XHHW, XHHW-2, Z, or ZW.

(C) Wet Locations. Insulated conductors and cables used in wet locations shall comply with one of the following:

(1) Be moisture-impervious metal-sheathed
(2) Be types MTW, RHW, RHW-2, TW, THW, THW-2, THHW, THWN, THWN-2, XHHW, XHHW-2, ZW
(3) Be of a type listed for use in wet locations

(D) Locations Exposed to Direct Sunlight. Insulated conductors or cables used where exposed to direct rays of the sun shall comply with (D)(1) or (D)(2):

(1) Conductors and cables shall be listed, or listed and marked, as being sunlight resistant
(2) Conductors and cables shall be covered with insulating material, such as tape or sleeving, that is listed, or listed and marked, as being sunlight resistant

(E) Shielding. Non-shielded, ozone-resistant insulated conductors with a maximum phase-to-phase voltage of 5000 volts shall be permitted in Type MC cables in industrial establishments
where the conditions of maintenance and supervision ensure that only qualified persons service the installation. For other establishments, solid dielectric insulated conductors operated above 2000 volts in permanent installations shall have ozone-resistant insulation and shall be shielded. All metallic insulation shields shall be connected to a grounding electrode conductor, a grounding busbar, an equipment grounding conductor, or a grounding electrode.

Informational Note: The primary purposes of shielding are to confine the voltage stresses to the insulation, dissipate insulation leakage current, drain off the capacitive charging current, and carry ground-fault current to facilitate operation of ground-fault protective devices in the event of an electrical cable fault.

Exception No. 1: Nonshielded insulated conductors listed by a qualified testing laboratory shall be permitted for use up to 2400 volts under the following conditions:

(a) Conductors shall have insulation resistant to electric discharge and surface tracking, or the insulated conductor(s) shall be covered with a material resistant to ozone, electric discharge, and surface tracking.

(b) Where used in wet locations, the insulated conductor(s) shall have an overall nonmetallic jacket or a continuous metallic sheath.

(c) Insulation and jacket thicknesses shall be in accordance with Table 310.104(D).

Exception No. 2: Nonshielded insulated conductors listed by a qualified testing laboratory shall be permitted for use up to 5000 volts to replace existing nonshielded conductors, on existing equipment in industrial establishments only, under the following conditions:

(a) Where the condition of maintenance and supervision ensures that only qualified personnel install and service the installation.

(b) Conductors shall have insulation resistant to electric discharge and surface tracking, or the insulated conductor(s) shall be covered with a material resistant to ozone, electric discharge, and surface tracking.

(c) Where used in wet locations, the insulated conductor(s) shall have an overall nonmetallic jacket or a continuous metallic sheath.

(d) Insulation and jacket thicknesses shall be in accordance with Table 310.~~13~~104(D).

Informational Note: Relocation or replacement of equipment may not comply with the term *existing* as related to this exception.

Exception No. 3: Where permitted in 310.10(F), Exception No. 2.

(F) Direct-Burial Conductors. Conductors used for direct-burial applications shall be of a type identified for such use.

Cables rated above 2000 volts shall be shielded.

Exception No. 1: Nonshielded multiconductor cables rated 2001–2400 volts shall be permitted if the cable has an overall metallic sheath or armor.

The metallic shield, sheath, or armor shall be connected to a grounding electrode conductor, grounding busbar, or a grounding electrode.

Exception No. 2: Airfield lighting cable used in series circuits that are rated up to 5000 volts and are powered by regulators shall be permitted to be nonshielded.

Informational Note to Exception No. 2: Federal Aviation Administration (FAA) Advisory Circulars (ACs) provide additional practices and methods for airport lighting.

Informational Note No. 1: See 300.5 for installation requirements for conductors rated 600 volts or less.

Informational Note No. 2: See 300.50 for installation requirements for conductors rated over 600 volts.

(G) Corrosive Conditions. Conductors exposed to oils, greases, vapors, gases, fumes, liquids, or other substances having a deleterious effect on the conductor or insulation shall be of a type suitable for the application.

(H) Conductors in Parallel.

(1) General. Aluminum, copper-clad aluminum, or copper conductors, for each phase, polarity, neutral, or grounded circuit shall be permitted to be connected in parallel (electrically joined at both ends) only in sizes 1/0 AWG and larger where installed in accordance with 310.10(H)(2) through (H)(6).

Exception No. 1: Conductors in sizes smaller than 1/0 AWG shall be permitted to be run in parallel to supply control power to indicating instruments, contactors, relays, solenoids, and similar control devices, or for frequencies of 360 Hz and higher, provided all of the following apply:

(a) They are contained within the same raceway or cable.

(b) The ampacity of each individual conductor is sufficient to carry the entire load current shared by the parallel conductors.

(c) The overcurrent protection is such that the ampacity of each individual conductor will not be exceeded if one or more of the parallel conductors become inadvertently disconnected.

Exception No. 2: Under engineering supervision, 2 AWG and 1 AWG grounded neutral conductors shall be permitted to be installed in parallel for existing installations.

Informational Note to Exception No. 2: Exception No. 2 can be used to alleviate overheating of neutral conductors in existing installations due to high content of triplen harmonic currents.

(2) Conductor Characteristics. The paralleled conductors in each phase, polarity, neutral, grounded circuit conductor, equipment grounding conductor,

or equipment bonding jumper shall comply with all of the following:
(1) Be the same length
(2) Consist of the same conductor material
(3) Be the same size in circular mil area
(4) Have the same insulation type
(5) Be terminated in the same manner

(3) Separate Cables or Raceways. Where run in separate cables or raceways, the cables or raceways with conductors shall have the same number of conductors and shall have the same electrical characteristics. Conductors of one phase, polarity, neutral, grounded circuit conductor, or equipment grounding conductor shall not be required to have the same physical characteristics as those of another phase, polarity, neutral, grounded circuit conductor, or equipment grounding conductor.

(4) Ampacity Adjustment. Conductors installed in parallel shall comply with the provisions of 310.15(B)(3)(a).

(5) Equipment Grounding Conductors. Where parallel equipment grounding conductors are used, they shall be sized in accordance with 250.122. Sectioned equipment grounding conductors smaller than 1/0 AWG shall be permitted in multiconductor cables in accordance with 310.104, provided the combined circular mil area of the sectioned equipment grounding conductors in each cable complies with 250.122.

(6) Equipment Bonding Jumpers. Where parallel equipment bonding jumpers are installed in raceways, they shall be sized and installed in accordance with 250.102.

*****

[This part name is added to contain all of the ampacity rules. Existing part III. Construction Specifications is changed to part IV. Construction Specifications.]

III. Ampacities for Conductors

*****

[This Section number is added to bring into one section the items general to both the 0 through 2000 and the 2001 through 35,000 volts section items. Texts which apply to both 0 through 2000 and to 2001 through 35,000 volts. are combined and transferred into new A, B, C, D, E, and F below, and placed in the new 310.13, before the individual voltage-group sections: 310.15 and 310.60. This eliminates a full half-page of lines of text.]

310.13 General.

*****

[The specific reference numbers are adjusted to take the relocations into account. Within Info Note 1, "section" becomes "part" because three sections within this new part affect the ampacity.]

~~[310.15(A)(1)]~~ [310.13](A) Tables or Engineering Supervision. Ampacities for conductors shall be permitted to be determined by tables as provided in 310.15~~(B)~~ or 310.60, or under engineering supervision, as provided in ~~310.15(C)~~ 310.13(F).

Informational Note No. 1: Ampacities provided by this ~~section~~ part do not take voltage drop into consideration. See 210.19(A), Informational Note No. 4, for branch circuits and 215.2(A), Informational Note No. 2, for feeders.

Informational Note No. 2: For the allowable ampacities of Type MTW wire, see Table 13.5.1 in NFPA 79-2007, *Electrical Standard for Industrial Machinery*.

*****

[The texts and exceptions of 310.15(A)(2) and 310.60(B)(1) "Selection of Ampacity" say the same thing, but with different syntax/wording. The most recently edited, the body of 310.15(A)(2), and the exception of 310.60(B)(1) are used here. The corresponding Informational Notes are identical, and only one is shown here.]

~~[310.15(A)(2)]~~ [310.13](B) Selection of Ampacity. Where more than one ampacity applies for a given circuit length, the lowest value shall be used.

~~*Exception: Where two different ampacities apply to adjacent portions of a circuit, the higher ampacity shall be permitted to be used beyond the point of transition, a distance equal to 3.0 m (10 ft) or 10 percent of the circuit length figured at the higher ampacity, whichever is less.*~~

~~**310.60(B)(1) Selection of Ampacity.** Where more than one calculated or tabulated ampacity could apply for a given circuit length, the lowest value shall be used.~~

~~[310.60(B)(1)]~~ *Exception: Where two different ampacities apply to adjacent portions of a circuit, the higher ampacity shall be permitted to be used beyond the point of transition, a distance equal to 3.0 m (10 ft) or 10 percent of the circuit length calculated at the higher ampacity, whichever is less.*

Informational Note: See 110.40 for conductor temperature limitations due to termination provisions.

*****

[The single ambient temperature correction factors Table number is removed since there are two within 310.15 and one in 310.60, and all three provide guidance.]

~~[310.15(A)(3)]~~ [310.13](C) Temperature Limitation of Conductors. No conductor shall be used in such a manner that its operating temperature exceeds that designated for the type of insulated conductor involved. In no case shall conductors be associated together in such a way, with respect to type of circuit, the wiring method employed, or the number of conductors, that the limiting temperature of any conductor is exceeded.

Informational Note No. 1: The temperature rating of a conductor [see Table 310.104(A) and Table 310.104(C)] is the maximum temperature, at any location along its length, that the conductor can withstand over a prolonged time period without serious degradation. The allowable ampacity tables, the ampacity tables of Article 310 and the ampacity tables of Informative Annex B, the ambient temperature correction factors ~~in 310.15(B)(2)~~, and the notes to the tables provide guidance for coordinating conductor sizes, types, allowable ampacities, ampacities, ambient temperatures, and number of associated conductors. The principal determinants of operating temperature are as follows:

(1) Ambient temperature — ambient temperature may vary along the conductor length as well as from time to time.

(2) Heat generated internally in the conductor as the result of load current flow, including fundamental and harmonic currents.

(3) The rate at which generated heat dissipates into the ambient medium. Thermal insulation that covers or surrounds conductors affects the rate of heat dissipation.

(4) Adjacent load-carrying conductors — adjacent conductors have the dual effect of raising the ambient temperature and impeding heat dissipation.

Informational Note No. 2: Refer to 110.14(C) for the temperature limitation of terminations.

*****

[The term "Tables" is added in front of "General" for clarity; this general information is about only the tables. The two table sections involved are referenced. 310.15(A)(3) is changed to 310.13(C) to reflect the relocations of 310.15(A)'s paragraphs (1), (2), and (3).]

~~[310.15(B)(1)]~~ [310.13](D) Tables General. For explanation of type letters used in the tables of 310.15 and 310.60 and for recognized sizes of conductors for the various conductor insulations, see Table 310.104(A) and Table 310.104(B). For installation requirements, see 310.1 through 310.13(C) and the various articles of this *Code*. For flexible cords, see Table 400.4, Table 400.5(A)(1), and Table 400.5(A)(2).

*****

[This panel had edited the titles and texts below of both sections for the 2011 cycle. They are functionally the same, but the title of 310.15 and the body of 310.60 seemed best. The formulas are the same, and the "where"s are the same other than 310.60's more clear expression of I in the "where" portion.]

~~[310.15(B)(2)]~~ [310.12](E) Ambient Temperature Correction Factors. ~~Ampacities for ambient temperatures other than those shown in the ampacity tables shall be corrected in accordance with Table 310.15(B)(2)(a) or Table 310.15(B)(2)(b), or shall be permitted to be calculated using the following equation:~~

~~[Unedited formula]~~
~~where:~~
~~*I'* = ampacity corrected for ambient temperature~~
~~*I* = ampacity shown in the tables~~
~~*Tc* = temperature rating of conductor (°C)~~
~~*Ta'* = new ambient temperature (°C)~~
~~*Ta* = ambient temperature used in the table (°C)~~

~~[310.60(C)](4)] Ambient Temperature Correction.~~ Ampacities for ambient temperatures other than those specified in the ampacity tables shall be corrected in accordance with ~~Table 310.60(C)(4)(4)~~ the Tables of 310.15(B)(2) or 310.60(B)(4), or shall be permitted to be calculated using the following equation:

[Unedited formula]
where:
I' = ampacity corrected for ambient temperature
I = ampacity shown in the table for *Tc* and *Ta*
Tc = temperature rating of conductor (°C)
Ta' = new ambient temperature (°C)
Ta = ambient temperature used in the table (°C)

*****

[Again, both 310.15 and 310.60 had been edited for 2011, but are functionally identical other than the "dielectric loss temperature rise" component. This component can simply be ignored for 0-2000 volts, and text to indicate that is added in that line. I do not have the expertise to evaluate if the term should be there at all, since the Info Note seems to say that it does not apply to voltages below 46,000 volts. Unless there are 2001-35,000 volt conductors where it does apply, then perhaps the formula of 310.15(B)(2) and its "where" terms should be used instead.]

~~**[310.15](C) Engineering Supervision.** Under engineering supervision, conductor ampacities shall be permitted to be calculated by means of the following general equation:~~

~~[Unedited formula]~~
~~where:~~
~~*Tc* = conductor temperature in degrees Celsius (°C)~~
~~*Ta* = ambient temperature in degrees Celsius (°C)~~
~~*Rdc* = dc resistance of conductor at temperature *Tc*~~
~~*Yc* = component ac resistance resulting from skin effect and proximity effect~~
~~*Rca* = effective thermal resistance between conductor and surrounding ambient~~

~~[310.60](D)~~ [310.13](F) Engineering Supervision. Under engineering supervision, conductor ampacities shall be permitted to be calculated by using the following general equation:

[Unedited formula]
where:
Tc = conductor temperature (°C)
Ta = ambient temperature (°C)

ΔTd = dielectric loss temperature rise, used only for 2001 through 35,000 volts

Rdc = dc resistance of conductor at temperature *Tc*

Yc = component ac resistance resulting from skin effect and proximity effect

Rca = effective thermal resistance between conductor and surrounding ambient

Informational Note: The dielectric loss temperature rise (ΔTd) is negligible for single circuit extruded dielectric cables rated below 46 kV.

*****

[The Title of 310.15 is left as general for the voltage, and the term "Ampacities is moved to the redone (A) title below it where the rules for ampacity are stated. The ambiguity of the 0-2000 dash and the use of the term "to" elsewhere is resolved by the use of the term "through" in the text locations. An edited copy of 310.60(B) is utilized here as the text source for a simple declarative statement for (A).]

310.15 Conductors rated 0 through 2,000 Volts.

~~[310.15(B)]~~ (A) Ampacities of Conductors Rated 0 through 2000 Volts. Ampacities for ~~solid dielectric-insulated~~ conductors shall be permitted to be determined by ~~tables~~ 310.15(B) Tables, or under engineering supervision ~~;~~ as provided in ~~310.60(C) and (D)~~ 310.13(F).

*****

[The term "to" is changed to "through". 310.15(B)(1) and (2) are moved to 310.13(D) and (E). The number of items in (B) changes from 7 to 6 because of the complete relocation of 310.15(B)(1) to 310.13).]

[310.15](B) Tables. Ampacities for conductors rated 0 ~~to~~ through 2000 volts shall be as specified in the Allowable Ampacity Table 310.15(B)(16) through Table 310.15(B)(19), and Ampacity Table 310.15(B)(20) and Table 310.15(B)(21) as modified by 310.13(D) and (E), and 310.15(B)(1) through (B)~~(7)~~(6).

The temperature correction and adjustment factors shall be permitted to be applied to the ampacity for the temperature rating of the conductor, if the corrected and adjusted ampacity does not exceed the ampacity for the temperature rating of the termination in accordance with the provisions of 110.14(C).

Informational Note: Table 310.15(B)(16) through Table 310.15(B)(19) are application tables for use in determining conductor sizes on loads calculated in accordance with Article 220. Allowable ampacities result from consideration of one or more of the following:

(1) Temperature compatibility with connected equipment, especially the connection points.

(2) Coordination with circuit and system overcurrent protection.

(3) Compliance with the requirements of product listings or certifications. See 110.3(B).

(4) Preservation of the safety benefits of established industry practices and standardized procedures.

*****

[Existing (1) is relocated to 310.13, and (4) is moved to take its place both because it has to do with temperature (as does the last section paragraph above), and because it allows the highly referenced (2) and (3) to remain (2) and (3).]

[310.15(B)~~(4)~~](1) Bare or Covered Conductors. Where bare or covered conductors are installed with insulated conductors, the temperature rating of the bare or covered conductor shall be equal to the lowest temperature rating of the insulated conductors for the purpose of determining ampacity.

*****

[The sub-section title is added for the tables because the main text is now in 310.13(E). The 0 through 2000 volt 310.15(B)(2) tables are used as-is.]

[310.15(B)](2) Ambient Temperature Correction Factors Tables (a) and (b). Tables for 310.13(E) for 0 through 2000 volt conductors.

Table 310.15(B)(2)(a)

[Content unchanged]

Table 310.15(B)(2)(b)

[Content unchanged]

*****

[310.15(B)(3) Content unchanged including both its Tables, (3)(a) and (3)(c).]

(3) Adjustment Factors.

(a) *More Than Three Current-Carrying Conductors in a. Raceway or Cable.* Where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multiconductor cables are installed without maintaining spacing for a continuous length longer than 600 mm (24 in.) and are not installed in raceways, the allowable ampacity of each conductor shall be reduced as shown in Table 310.15(B)(3)(a). Each current-carrying conductor of a paralleled set of conductors shall be counted as a current-carrying conductor. Where conductors of different systems, as provided in 300.3, are installed in a common raceway or cable, the adjustment factors shown in Table 310.15(B)(3)(a) shall apply only to the number of power and lighting conductors (Articles 210, 215, 220, and 230).

Informational Note No. 1: See Annex B, Table B.310.15(B)(2)(11), for adjustment factors for more than three current-carrying conductors in a raceway or cable with load diversity.

Informational Note No. 2: See 366.23(A) for adjustment factors for conductors in sheet metal auxiliary gutters and 376.22(B) for adjustment factors for conductors in metal wireways.

(1) Where conductors are installed in cable trays, the provisions of 392.80 shall apply.

(2) Adjustment factors shall not apply to conductors in raceways having a length not exceeding
600 mm (24 in.).

(3) Adjustment factors shall not apply to underground conductors entering or leaving an outdoor trench if those conductors have physical protection in the form of rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit (PVC), or reinforced thermosetting resin conduit (RTRC) having a length not exceeding 3.05 m (10 ft), and if the number of conductors does not exceed four.

(4) Adjustment factors shall not apply to Type AC cable or to Type MC cable under the following conditions:

a. The cables do not have an overall outer jacket.

b. Each cable has not more than three current-carrying conductors.

c. The conductors are 12 AWG copper.

d. Not more than 20 current-carrying conductors are installed without maintaining spacing, are stacked, or are supported on "bridle rings."

(5) An adjustment factor of 60 percent shall be applied to Type AC cable or Type MC cable under the following conditions:

a. The cables do not have an overall outer jacket.

b. The number of current carrying conductors exceeds 20.

c. The cables are stacked or bundled longer that 600 mm (24 in) without spacing being maintained.

[Table 310.15(B)(3)(a) unchanged]

(b) *More Than One Conduit, Tube, or Raceway.* Spacing between conduits, tubing, or raceways shall be maintained.

(c) *Circular Raceways Exposed to Sunlight on Rooftops.* Where conductors or cables are installed in circular raceways exposed to direct sunlight on or above rooftops, the adjustments shown in Table 310.15(B)(3)(c) shall be added to the outdoor temperature to determine the applicable ambient temperature for application of the correction factors in Table 310.15(B)(2)(a) or Table 310.15(B)(2)(b).

Informational Note: One source for the average ambient temperatures in various locations is the ASHRAE *Handbook — Fundamentals*.

[Table 310.15(B)(3)(c) unchanged]

Informational Note to Table 310.15(B)(3)(c): The temperature adders in Table 310.15(B)(3)(c) are based on the results of averaging the ambient temperatures.

*****

[(5) to (4) due to relocation of (4) to take the place of (1), which was relocated to 310.13. Text content unchanged]

[310.15(B)~~(5)~~](4) Neutral Conductor.

(a) A neutral conductor that carries only the unbalanced current from other conductors of the same circuit shall not be required to be counted when applying the provisions of 310.15(B)(3)(a).

(b) In a 3-wire circuit consisting of two phase conductors and the neutral conductor of a 4-wire, 3-phase, wye-connected system, a common conductor carries approximately the same current as the line-to-neutral load currents of the other conductors and shall be counted when applying the provisions of 310.15(B)(3)(a).

(c) On a 4-wire, 3-phase wye circuit where the major portion of the load consists of nonlinear loads, harmonic currents are present in the neutral conductor; the neutral conductor shall therefore be considered a current-carrying conductor.

*****

[(6) to (5) due to relocation of (4) to take the place of the relocated (1). Text content unchanged]

[310.15(B)~~(6)~~](5) Grounding or Bonding Conductor. A grounding or bonding conductor shall not be counted when applying the provisions of 310.15(B)(3)(a).

*****

[(7) to (6) due to relocation of (4) to take the place of the relocated (1). Content unchanged, except for the table reference change of (7) to (6) within the text.]

[310.15(B)~~(7)~~](6) 120/240-Volt, 3-Wire, Single-Phase Dwelling Services and Feeders. For individual dwelling units of one-family, two-family, and multifamily dwellings, conductors, as listed in Table 310.15(B)~~(7)~~(6), shall be permitted as 120/240-volt, 3-wire, single-phase service-entrance conductors, service-lateral conductors, and feeder conductors that serve as the main power feeder to each dwelling unit and are installed in raceway or cable with or without an equipment grounding conductor. For application of this section, the main power feeder shall be the feeder between the main disconnect and the panelboard that supplies, either by branch circuits or by feeders, or both, all loads that are part or associated with the dwelling unit. The feeder conductors to a dwelling unit shall not be required to have an allowable ampacity rating greater than their service-entrance conductors. The grounded conductor shall be permitted to be smaller than the ungrounded conductors, provided the requirements of 215.2, 220.61, and 230.42 are met.

*****

[(7) to (6) due to relocation of (4) to take the place of the relocated (1). Content unchanged.]

Table 310.15(B)~~(7)~~(6)

*****

[These tables are unchanged.]

Tables 310.15(B)(16) through 310.15(B)(21)

*****

[The ambiguity of the 0-2000 dash and the use of the term "to" elsewhere is resolved by the use of the term "through" in the text locations.]

310.60 Conductors rated 2001 ~~to~~ through 35,000 Volts.

*****

[These two (duplicated, but better) definitions are deleted here because they are moved to **310.2 Definitions** at the front of the Article and should not be duplicated here, but the texts of 310.60(A) are used for the 310.2 definitions.]

~~**[310.60](A) Definitions.**~~

~~**Electrical Ducts. As used in Article 310, electrical ducts shall include any of the electrical conduits recognized in Chapter 3 as suitable for use underground; other raceways round in cross section, listed for underground use, and embedded in earth or concrete.**~~

~~**Thermal Resistivity. As used in this *Code*, the heat transfer capability through a substance by conduction. It is the reciprocal of thermal conductivity and is designated Rho and expressed in the units °C-cm/watt.**~~

*****

[310.60(B) is utilized here as a simple declarative statement. The ambiguity of the 2001-35,000 dash and the use of the term "to" elsewhere is resolved by the use of the term "through" in the text locations.]

[310.60~~(B)~~] (A) Ampacities of Conductors Rated 2001 ~~to~~ through 35,000 Volts. Ampacities for solid dielectric-insulated conductors shall be permitted to be determined by ~~tables~~ 310.60(B) Tables, or under engineering supervision as~~,~~ provided in ~~310.60(C) and (D)~~ 310.13(F).

*****

[Reference numbering is edited. Also, it was felt that the addition of ". . . in compliance with 310.60(B)(1), (2), and (3).", similar to the existing 310.15(B) Tables' note: " . . . as modified by 310.13(D) and (E), and 310.15(B)(1) through (B)(6)." was appropriate editorial clarification.]

[310.60~~(C)~~](B) Tables. Ampacities for conductors rated 2001 ~~to~~ through 35,000 volts shall be as specified in Table 310.60~~(C)~~(B)(67) through Table 310.60~~(C)~~(B)(86) in compliance with 310.60~~(C)~~(B)(1), (2), and (3). Ampacities for ambient temperatures other than those specified in the ampacity tables shall be corrected in accordance with ~~310.60(C)(4)~~ 310.13(E) .

Informational Note No. 1: For ampacities calculated in accordance with 310.60~~(B)~~(A), reference IEEE 835-1994 (IPCEA Pub. No. P-46-426), *Standard Power Cable Ampacity Tables,* and the references therein for availability of all factors and constants.

Informational Note No. 2: Ampacities provided by this section do not take voltage drop into consideration. See 210.19(A), Informational Note No. 4, for branch circuits and 215.2(A), Informational Note No. 2, for feeders.

*****

[Text is identical except "(C)" references change to "(B)"]

[310.60~~(C)~~(B)] (1) Grounded Shields. Ampacities shown in Table 310.60~~(C)~~(B)(69), Table 310.60~~(C)~~(B)(70), Table 310.60~~(C)~~(B)(81), and Table 310.60~~(C)~~(B)(82) are for cable with shields grounded at one point only. Where shields are grounded at more than one point, ampacities shall be adjusted to take into consideration the heating due to shield currents.

*****

[Text is identical except "(C)" references change to "(B)"]

[310.60~~(C)~~(B)](2) Burial Depth of Underground Circuits. Where the burial depth of direct burial or electrical duct bank circuits is modified from the values shown in a figure or table, ampacities shall be permitted to be modified as indicated in ~~(C)~~(B)(2)(a) and ~~(C)~~(B)(2)(b).

(a) Where burial depths are increased in part(s) of an electrical duct run, no decrease in ampacity of the conductors is needed, provided the total length of parts of the duct run increased in depth is less than 25 percent of the total run length.

(b) Where burial depths are deeper than shown in a specific underground ampacity table or figure, an ampacity derating factor of 6 percent per 300-mm (1-ft) increase in depth for all values of rho shall be permitted.

No rating change is needed where the burial depth is decreased.

*****

[Identical except sub-section "(C)" changes to "(B)"]

[310.60~~(C)~~(B)](3) Electrical Ducts in Figure 310.60. At locations where electrical ducts enter equipment enclosures from under ground, spacing between such ducts, as shown in Figure 310.60, shall be permitted to be reduced without requiring the ampacity of conductors therein to be reduced.

*****

[The sub-section title is added for the tables because the main rule text was moved to 310.13(E).]

[310.60(B)](4) Ambient Temperature Correction Factors Table. Table for 310.13(E) for 2001 through 35,000 volt conductors.

*****

[The 310.60(C)(4) table is used as-is, except to correct its title-reference number from (C) to (B): ~~310.60(C)(4)~~ to 310.60(B)(4).]

Table 310.60~~(C)~~(B)(4)

*****

[Only the section references utilized in the figure are changed. All data stays as-is.]

The content of **Figure 310.60** is unchanged. The two references to "**(C)**" in the title of Figure 310.60 change to "**(B)**" instead.

*****

[Only the section references utilized in the tables are changed. Data remains as-is.]

The "**(C)**" table title references in Tables 310.60(C)(67) through (86) change to "**(B)**" instead. This is in all the tables. The final parenthetic table number remains unchanged. IE: "**Table 310.60(C)(4)**" changes to "**Table 310.60(B)(4)**"

The data of the tables (67) through (86) remains unchanged.

Table asterisk * footnote references to "**310.60(C)(4)**" are to be changed to "**310.13(E)**" instead. This is in Tables (67) through (76).

*****

[Existing part name III is changed to IV, due to new part "III Ampacities for Conductors" placed just after Section 310.10.

310.104 and the rest of article 310 are unchanged.]

~~III.~~ IV. Construction Specifications

[310.104 to the end of Article 310 are unchanged.]

Substantiation: This comment was submitted by a panel 6 task group. The original proposer's recommendations were for both reorganization and changes to the requirements of the Code. We did find that there was basis for reorganizing based basically on reduction of duplicated text. We felt that the requirements changes were not warranted, and/or did not have the required technical substantiation for the change. Great effort and review of this work has taken place by the participating members of the CMP-6 who chose to participate in this task group effort.

Panel Meeting Action: Hold

Panel Statement: Acceptance of the comment would change the text to the point where the panel would have to restudy the entire subject text. It would also propose text that could not be properly handled in the time available to process the report.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

Comment on Affirmative:

LAIDLER, W.: The action to hold this comment was unfortunate considering the effort that went in to the initial proposal and the comment that was the end result of a task group addressing the proposal. Article 310 went through a rewrite in the 2011 cycle that did a great job of organizing the article. Proposal 6-19 showed panel 6 that there is an alternative means to structure this article. The idea of the creation of a new section "III. Ampacities for Conductors" was a great idea. The action to put this comment on hold will allow the panel to have a guideline for future reorganization.

6-10 Log #1042 NEC-P06 **Final Action: Reject**
(310.15)

Submitter: George M. Stolz, II, Quicksilver Electrical Training

Comment on Proposal No: 3-19

Recommendation: Accept the proposal in part regarding using the 2011 text of 310.15(B)(5) and (B)(6) as a platform for elaborating on the definition of a current-carrying conductors as follows:

~~310.15(B)(5) Neutral Conductor.~~ 310.30 Current-Carrying Conductors. Conductors shall be defined as current-carrying conductors for the purposes of ampacity correction as specified in (A) through (C).

(A) Ungrounded Conductors. All ungrounded conductors capable of being energized simultaneously shall be considered current-carrying.

(B) Grounded Conductors.

(1) In a single phase system, if a circuit consists of a single ungrounded conductor and a grounded conductor, the grounded conductor shall be considered current-carrying.

(2) In a single-phase system, if a circuit consists of a pair of ungrounded circuit conductors sharing a common grounded conductor, the grounded conductor shall not be considered current-carrying.

(3) In a 3-phase system, if a circuit consists of one or two ungrounded conductors sharing a common grounded conductor, the conductor shall be considered current-carrying.

(4) In a 3-phase system, if a circuit consists of three ungrounded conductors sharing a common grounded conductor, the grounded conductor shall not be considered current-carrying.

Exception to (4): Where a major portion of the loads are non-linear loads, the grounded conductor shall be considered current-carrying.

~~(a) A neutral conductor that carries only the unbalanced current from other conductors of the same circuit shall not be required to be counted when applying the provisions of 310.15(B)(3)(a).~~

~~(b) In a 3-wire circuit consisting of two phase conductors and the neutral conductor of a 4-wire, 3-phase, wye-connected system, a common conductor carries~~

~~approximately the same current as the line-to-neutral load currents of the other conductors and shall be counted when applying the provisions of 310.15(B)(3)(a).~~

~~(c) On a 4-wire, 3-phase wye circuit where the major portion of the load consists of nonlinear loads, harmonic currents are present in the neutral conductor; the neutral conductor shall therefore be considered a current-carrying conductor.~~

~~310.15(B)(6) Grounding or Bonding Conductor. A grounding or bonding conductor shall not be counted when applying the provisions of 310.15(B)(3)(a).~~

310.30(C) Grounding and Bonding Conductors. All grounding and bonding conductors shall not be considered current-carrying.

Substantiation: This concept was put forth in the original proposal. The existing text is somewhat unclear, as it requires a fundamental understanding of electrical theory and systems in order to understand and comply with the rules.

Before you even start, I agree that this level of understanding should be expected in the field, but two qualified people can have differing views of "unbalanced current." The proposed wording will eliminate all question through simply stating the number of conductors involved and handing the reader a result: Yes, it is "current-carrying" or no, it is not. I have met people who believe that in the scenario outlined in proposed 310.30(B)(1), the grounded conductor is not current-carrying. It happens.

The proposed text uses the existing principles in 310.15(B)(5) and (B)(6) to create a list akin to the format used in 210.5. The main purpose of the list is given in the parent section, "defining current-carrying conductor for the purpose of ampacity correction." Repeating the phrase "when applying the provisions of 310.15(B)(3)(a)" as 2011 does over and over again is unnecessary with the purpose stated clearly in a parent section, and repeating the code reference is not as clear as simply calling an apple an apple. 310.15 is currently a minefield of cross-references that can be safely replaced with words that simply state the concept being addressed.

It is sensible to group the three different types of conductor in the same section, on the same footing, to clearly define when to count and when not to count a conductor as current-carrying.

2011's 310.15(B)(5)(c) is more appropriate as an exception, as it directly contradicts the main rule.

The terms "3-wire" and "4-wire" were discarded as they add little clarity to the rule.

The new section number proposed is coordinated with my comment regarding changing the outline of 310.15 on the whole. By segregating ungrounded, grounded and grounded conductors into separate subsections of a new section, it is easy to determine where to insert changes to these base concepts in the future. Further substantiation was provided in the original proposal, under new sections "310.15(A)".

This section should be located ahead of the 2011's 310.15(B)(3)(a) – informing us what current-carrying conductors are, before telling us what to do with them.

Panel Meeting Action: Reject

Panel Statement: All users of the NEC are expected to have a fundamental understanding of electrical theory and systems. The existing language is descriptive and adequate, and is well understood in the field. If the submitter chooses to resubmit this proposal in the next cycle, it is suggested that he clarify his proposed 310.30(B)(3).

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

Comment on Affirmative:

CLINE, S.: In support of the Panel's action:

Among other problems, Item (B)(2) is false/confusing since this is not the case for a circuit such as those coming from a typical 208/120-Volt Single-Phase dwelling service. The system is single-phase, the source transformer is not.

6-11 Log #1043 NEC-P06 **Final Action: Reject**

(310.15)

Submitter: George M. Stolz, II, Quicksilver Electrical Training

Comment on Proposal No: 6-19

Recommendation: Accept the proposal in principle pertaining to the rewrite and expansion of 310.15(B)(3)(a) as follows:

Retitle Table 310.15(B)(3)(a) to Table 310.52.

Add a line to new Table 310.52 to reduce verbiage in the text of (B)(3)(a):

1-3 conductors = 100% Percent of Values Given in Ampacity Tables

Renumber 310.15(B)(3)(a) to Section 310.32.

Revise the text of 310.15(B)(3)(a) (new section 310.32) as follows:

~~310.15(B)(3) Adjustment Factors.~~

310.32 Number of Current-Carrying Conductors in Proximity.

~~(a) More Than Three Current-Carrying Conductors in a Raceway or Cable.~~

(A) Conductors. ~~Where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multiconductor cables are installed without maintaining spacing for a continuous length longer than 600 mm (24 in.) and are not installed in raceways, the allowable ampacity of each conductor shall be reduced as shown in Table 310.15(B)(3)(a).~~ Except as specified in (C) through (F), current-carrying conductors inside a raceway or cable shall have their ampacity adjusted according to Table 310.52. Each current-carrying conductor of a paralleled set of conductors shall be counted as a current-carrying conductor.

Where conductors of different systems, as provided in 300.3, are installed in a common raceway or cable, the adjustment factors shown in ~~Table 310.15(B)(3)(a)~~ Table 310.52 shall apply only to the number of power and lighting conductors ~~(Articles 210, 215, 220, and 230)~~.

~~310.15(B)(3)(a)(2)~~ *Exception: Adjustment factors shall not apply to conductors in raceways having a length not exceeding 600 mm (24 in.).*

(B) Cables. Except as specified in (C) through (F), a bundle of single-conductor or multiconductor cables installed without maintaining spacing for a continuous length longer than 600 mm (24 in.) outside of a cable tray shall have the ampacities of their current-carrying conductors adjusted according to Table 310.52. Cables passing through a raceway shall be considered bundled for the purposes of this section.

~~310.15(B)(3)(a)(3)~~ *Exception No. 1: Adjustment factors shall not apply to underground cables entering or leaving an outdoor trench if those conductors have physical protection in the form of rigid metal conduit (RMC), intermediate metal conduit (IMC), rigid polyvinyl chloride conduit (PVC), or reinforced thermosetting resin conduit (RTRC) having a length not exceeding 3.05 m (10 ft), and if the number of current-carrying conductors does not exceed four.*

~~310.15(B)(3)(a)(4), 310.15(B)(3)(a)(5)~~ *Exception No. 2: The following allowances shall be permitted to adjust type AC cables or MC cables without overall outer jackets, where each cable has less than four current-carrying conductors, and the conductors are 12 AWG copper:*

(1) Zero to twenty current-carrying conductors shall not be required to be adjusted.

(2) A 60 percent adjustment factor shall be applied where there are more than 20 current-carrying conductors.

~~310.15(B)(3)(a)(1)~~ 310.30(C) Cable Trays. Conductors and/or cables in cable trays shall be adjusted according to 392.80. ~~Where conductors are installed in cable trays, the provisions of 392.80 shall apply.~~

~~Informational Note No. 2: See 366.23(A) for adjustment factors for conductors in sheet metal auxiliary gutters and 376.22(B) for adjustment factors for conductors in metal wireways.~~

(D) Sheet Metal Auxilliary Gutters. Conductors and/or cables in Sheet Metal Auxiliary Gutters shall be adjusted according to 366.23(A).

(E) Metal Wireways. Conductors and/or cables in Metal Wireways shall be adjusted according to 376.22(B).

(F) Nonmetallic Wireways. Conductors and/or cables in Nonmetallic Wireways shall be adjusted according to 310.30 (A) and/or (B) as applicable.

Substantiation: All language about rules kicking in with "with more than three conductors" is eliminated when you add the first lines to the associated table, "1-3 conductors." This makes the language in the text easier to follow without interruption.

2011's 310.15(B)(3)(a) is complicated enough to warrant it's own section.

Proposed subsection 310.32(A) covers conductors installed inside a cable or raceway in solitude to start – and covers only that. By dividing the similar (but different) concepts that the conductors inside a cable or raceway need derating, and then later covering that cables that are bundled require derating, it makes both concepts easier to understand. The language in this comment varies from what was proposed in that by using the successful "Except as specified in (C) through (F)" language that is also employed in 240.4(D), it becomes clear that (A) and (B) cover most installations, while (C) through (F) make their presence known right up front as exceptions from these two general rules. In the 2011 cycle, items (1) through (4) are not even referenced in the parent text, which leaves the reader confused as to whether (1) through (4) fall in line with the parent text or contradict it. With the proposed language written in positive text given context by the parent section, readers should be far less confused how the machine fits together.

2011's (B)(3)(a)(4), (5) and (6) were changed from exceptions from the 2008 to the 2011 cycle, but little was changed except the italics of the text. These sections are in fact exceptions to the main rule that says these cables must be derated. They should return to being exceptions to proposed 310.32(B). Exceptions also serve to clarify a code rule. For years, the exceptions made it clear that cables bundled together required derating – in 2011 that clarification is lost. If this proposal is accepted, is clarified and reinforced.

The language of proposed Exception #2 to (B) is improved, and puts the "less than four conductors" limitation back to it's 2008 status of pertaining to both 2011 (B)(3)(a)(4) and (5). It was unintentionally lost in 2011. Additionally, the phrase "less than four conductors" replaces "more than three conductors" where it remained, for uniformity.

Proposed 310.32 (D) through (F) are changed from Informational Notes (or omissions) to enforceable "exceptions" or clarifications of what to do with these wiring methods. Control of how these wiring methods are adjusted remain with the CMPs in charge of each wiring method. Also, with the list format given, it is extremely easy for new wiring methods (or new rules for existing wiring methods) to be added as "exceptions" to the normal rules of derating.

The reference in (B)(3)(a) to "(Articles 210, 215, 220, and 230)" was deleted because the style manual directs us not to reference Articles en masse, much less four times. It adds no clarity to "power and lighting conductors."

Panel Meeting Action: Reject

Panel Statement: CMP-6 does not agree that the proposed changes provide added clarity to the code. Certain words might cause confusion, such as "proximity". CMP-6 refers the submitter to the 2011 NEC Style Manual and NFPA Manual of Style. Changing the informational note referring to Article 366.23(A) and 376.22(B) to mandatory text provides a circular reference.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

Comment on Affirmative:

CLINE, S.: In support of the Panel's action:

Among other problems to do with significant violations of the NFPA style directives, the various sub-sections having to do with conductor ampacity of general wiring 0 through 2000-Volt conductors must not be separated into separate sections.

6-12 Log #1044 NEC-P06 **Final Action: Reject**
(310.15)

Submitter: George M. Stolz, II, Quicksilver Electrical Training
Comment on Proposal No: 6-19
Recommendation: Accept the proposal in part. Reorganize the 2011 edition of the NEC as follows:

Part III Ampacity Calculation for Conductors Rated 0 – 2000V
~~310.15(A)(1)~~ 310.14 (Text Unchanged including Informational Notes if existing)
~~310.15(A)(2)~~ 310.16 (Text Unchanged including Informational Notes if existing)
~~310.15(A)(3)~~ 310.18 (Text Unchanged including Informational Notes if existing)
~~310.15(B)~~ 310.20 (Text Unchanged including Informational Notes if existing)
~~310.15(B)(1)~~ 310.22 (Text Unchanged including Informational Notes if existing)
~~310.15(B)(4)~~ 310.24 (Text Unchanged including Informational Notes if existing)
~~310.15(B)(3)(b)~~ 310.26 (Text Unchanged including Informational Notes if existing)
~~310.15(B)(7)~~ 310.28 (Text Unchanged including Informational Notes if existing)
~~310.15(B)(5)~~ 310.30(B) (Text Unchanged including Informational Notes if existing)
~~310.15(B)(6)~~ 310.30(C) (Text Unchanged including Informational Notes if existing)
~~310.15(B)(3)(a)~~ 310.32 (Text Unchanged including Informational Notes if existing)
~~310.15(B)(2)~~ 310.34 (Text Unchanged including Informational Notes if existing)
~~310.15(B)(3)(c)~~ 310.36 (Text Unchanged including Informational Notes if existing)
~~310.15(C)~~ 310.38 (Text Unchanged including Informational Notes if existing)
Part IV. Tables
~~Table 310.15(B)(2)(a)~~ Table 310.50
~~Table 310.15(B)(2)(b)~~ Table 310.51
~~Table 310.15(B)(3)(a)~~ Table 310.52
~~Table 310.15(B)(3)(c)~~ Table 310.53
~~Table 310.15(B)(7)~~ Table 310.54
~~Table 310.15(B)(16)~~ Table 310.60
~~Table 310.15(B)(17)~~ Table 310.61
~~Table 310.15(B)(18)~~ Table 310.62
~~Table 310.15(B)(19)~~ Table 310.63
~~Table 310.15(B)(20)~~ Table 310.64
~~Table 310.15(B)(21)~~ Table 310.65
Part V. Conductors Rated 2001 – 35,000 Volts
(Remainder of Article Unchanged)

Substantiation: Essentially, this is the same outline proposed by the original proposal, going a step further in eliminating the need for all subsections. Similar concepts have been grouped, and the Tables have been grouped and moved to their own Part. While some effort was placed in grouping similar concepts, that has taken a backseat to what I believe should be the primary first step – getting this one section spread out to several, to ease the editing process, both for myself and for future cycles. It is not absolutely critical that like concepts be grouped at this time; I believe the first step is fanning out the existing text first. Every "new" section shown is essentially a standalone concept that can easily hold it's own as a section.

In response to the Chair's objection to having a separate Part for Tables, I would ask that the Panel locate "Section 310.15(B)(16)" for me and read it aloud. 2011 NEC section 310.15 (parent) references all these Tables within the same sentence, leaving the reader to make their own determination as to which Table best fits their installation. 2011 NEC 310.15(B)(2) expects the reader to select the correct Table based upon their selection of Tables 16 – 21. Getting the tables out of the text is a great benefit to the reader, and arguably does not even violate the Manual of Style 2.3.1 per se.

More than half the problem with the coherence of this section are the tables interrupting all over the place! As I see it, if a person is trying to better understand how to use the tables, they are going to read and understand the text first, and then go to the Tables to work examples. You don't necessarily need to refer to the text while you are making use of the tables, and it would be helpful if they were grouped together as well. Just looking at the 2014 ROP Draft is proof that the tables greatly impair legibility.

By placing the first Table at 310.50 (per MOS 2.4.2.1), ample room prior to 310.50 is provided for future expansion of text in Part III. By placing the first Ampacity Table at 310.60, there is room for more Correction Tables to be added without disrupting the pattern. Also, "310.60" is much friendlier on the tongue than "310.15(B)(16)." The term "310.60" is also phonetically similar to "310.16". The suggested alternative of verbally calling it "Ampacity Table 16" regardless of it's true name is not very reasonable in a class setting, and illustrates the problem very well – we shouldn't have to call it something else because the TCC had a lapse.

By spacing the existing rules mostly to even-numbered sections, there is ample room for future expansion of these rules while avoiding the "super sub-section effect" that has pervaded this portion of the code for many cycles, and gotten less intuitive with each cycle.

I hope the panel will consider this proposal the first and most important step in bringing clarity to the core of the NEC. This comment serves as the outline for section-number selections of other more specific comments on this proposal.

An example has been provided with this comment, using 2011 text with the proposed section numbers. It does not feature many corrected references within the text itself.

Note: Supporting material is available for review at NFPA Headquarters.

Panel Meeting Action: Reject
Panel Statement: The table references do not refer back to the section language. Code users must choose the correct ampacity table based on the conditions of use.

CMP-6 agrees that the table and language formatting is difficult to follow in some cases and requests that the tables be grouped more logically.

Number Eligible to Vote: 10
Ballot Results: Affirmative: 10
Comment on Affirmative:
CLINE, S.: In support of the Panel's action:
I can't read it to him aloud as requested by the submitter, but I can point it out: "310.15(B) Tables. Ampacities for conductors rated 0 to 2000 volts shall be as specified in the Allowable Ampacity Table 310.15(B)(16) through Table 310.15(B)(19), and... ". A section may refer to more than one table, and therefore the tables must have their own numbers as a subset of the section number. The 2008 NEC table suffix numbering was utilized to aid users in the transition to the corrected format. There was no lapse by the TCC nor by the CMP; the submitter needs to study and follow the NFPA style directives. The submitter should understand that the "grouping" we speak of has to do with the table's page layout location relative to the section, not the numbering.

6-13 Log #1046 NEC-P06 **Final Action: Reject**
(310.15)

Submitter: George M. Stolz, II, Quicksilver Electrical Training
Comment on Proposal No: 6-51
Recommendation: The proposal should have been accepted.
Substantiation: Simply put, residential load diversity should not be addressed by manipulating conductor sizing in Article 310, it should be handled in Article 220 when calculating the load. The entire premise of the section is flawed, which means that if the section remains then CMP-6 will be harassed about it forever. This proposal and it's companions should have been accepted.

The panel's action in proposal 6-49a still has an additional fundamental problem. Conductors connected to circuit breakers are required to be sized to 125% of the continuous load in order for the conductor to draw heat away from the breaker as a heat sink. By the panel's action, undersized conductors are still allowed to be connected to overcurrent devices. By accepting this proposal and leaning on CMP-2 to accept a load diversity factor in lieu of 310.15(B)(7), this basic problem is averted while meeting the intentions of CMP-6. It is the right way to put this issue to bed, forever.

Panel Meeting Action: Reject
Panel Statement: Technical substantiation was not provided to justify the deletion of the allowances of 310.15(B)(7) and Table 310.15(B)(7).

The submitter has not provided any technical substantiation that the existing text would allow undersized conductors.

Number Eligible to Vote: 10
Ballot Results: Affirmative: 10
Comment on Affirmative:
CLINE, S.: In support of the Panel's action:
Stating that "The entire premise of the section is flawed, " without any evidence or justification is a waste of everyone's time. The basis for this allowance was well established when this section was first adopted. It has been a successful practice for decades. Could it be a load adjustment rather than an ampacity adjustment? Certainly. Would it be better for CMP-2 to "be harassed about it forever"? Perhaps.

But for that to happen, joint-action Proposals would have to be submitted to both CMP-2 and CMP-6, with full and accurate suggested text, clearly and correctly stating the equivalent existing technical allowance in the relocated format. Both panels would have to accept, and the CC would have to agree.

6-14 Log #1057 NEC-P06 **Final Action: Accept in Part**
(310.15)

Submitter: George M. Stolz, II, Quicksilver Electrical Training
Comment on Proposal No: 6-19
Recommendation: Revise text to read as follows:
~~310.15(B)(3)(b)~~ 310.26 ~~More Than One Conduit, Tube, or~~ Raceway Spacing. Spacing between ~~conduits, tubing, or~~ raceways shall be maintained.
Substantiation: In response to the Chair's objection: "The changes made in 310.14(F) are neither accurate nor acceptable. Conduits and tubing are only two of the many types of raceways. There is no substantiation to support

adding all other raceways to this requirement."

All raceways are currently bound by this requirement. It says, "Spacing between conduits, tubing OR RACEWAYS shall be maintained." Unless the text is supposed to ensure spacing between different types of wiring methods exclusively (i.e. Space EMT from FMC, Space FMT from IMC), then the Chair's statement is inaccurate.

Conduits and tubing are types of raceways, the 2011 sentence structure is redundant, and unnecessarily confusing.

Cables are permitted to be bundled without spacing, we are given instructions on what we must do if we bundle them. This sub-sub-section is prohibiting raceways from being bundled.

Panel Meeting Action: Accept in Part

Revise text to read as follows:

310.15(B)(3)(b) Raceway Spacing. Spacing between raceways shall be maintained.

Panel Statement: CMP-6 accepts the submitter's text but rejects the renumbering.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

Comment on Affirmative:

CLINE, S.: In support of the Panel's action:

The reason for my comment was due to the inaccurate presentation of the existing text of 310.15(B)(3)(b) in the Proposal. The submitter's incorrect portrayal of the 2011 text (below) indicated that "Conduit" was to change to "Raceway" - not all raceways are conduits. The body of the text was acceptable, but the title was not.

~~"310.15(B)(3)(b)~~ (F) ~~Conduit~~ Raceway Spacing. Spacing between ~~conduits, tubing, or~~ raceways shall be maintained."

6-14a Log #CC600 NEC-P06 **Final Action: Accept**
(Table 310.15(B)(3)(c))

Submitter: Code-Making Panel 6,

Comment on Proposal No: 6-29

Recommendation: Reject Proposal 6-29.

Substantiation: Due to what appears to be conflicting data presented, and the panel's request to the Correlating Committee to assemble an independent Task Group to review the Ambient Temperature Adjustment Table, 310.15(B)(2)(a), the panel revises its action on Proposal 6-29 from "Accept in Principle in Part" to "REJECT". Thus, Table 310.15(B)(3)(c) shall revert to the NEC 2011 values. This is an effort to respond to all comments on this issue. The panel is unable to come to a decision to revise the values of Table 310.15(B)(3)(c) and looks forward to the independent task group's findings concerning the need for Table 310.15(B)(3)(c), "Ambient Temperature Adjustment for Raceways or Cables Exposed to Sunlight on or Above Rooftops" and whether CMP-6 acted correctly upon past substantiation. CMP-6 requests that the task group evaluate the need for and the values in Tables 310.15(B)(2)(a), (2)(b) and (3)(c).

Panel Meeting Action: Accept

Number Eligible to Vote: 10

Ballot Results: Affirmative: 8 Negative: 1 Abstain: 1

Explanation of Negative:

ZIMNOCH, J.: Limited parameters were presented to understand the context of "what appears to be conflicting data presented" to the panel. The original studies and the UL Fact-Finding Study that supports Proposal 6-29 was sponsored and monitored by nine wire and cable manufacturers. None of the manufacturers found any problems with the results of the study. The addendum to the original Fact-Finding Study performed by UL showed the maximum temperature rise above outdoor ambient for all wiring systems mounted 36 inches above the roof with a 95 % confidence interval is 46.2 F and the maximum temperature rise above outdoor ambient for all wiring systems mounted 60 inches above the roof with a 95 % confidence interval is 40.6 F.

1. Only 1 size of cables (#6) was tested using two insulations. Other insulations and wire types were not considered.
2. Tests were indoors and not related to real world.
3. Were oven tests on a mandrill, not real installation conditions
4. Tests were at continuous temperature, not daily temperature cycles, thus not heating and cooling at frequent intervals
5. The testing was performed in free air, not conduits in sunlight
6. Testing does not consider friction from expansion and contraction due to heating and cooling. In a larger sense, wear and tear due to expansion and contraction has more of an effect than simply temperature, and was not considered in the testing.
7. Code is written for all cables in all sizes. This test was not comprehensive and thorough
8. The concluding statement was very specifically worded "XHHW sample can better withstand the 212 C temperatures for a 60 day period." Electrical equipment is expected to last 40 years or more.
9. Thermoset insulation is not the only way to make XHHW; for example, XHHW-2 can be made with EPR rubber.
10. The UL letter is not a Fact Finding and has little meaning

The UL letter specifically states: UL Verification Services did not select the samples, determine whether the samples were representative of production samples, witness the production of the test samples, nor were we provided with information relative to the formulation or identification of component materials used in the test samples. The test results apply only to the actual samples tested.

11. UL is basically not certifying anything other than that a report of the testing was submitted by General Cable
12. The test report and UL letter were not reviewed or available to the public. Both the report and letter are dated in the Fall of 2012. They were not available for Public Comment.
13. Based on the above, this Comment should be rejected. The report and letter are non-persuasive, and have no relevance to real cables installed in sunlight directly or in conduit, which was the subject of a UL Fact Finding.

Explanation of Abstention:

PICARD, P.: The Aluminum Association could not reach consensus.

Comment on Affirmative:

HUDDLESTON, JR., R.: The Panel is correct that there is conflicting data from various reports on temperatures inside of circular raceways. Also of concern is the evidence presented to the Panel that wiring installed for many years on rooftops is not failing. This Panel Member looks forward to the results from the Independent Task Groups findings so that this issue can be put to rest.

KENT, G.: With little doubt, all studies review show an increase in the temperature inside the conduit. A further study reviewed at the Comment meeting revealed the lack of damage to an XHHW-2 conductors at extreme heat. None of the studies reflect damage to wiring, in fact just the opposite for at least two studies, which show no damage to wire. It would seem the studies indicate the need for a study to determine if our correction requirements for ambient temperature need to be altered or in some situations eliminated altogether. Today's technology in insulation design is without a doubt much further advanced than this table which had not changed in the NEC since at least the 1971 edition which is the oldest I have that actually has the table. I do not find this table in my 1953 edition.

STACEY, J.: Although it is our position that 310.15(B)(3)(c) be deleted in its entirety, it appears unlikely that the panel will agree. Therefore we are voting to accept this panel comment and await the findings of the requested review. See comment 6-16.

WALL, C.: I concur with the panel to reject Proposal 6-29. Different wiring systems exposed to solar radiation heat differently; however, the fact finding report combined the various systems together. Reports submitted during the cycle related to this one subject contain useful information but seemingly contradict one another. I believe that the sum of the reports is too limited to make a decision. Since the NEC is a truly an international code, it must provide allowances for application worldwide without being burdensome. The independent task group should:

1. In the absence of data showing failures of conductors on rooftops, consider whether adjustments for solar heating are indicated.
2. If solar heating is found to be a factor, the solar heating adjustments should be based on actual geographic location and not based on one worst case location.
3. Cables, cables in cable trays and raceways exposed to the sun heat differently and should be afforded this variance rather than being lumped into one category based on a "worst case" approach.
4. Consider providing options for solar heating calculations.

6-15 Log #588 NEC-P06 **Final Action: Reject**
(Table 310.15(B)(3)(a) and 310.15(B)(X))

Submitter: James F. Williams, Fairmont, WV

Comment on Proposal No: 6-40

Recommendation: Revise text to read as follows:

Table 310.15(B)(3)(a) Adjustment Factors for More Than Three Current-Carrying Conductors in a Raceway or Cable

Number of conductors is the total number of conductors in the raceway or cable, including spare conductors. The count shall be adjusted in accordance with 310.15(B)(5), ~~and~~ (6), and (X). ~~and shall not include conductors that are connected to electrical components but that cannot be simultaneously energized.~~ **[ROP 6–40]**

310.15(B)(X) Diversity. When two or more conductors cannot be simultaneously energized due to the nature of the circuit, only the maximum number of simultaneously energized shall be considered current-carrying conductors.

Informational note: The two conductors used as travelers between 3-way and 4-way switches count as one current-carrying conductor under this rule.

Substantiation: The concept of not including all the conductors in a group where not all are simultaneously energized (e.g.: 3-way travelers) is important enough that it should be in the main text, not buried in the text following a table. The ideal location would be 310.15(B)(7), and shift the present (7) to (8).

If 310.15(B)(7) is moved to 310.15(B)(8) the following references would need to be fixed: 110.14(C)(1)

Panel Meeting Action: Reject

Panel Statement: The submitter's additional text to the table does not add clarity.

CMP-6 does not agree with the submitter's text of 310.15(B)(X) Diversity as it is not accurate or substantiated.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

6-16 Log #825 NEC-P06 **Final Action: Reject**
(310.15(B)(3)(c) and Table 310.15(B)(3)(c))

Submitter: Robert Huddleston, American Chemistry Council
Comment on Proposal No: 6-18
Recommendation: Delete Section 310.15(3)(2)(c) and Table 310.15(8)(3)(c).
Substantiation: This proposal should have been accepted by the Panel. See the "Rooftop Wiring Study" which has been provided to the Panel for their edification and knowledge. This study clearly shows that wiring installed in raceways on rooftops is NOT being damaged by heat from the sun, and that ambient temperature correction that has always been utilized (Table 310.15(8)(2)(a)) is sufficient to ensure safe, long-life installations.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: Technical substantiation has been provided during the 2008 and 2011 NEC code cycles to support the ambient adjustment factors to conduit exposed to sunlight on rooftops. The original testing and a subsequent Underwriters Laboratories Fact-Finding Report has been accepted by the panel. CMP-6 requests the Correlating Committee appoint a task group to review the basis for ambient temperature correction factors.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 6 Negative: 3 Abstain: 1
Explanation of Negative:
HUDDLESTON, JR., R.: The Comment should have been accepted by the Panel. The substantiation for rejecting this Comment conflicts with the Panel Comment for 6-14a which points out the conflicting temperature data from the various studies and that the Panel may have accepted data in the past that may not have been correct. The Rooftop Wiring Study and other evidence presented to the Panel provided substantial real data that rooftop wiring is not being damaged by exposure to sunlight-heated conduits.
STACEY, J.: This proposal should have been accepted. Evidence was submitted by multiple commenters indicating that this additional temperature adder for wiring on rooftops is unnecessary. Long term installations of wiring on rooftops all over the country have proven for decades that the short term exposure of wiring to the effects of direct sunlight has no appreciable effect on the longevity or durability of conductors. The reason for this has been explained many times by several engineers on CMP-6, with evidence previously submitted from IEEE, ICEA and NEMA documents indicating that conductors are designed and manufactured to withstand high operating temperatures for short periods of time (such as those experienced on rooftops during a few hours a day a few days a year) with no detrimental effect. In addition, the Southern Nevada Chapter of IAEI performed testing proving that the adders presently in the Code are far too high to be realistic. The requirement in Section 310.15(B)(3)(c) increases cost with no benefit to the safety of people or the protection of equipment, and this requirement should be removed in its entirety.
WALL, C.: Panel action on comment 6-14a casts doubt on the 2008 technical substantiation referenced. Based on the data provided by the submitter, other reports available to the panel, and panel's request for appointment of a task group to review the basis for ambient temperature correction factors, I believe this comment should be accepted. Also see my explanation on comment 6-14a.
Explanation of Abstention:
PICARD, P.: The Aluminum Association could not reach consensus.

6-17 Log #826 NEC-P06 **Final Action: Reject**
(310.15(B)(3)(c) and Table 310.15(B)(3)(c))

Submitter: Robert Huddleston, American Chemistry Council
Comment on Proposal No: 6-28
Recommendation: Delete Section 310.15(8)(3)(c) and Table 310.15(8)(3)(c).
Substantiation: This proposal should have been accepted by the Panel. See the "Rooftop Wiring Study" which has been provided to the Panel for their edification and knowledge. This study clearly shows that wiring installed in raceways on rooftops is NOT being damaged by heat from the sun, and that ambient temperature correction that has always been utilized (Table 310.15(8)(2)(a)) is sufficient to ensure safe, long-life installations.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 6-16.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 6 Negative: 3 Abstain: 1
Explanation of Negative:
HUDDLESTON, JR., R.: See my explanation of negative vote on Comment 6-16.
STACEY, J.: See my negative comment on 6-16.
WALL, C.: See my explanation on comment 6-16.
Explanation of Abstention:
PICARD, P.: The Aluminum Association could not reach consensus.

6-18 Log #827 NEC-P06 **Final Action: Reject**
(310.15(B)(3)(c) and Table 310.15(B)(3)(c))

Submitter: Robert Huddleston, American Chemistry Council
Comment on Proposal No: 6-29
Recommendation: Delete Section 310.15(8)(3)(c) and Table 310.15(8)(3)(c).
Substantiation: This proposal should be rejected by the Panel. The entire premise of the study is flawed, and no evidence has been presented to the Panel to substantiate that wiring is being damaged in rooftop applications by heating from sunlight. However, the "Rooftop Wiring Study" which has been provided to the Panel for their edification and knowledge clearly shows that wiring installed in raceways on rooftops is NOT being damaged by heat from the sun, and that ambient temperature correction that has always been utilized (Table 310.15(8)(2)(a)) is sufficient to ensure safe, long-life installations.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 6-16.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 6 Negative: 3 Abstain: 1
Explanation of Negative:
HUDDLESTON, JR., R.: See my explanation of negative vote on Comment 6-16.
STACEY, J.: See my negative comment on6-16.
WALL, C.: See my explanation on comment 6-16.
Explanation of Abstention:
PICARD, P.: The Aluminum Association could not reach consensus.

6-19 Log #828 NEC-P06 **Final Action: Reject**
(310.15(B)(3)(c) and Table 310.15(B)(3)(c))

Submitter: Robert Huddleston, American Chemistry Council
Comment on Proposal No: 6-31
Recommendation: Delete Section 310.15(8)(3)(c) and Table 310.15(8)(3)(c).
Substantiation: This proposal should be rejected by the Panel. The entire premise of the Copper Development Association's study is flawed, and no evidence has been presented to the Panel to substantiate that wiring is being damaged in rooftop applications by heating from sunlight. However, the "Rooftop Wiring Study" which has been provided to the Panel for their edification and knowledge clearly shows that wiring installed in raceways on rooftops is NOT being damaged by heat from the sun, and that ambient temperature correction that has always been utilized (Table 310.15(8)(2)(a)) is sufficient to ensure safe, long-life installations.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 6-16.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 6 Negative: 3 Abstain: 1
Explanation of Negative:
HUDDLESTON, JR., R.: See my explanation of negative vote on Comment 6-16.
STACEY, J.: See my negative comment on 6-16.
WALL, C.: See my explanation on comment 6-16.
Explanation of Abstention:
PICARD, P.: The Aluminum Association could not reach consensus.

6-20 Log #829 NEC-P06 **Final Action: Reject**
(310.15(B)(3)(c) and Table 310.15(B)(3)(c))

Submitter: Robert Huddleston, American Chemistry Council
Comment on Proposal No: 6-37
Recommendation: Delete Section 310.15(8)(3)(c) and Table 31 0.15(8)(3)(c).
Substantiation: This proposal should have been accepted by the Panel. See the "Rooftop Wiring Study" which has been provided to the Panel for their edification and knowledge. This study clearly shows that wiring installed in raceways on rooftops is NOT being damaged by heat from the sun, and that ambient temperature correction that has always been utilized (Table 310.15(8)(2)(a)) is sufficient to ensure safe, long-life installations.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 6-16.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 6 Negative: 3 Abstain: 1
Explanation of Negative:
HUDDLESTON, JR., R.: See my explanation of negative vote on Comment 6-16.
STACEY, J.: See my negative comment on 6-16.
WALL, C.: See my explanation on comment 6-16.
Explanation of Abstention:
PICARD, P.: The Aluminum Association could not reach consensus.

6-21 Log #830 NEC-P06 **Final Action: Reject**
(310.15(B)(3)(c) and Table 310.15(B)(3)(c))

Submitter: Robert Huddleston, American Chemistry Council
Comment on Proposal No: 6-38
Recommendation: Delete Section 310.15(8)(3)(c) and Table 310.15(8)(3)(c).
Substantiation: This proposal should have been accepted by the Panel. See the "Rooftop Wiring Study" which has been provided to the Panel for their edification and knowledge. This study clearly shows that wiring installed in raceways on rooftops is NOT being damaged by heat from the sun, and that ambient temperature correction that has always been utilized (Table 31 0.15(8)(2)(a)) is sufficient to ensure safe, long-life installations.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 6-16.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 6 Negative: 3 Abstain: 1
Explanation of Negative:
HUDDLESTON, JR., R.: See my explanation of negative vote on Comment 6-16.
STACEY, J.: See my negative comment on 6-16.
WALL, C.: See my explanation on comment 6-16.
Explanation of Abstention:
PICARD, P.: The Aluminum Association could not reach consensus.

6-22 Log #831 NEC-P06 **Final Action: Reject**
(310.15(B)(3)(c) and Table 310.15(B)(3)(c))

Submitter: Robert Huddleston, American Chemistry Council
Comment on Proposal No: 6-43
Recommendation: Delete Section 310.15(B)(3)(c) and Table 310.15(B)(3)(c).
Substantiation: This proposal should have been accepted by the Panel. See the "Rooftop Wiring Study" which has been provided to the Panel for their edification and knowledge. This study clearly shows that wiring installed in raceways on rooftops is NOT being damaged by heat from the sun, and that ambient temperature correction that has always been utilized (Table 310.15(8)(2)(a)) is sufficient to ensure safe, long-life installations.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 6-16.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 6 Negative: 3 Abstain: 1
Explanation of Negative:
HUDDLESTON, JR., R.: See my explanation of negative vote on Comment 6-16.
STACEY, J.: See my negative comment on 6-16.
WALL, C.: See my explanation on comment 6-16.
Explanation of Abstention:
PICARD, P.: The Aluminum Association could not reach consensus.

6-23 Log #832 NEC-P06 **Final Action: Accept in Principle**
(310.15(B)(3)(c) and Table 310.15(B)(3)(c))

Submitter: Robert Huddleston, American Chemistry Council
Comment on Proposal No: 6-62
Recommendation: Accept proposal 6-62 as worded by the author.
Substantiation: This proposal should have been accepted by the Panel. Currently, the ampacity for bus bars is found under Article 366 (Auxiliary Gutters) in section 366.23 which is titled "Ampacity of Conductors". It is also referenced in Article 669 (Electroplating). While bus bars are not technically "conductors for general wiring", it would seem that their ampacity calculation would fit much better under Article 310 than Article 366. As the NEC attempts to make corrections and revisions that are (1) easier to use, and (2) easier to find the information that is being sought, it is obviously a much better place in the Code to have bus bar ampacity information in Article 310 rather than buried in Article 366. <u>No one</u> would readily think to look for this information in an Article titled "Auxiliary Gutters".
Panel Meeting Action: Accept in Principle
Revise informational note 2 in 310.15(B)(3)(a) to read as follows:
Informational Note No. 2: See 366.23(A) for adjustment factors for conductors and ampacity for bare copper and aluminum bars in sheet metal auxiliary gutters, and 376.22(B) for adjustment factors for conductors in metal wireways.
Panel Statement: CMP-6 notes that the submitter intended to refer to 310.15(B)(8).
CMP-6 does not agree to relocate the text as requested by the submitter. However, CMP-6 sees the difficulty of locating the requirement and revises an informational note to direct the user to 366.23(A). The change meets the submitter's intent.
As a convenience to the user, CMP-6 requests a reference to 366.23 for busbar ampacity be placed in the index.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

6-24 Log #854 NEC-P06 **Final Action: Reject**
(Table 310.15(B)(3)(c))

Submitter: Travis Lindsey, Travis Lindsey Consulting Services
Comment on Proposal No: 6-29
Recommendation: Revise the last line in the table as shown with panel actions included:
~~Greater than 300 mm (12 in.) 900 mm (36 in.) 14 C 25F~~
<u>Greater than 900 mm (12 in.)-4500 mm (60 in.) 22 C 40F</u>
Substantiation: In review of proposal 6-29, the committee chose to limit temperatures for wiring located above t2 inches to previous values. Ongoing research was conducted
subsequent to the submission of proposal 6-29. This research was the subject of an addendum to the original Fact Finding Investigation by Underwriters Laboratories. This investigation indicated that the maximum temperature rise above outdoor ambient for all wiring systems mounted 36 inches above the roof with a 95 % confidence interval would be 46.2 F and the maximum temperature rise above outdoor ambient for all wiring systems mounted 60 inches above the roof with a 95 % confidence interval would be 40.6 F.
The subject Fact Finding Report Investigation Part II is included with this comment for review.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: CMP-6 notes conflicting reports presented to the panel. CMP-6 finds variations in the results of the tests. Refer to the data to Comment 6-34.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 8 Negative: 2
Explanation of Negative:
XERRI, M.: Subsequent to the committee meeting and after reviewing the information provided I have the following comments:
Code panel 6 reject panel comment 6-24 stating "CMP-6 notes conflicting reports presented to the panel. CMP-6 finds variations in the results of the tests. Refer to the data to Comment 6-34". The conflicting data referred to in the panels' response is that the data provided by Travis Lindsey by way of the UL fact finding report did not correlate with the data provided by Howard Herndon from his Roof top study.
I have the following comments:
Correlating data between 2 laboratories where you can control the environment, the test set up, etc. can at times be challenging. Correlating data between two studies where several variables exist can be very difficult and should not be expected.
1. In the Howard Herndon report ½ EMT was tested. The UL Fact finding Reports of 2010 and 2011 did not test this size EMT. UL tested ¾ EMT at one (1) foot above the roof. However, this testing was conducted with a white colored roof. The UL report noted that from the testing experiences, "…as wiring systems are mounted further from the roof, solar reflection off the roof becomes more of an influencing factor than the solar absorption by the roof." Therefore, a white roof would likely have produced hotter temperatures. From the pictures provided with the Herndon report, the roof did appear to be darker than the one used with the UL fact Finding report which would reflect less heat back up to the EMT resulting in lower temperature measurements.
2. In the UL fact Finding Report, 17 different conduit and cable systems were tested. From the data, larger conduits and dark color cable tended to produce the maximum temperature differentials. Based on this, one could infer that ½ EMT, although not tested by UL, would be expected to produce a lesser temperature differential than the other 17 systems that UL had tested.
3. In the UL Fact Finding report, solar irradiance was measured and recorded. This data was not provided with the Herndon report. The UL Fact Finding report noted that because of the variable weather conditions during the time period of August - September 2012 in the Las Vegas area, only three days were found where the solar irradiance was greater than or equal to 1000 W/m2 for an extended period of time, and even on those three days, the time period those days where that solar irradiance exceeded 1000 W/m2 was only for about one hour. On some very hot days solar irradiance can exceed 1000 W/m2 for three or more hours.
4. Other variables that could affect correlation of data include shading differences and air flow(winds).
Although the data from both these studies do not correlate, that does not mean that the data is wrong from either report. If you want to get correlating data from different locations or different roof tops, you need to control the variables.
ZIMNOCH, J.: See Comment 6-14a.
Comment on Affirmative:
STACEY, J.: This proposal was correctly rejected, but the reason should have been the deletion of this entire section and associated table. See my comment on 6-16.

6-25 Log #874 NEC-P06 **Final Action: Accept**
(Table 310.15(B)(3)(c))

TCC Action: Based on the Panel action on Comment 6-14a, to Reject Proposal 6-29, the Correlating Committee directs this Comment be reported as "Accept."
Submitter: C. Douglas White, Center Point Energy / Rep. Edison Electric Institute/Electric Light & Power Group
Comment on Proposal No: 6-29
Recommendation: Reject proposal 6-29.
Substantiation: 1. The application of the findings in the UL *Fact-Finding Report on Ambient Temperature Adjustment for Raceway and Cable Systems Exposed to Sunlight on Rooftops* (File IN16969) to all locations where the NEC is adopted is flawed. The proposed change for the "On Roof" temperature adder for cables was determined from tests performed in Las Vegas. The sun's rays strike roofs at smaller angles the further a location is from the equator, causing less heating of the roof. For example, the sun's rays striking a roof in Alaska occurs at a much smaller angle than Las Vegas. Thus the "On Roof" temperature adder for Las Vegas would not be justified for Alaska. The fact finding report erroneously extends these solar radiation heating effects to all locations in the United States without verification. Additionally, by inclusion of the requirements in the NEC, the requirement would erroneously be extended to all locations where the NEC is adopted or used. The NEC is an international standard that has been adopted in Mexico, Columbia, Costa Rica, Venezuela, Panama, and Ecuador and has been translated into Korean, Thai, and Japanese, suggesting use in these locations. The fact finding report did not justify application of the findings to all these locations.

2. The fact finding report considered cable systems on a black roof, and did not consider cable systems on a white roof. Similarly, it considered cable systems above a white roof and did not consider cable systems above a black roof. According to page 11 of the report, this was done to account for additional heating. The cable systems on a white roof would experience less heating than those on a black roof because the white roof reflects the sun. Similarly, when cable systems are above a black roof the cable systems would experience less heating than those above a white roof because the black roof does not reflect the sun onto the cable system the same as a white roof does. Cable systems should only be required to be designed for actual conditions.

3. The testing was performed with a flat roof surface, horizontal to the earth's surface. It did not consider that some roof surfaces are inclined away from the sun, thus would have less heating due to the smaller angle at which the sun's rays strike the roof.

4. The data presented on page 17 of the UL report to justify a 60 degree adder indicates that many of the cable types "On Roof" were much less than 60 degrees higher (the suggested adder). More than 50% of the cable types were 50 degrees Fahrenheit difference or less. Some were less than 40 degrees Fahrenheit difference. The proposed change would require the de-rating of cable systems more than necessary, at considerable expense.

5. Similarly, over 61% of the cable system types "Above the Roof" had no more than a 40 degree Fahrenheit temperature rise; 72% had no more than a 41 degree rise, whereas the UL report was used to propose a temperature adder of 50 degrees Fahrenheit, requiring more de-rating of cable systems than justified. These 72% of the cable systems have a high probability of being adequately rated with the current 40 degree Fahrenheit adder.

6. There have not been any submissions of data of failures of cable systems on roofs.

7. No options for reducing the cable heating by such means as shading wiring systems on or above roofs were considered in the fact finding report.

These concerns warrant rejection of proposal 6-29.
Panel Meeting Action: Reject
Panel Statement: Adequate evidence has not been provided by the submitter to substantiate this change.

CMP-6 is looking at worst case data for rise of ambient temperature. In other areas of the world, ambient correction factors would apply. The installer is still able to perform his own calculations in accordance with 310.15(C).

An installation in a shaded area is not in direct sunlight and would not apply.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 6 Negative: 3 Abstain: 1
Explanation of Negative:

HUDDLESTON, JR., R.: Panel's substantiation for rejecting this comment did not address the submitter's Comment substantiation.

STACEY, J.: The panel should have accepted this comment and rejected proposal 6-29. The values requested by the Copper Development Association have been proven to be artificially elevated by the test methods employed. The Southern Nevada Chapter of IAEI testing proves that the temperatures experienced inside wiring methods on rooftops during sunlight exposure do not even come close to those "measured" in the backyard testing performed by the Copper conductor manufacturers. The panel statement was inadequate and shows that the panel did not even attempt to address the majority of the submitter's substantiation, particularly point 6 - there have been no failed conductors due to sunlight exposure on rooftops.

WALL, C.: The panel is overlooking the fact that solar heating of conductors on rooftops in other areas of the world could be significantly less than the solar heating recorded in Las Vegas and is not accounted for by selecting the ambient temperature for that location. Panel action on comment 6-14a accomplished what the submitter of this comment desired.
Explanation of Abstention:

PICARD, P.: The Aluminum Association could not reach consensus.

6-26 Log #973 NEC-P06 **Final Action: Reject**
(Table 310.15(B)(3)(c))

Submitter: David Brender, Copper Development Assn. Inc.
Comment on Proposal No: 6-29
Recommendation: Revise text to read as follows:
~~Greater than 300 mm (12 in.) 900 mm 14C 25F~~
Greater than 300 mm (12 in.) - 1500 mm (60 in.) 22C 40F
Note: There is an error in the NEC Draft.
Substantiation: UL has performed Fact Finding investigation subsequent to the submission of the original proposal and the Panel ROP meeting. The new Fact Finding report is dated September 25, 2012. The findings were that a temperature adder of 46.2 degrees F applies to all wiring methods mounted 36 inches above the roof and 40.6 degrees F for wiring systems mounted 1500 mm (60 inches) above the roof, both with a 95% confidence interval at 1000 w/m2 solar irradiance. (Note that there is a mistake in the Draft of the 2014 NEC inconsistent with Panel actions at the ROC meeting.)
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: CMP-6 notes conflicting reports presented to the panel. CMP-6 finds variations in the results of the tests. Refer to the data of Comment 6-34.

CMP-6 disagrees with the submitter of an error for the greater than 300 mm values between the proposal action and the A2013 ROP Draft. Values for greater than 300 mm are to remain unchanged from 2011 NEC.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9 Negative: 1
Explanation of Negative:

ZIMNOCH, J.: See Comment 6-14a.
Comment on Affirmative:

STACEY, J.: See comment on 6-24.

6-27 Log #1113 NEC-P06 **Final Action: Accept**
(310.15(B)(3)(c) and Table 310.15(B)(3)(c))

Submitter: Phil Simmons, Simmons Electrical Services
Comment on Proposal No: 6-28
Recommendation: Continue to Reject the Proposal.
Substantiation: The Panel was correct in rejecting the proposal to delete Section 310.15(B)(3)(c) and Table 310.15(B)(3)(c). The requirement was added to the 2008 NEC after very significant documentation was provided that shows excessive temperatures in raceways that are exposed to direct sunlight.

The submitter of this proposal does not provide any evidence to refute the vast amount of data that proves the increased temperatures exist.

Elevated temperature is the major enemy of electrical safety. We take steps in several requirements in the NEC to reduce or manage this enemy. The science proven in the documentation for elevated temperatures in raceways on rooftops that are exposed to sunlight must be accepted.
Panel Meeting Action: Accept
Panel Statement: CMP-6 does not necessarily agree with all of the submitter's substantiation to the comment.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 7 Negative: 2 Abstain: 1
Explanation of Negative:

HUDDLESTON, JR., R.: I agree with the Panel Statement - the substantiation for the Comment is not correct. However, this Comment should have been rejected and the original Proposal accepted.

STACEY, J.: This submitter is a paid consultant for the Copper Development Association (who he represents on CMP-5.) His comments about the "vast amounts of data" refer to unrealistic simulation testing performed in a backyard in Las Vegas by the organization that is paying him. The CDA also paid UL to come in and witness this same unrealistic testing in the same backyard, generating the report from UL. See comment on 6-16.
Explanation of Abstention:

PICARD, P.: The Aluminum Association could not reach consensus.

6-28 Log #1114 NEC-P06 **Final Action: Reject**
(310.15(B)(3)(c) and Table 310.15(B)(3)(c))

Submitter: Phil Simmons, Simmons Electrical Services
Comment on Proposal No: 6-29
Recommendation: The Proposal should continue to be accepted in principle by incorporating the changes made in Proposal 6-31. Accept the values proposed to be added to the ambient temperature due to sunlight exposure.
Substantiation: The values to be added to the ambient temperature due to the raceway or cable having direct exposure to the sun have been determined through a Fact-Finding Report from Underwriters Laboratories. The Report should not be ignored or discounted but should be accepted as factual.

The requirement was added to the 2008 NEC after very significant documentation was provided that shows excessive temperatures in raceways that are exposed to direct sunlight. Every journeyman electrician knows better than with bare hands to pick up a piece of metal conduit that has been exposed to the sun for any length of time. The conduit gets much hotter than the ambient air temperature.

The requirement from UL that the raceways be plugged with cotton makes the test realistic to real-world installations. When raceways are installed for other than physical protection for cables, the raceways are installed complete from enclosure-to-enclosure. They are not installed in any manner to facilitate airflow through the raceway.

The Panel should not be looking for failures (aka body counts) to accept the science contained in the Fact-Finding Report. The science should be accepted as factual and the proposal accepted to prevent insulated conductor failure due to elevated operating temperatures.

This Comment was accepted by the Northwestern Section IAEI meeting in Missoula, MT for forwarding to the IAEI International Office for processing as an International Office Comment.

Panel Meeting Action: Reject

Panel Statement: CMP-6 accepted Proposal 6-29 in principle in part. The submitter's direction to the panel is unclear.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 9 Negative: 1

Explanation of Negative:

ZIMNOCH, J.: See Comment 6-14a.

Comment on Affirmative:

HUDDLESTON, JR., R.: The panel should have rejected the original proposal 6-29 and was correct in rejecting this comment. The substantiation for this Comment conflicts with the Panel Comment for 6-14a which points out the conflicting temperature data from the various studies and that the Panel may have accepted data in the past that may not have been correct. The Rooftop Wiring Study and other evidence presented to the Panel provided substantial real data that rooftop wiring is not being damaged by exposure to sunlight-heated conduits.

STACEY, J.: The submitter's comment that plugging conduit with cotton makes for a realistic test is puzzling. As an inspector for many years, I have never approved such an installation. See comment on 6-27.

6-29 Log #1115 NEC-P06 **Final Action: Accept**
(310.15(B)(3)(c) and Table 310.15(B)(3)(c))

Submitter: Phil Simmons, Simmons Electrical Services

Comment on Proposal No: 6-31

Recommendation: Continue to accept the Proposal in Principal with the actions by the Panel at the ROP meeting.

Substantiation: The Proposal presented actions that were appropriate based upon the testing that was performed by Underwriters Laboratory and reported in the Fact Finding Report. Removing the word "circular" and including "or cables" are correct actions to include the wiring methods that were covered in the exhaustive study of the effects of temperature gain due to solar exposure.

The requirement was added to the 2008 NEC after very significant documentation was provided that shows excessive temperatures in raceways that are exposed to direct sunlight. Every journeyman electrician knows better than with bare hands to pick up a piece of metal conduit that has been exposed to the sun for any length of time. The conduit gets much hotter than the ambient air temperature.

This Comment was accepted by the Northwestern Section IAEI meeting in Missoula, MT for forwarding to the IAEI International Office for processing as an International Office Comment.

Panel Meeting Action: Accept

Panel Statement: CMP-6 does not necessarily agree with all of the submitter's substantiation to the comment.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 7 Negative: 2 Abstain: 1

Explanation of Negative:

HUDDLESTON, JR., R.: The panel should have rejected this comment. The substantiation for this Comment conflicts with the Panel Comment for 6-14a which points out the conflicting temperature data from the various studies and that the Panel may have accepted data in the past that may not have been correct. The Rooftop Wiring Study and other evidence presented to the Panel provided substantial real data that rooftop wiring is not being damaged by exposure to sunlight-heated conduits.

STACEY, J.: The panel action should have been "Reject". See comments on 6-16 and 6-27.

Explanation of Abstention:

PICARD, P.: The Aluminum Association could not reach consensus.

6-30 Log #1116 NEC-P06 **Final Action: Accept**
(310.15(B)(3)(c))

Submitter: Phil Simmons, Simmons Electrical Services

Comment on Proposal No: 6-37

Recommendation: Continue to reject the proposal.

Substantiation: The Panel was correct in rejecting the proposal to delete Section 310.15(B)(3)(c). The requirement was added to the 2008 NEC after very significant documentation was provided that shows excessive temperatures in raceways that are exposed to direct sunlight. Every journeyman electrician knows better than with bare hands to pick up a piece of metal conduit that has been exposed to the sun for any length of time. The conduit gets much hotter than the ambient air temperature.

The submitter of this proposal does not provide any evidence to refute the vast amount of data that proves the increased temperatures exist.

Elevated temperature is the major enemy of electrical safety. We take steps in several requirements in the NEC to reduce or manage this enemy. The science proven in the documentation for elevated temperatures in raceways on rooftops that are exposed to sunlight must be accepted.

This Comment was accepted by the Northwestern Section IAEI meeting in Missoula, MT for forwarding to the IAEI International Office for processing as an International Office Comment.

Panel Meeting Action: Accept

Panel Statement: CMP-6 does not necessarily agree with all of the submitter's substantiation to the comment.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 6 Negative: 3 Abstain: 1

Explanation of Negative:

HUDDLESTON, JR., R.: See my explanation of negative vote on Comment 6-29.

STACEY, J.: The panel action should have been "Reject". See comments on 6-16 and 6-27.

WALL, C.: See my explanation on comments 6-14a and 6-16.

Explanation of Abstention:

PICARD, P.: The Aluminum Association could not reach consensus.

6-31 Log #1117 NEC-P06 **Final Action: Accept**
(Table 310.15(B)(3)(c))

Submitter: Phil Simmons, Simmons Electrical Services

Comment on Proposal No: 6-38

Recommendation: Continue to reject the proposal.

Substantiation: The Panel was correct in rejecting the proposal to delete Table 310.15(B)(3)(c). The requirement was added to the 2008 NEC after very significant documentation was provided that shows excessive temperatures in raceways that are exposed to direct sunlight. Every journeyman electrician knows better than with bare hands to pick up a piece of metal conduit that has been exposed to the sun for any length of time. The conduit gets much hotter than the ambient air temperature.

The submitter of this proposal does not provide any evidence to refute the vast amount of data that proves the increased temperatures exist.

Elevated temperature is the major enemy of electrical safety. We take steps in several requirements in the NEC to reduce or manage this enemy. The science proven in the documentation for elevated temperatures in raceways on rooftops that are exposed to sunlight must be accepted.

This Comment was accepted by the Northwestern Section IAEI meeting in Missoula, MT for forwarding to the IAEI International Office for processing as an International Office Comment.

Panel Meeting Action: Accept

Panel Statement: CMP-6 does not necessarily agree with all of the submitter's substantiation to the comment.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 6 Negative: 3 Abstain: 1

Explanation of Negative:

HUDDLESTON, JR., R.: The Panel should reject this Comment. There is much conflicting evidence about actual temperatures experienced in raceways on rooftops, and questions have arisen about the ampacity adjustments required for temperature correction. The submitter's substantiation is his opinion and not based in scientific facts.

STACEY, J.: The panel action should have been "Reject". See my comments on 6-16 and 6-27.

WALL, C.: See my explanation on comments 6-14a and 6-16.

Explanation of Abstention:

PICARD, P.: The Aluminum Association could not reach consensus.

6-32 Log #1238 NEC-P06 **Final Action: Reject**
(310.15(B)(3)(c))

Submitter: Richard A. Maddox, Las Vegas, NV

Comment on Proposal No: 6-37

Recommendation: Delete 310.15(B)(3)(c) and Table 310.15(B)(3)(c).

Substantiation: This proposal should have been accepted to delete this requirement. There have been no documented failures of conductor insulation due to sunlight exposure. I have seen conductors fail due to overloading, physical damage, poorly done connections and splices, etc., but not due to sunlight exposure on a rooftop.

I have been searching locally for some evidence of conductor failure on rooftops. You would think that with the high temperatures experienced in the Southern Nevada area that we would be likely to see some quite a bit of evidence of failures if the proposals submitted by the Copper Development Association were valid. Instead, I have found numerous examples of conductors pulled out of conduits after years and decades that show no deterioration at all. I'm including photos of several of these installations with

this proposal.
It appears likely that the methodology used by the Copper Development Association led to exaggerated temperatures that are not experienced in actual installations on rooftops. While UL came in and witnessed the Copper Development Association consultant, Travis Lindsey, again perform testing on tables in his backyard in Las Vegas, there was still no examples of real installations, insulation failure, etc. The Southern Nevada Chapter of IAEI sponsored a study to test the temperatures of conductors in conduit on a real roof in Las Vegas, and the results show that the temperatures experienced in actual installations come nowhere near what the Copper industry has been reporting for the past few code cycles.
Research that does not reflect the real world should not be used to write Code. People depend on the Code-Making Panels to identify safety concerns and address them in the most reasonable and economical way possible. This section of the code does not increase safety, it just makes more money for wire manufacturers while making installations more expensive for building owners and more complicated for installers and inspectors.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: Technical substantiation has been provided during the 2008 and 2011 NEC code cycles to support the ambient adjustment factors to conduit exposed to sunlight on rooftops. The original testing and a subsequent Underwriters Laboratories Fact-Finding Report has been accepted by the panel. CMP-6 requests the Correlating Committee appoint a task group to review the basis for ambient temperature correction factors.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 6 Negative: 3 Abstain: 1
Explanation of Negative:
HUDDLESTON, JR., R.: See my explanation of negative vote on Comment 6-16.
STACEY, J.: The panel action should have been "Accept". The submitter provided a report and examples of conductors (THW) that have survived with no visible deterioration in Las Vegas, NV and Laughlin, NV (two of the hottest areas of the country) for decades. The conductors were sized without using the adders in 310.15(B)(3)(c), and remained intact and flexible.
WALL, C.: See my explanation on comments 6-14a and 6-16.
Explanation of Abstention:
PICARD, P.: The Aluminum Association could not reach consensus.

6-33 Log #1264 NEC-P06 **Final Action: Accept**
(310.15(B)(3)(a))

TCC Action: The Correlating Committee understands that the words "in a Raceway or Cable" are also deleted in the title of Table 310.15(B)(3)(a) for correlation.
Submitter: Donald A. Ganiere, Ottawa, IL
Comment on Proposal No: 6-44
Recommendation: This proposal should be accepted.
Substantiation: I don't really understand the panel comment. The text seams very clear that derating is required for other than raceways or cables. The heading of the section is in direct conflict with the section text.. If the panel's intent is that the derating only applies to raceways and cables with more than three current carrying conductors than the words "or where single conductors or multiconductor cables are installed without maintaining spacing for a continuous length longer than 600 mm (24 in.) and are not installed in raceways," should be deleted from the section. If these words are to remain, then it is clear that the section requires derating for conductors that are not in a raceway or cable and that this proposal should be accepted.
Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10
Comment on Affirmative:
HUDDLESTON, JR., R.: It should be understood that the title of Table 310.15(B)(3)(a) should also have the same words "in a Raceway or Cable" deleted.
LAIDLER, W.: The title of Table 310.15(B)(3)(a) should also have the same words "in a Raceway or Cable" deleted, as they are not needed."

6-34 Log #1307 NEC-P06 **Final Action: Reject**
(310.15(B)(3)(c) and Table 310.15(B)(3)(c))

Submitter: Howard Herndon, South West Electritech Services
Comment on Proposal No: 6-29
Recommendation: Delete 310.15(B)(3)(c) and Table 310.15(B)(3)(c).
Substantiation: To test the hypothesis that the testing performed by the Copper Development Association and later observed by UL was not representative of real world electrical rooftop installations, the Southern Nevada Chapter of IAEI designed and installed a test setup to determine if real world electrical installations on rooftops experienced the temperatures reported to Code-Making Panel 6.
In short, the temperatures measured on an actual rooftop in Las Vegas in an actual installation of conduits with wires (both loaded and unloaded) did not approach the temperatures reported to CMP-6 by the Copper Development Association. On the contrary, the average temperature differential recorded was 15 degrees Fahrenheit for unloaded conductors in conduit. Since the conduits were installed approximately 6" above the rooftop, the adjustment factors required by CMP-6 would require an adder of 50 degrees F, over three times the actual measured values.
Additionally, it was observed during this real world rooftop test that the loaded conductors never exceeded the operating temperature of the conductors or terminations during the testing. Since the whole reason this additional temperature adjustment was added to the code was the premise that conductors would exceed their rated temperature, this testing shows that the premise was false. The highest recorded temperature was 148 degrees F for loaded conductors. The ambient temperature on that day was 114 degrees F according to NOAA, resulting in a differential of 34 degrees Fahrenheit for loaded conductors in conduit operating at the maximum load recorded on the circuit (37 amps). The conductors are rated at 194 degrees F and the connections are limited to 167 degrees F.
This indicates that even should the temperature be more extreme or if there was additional load on the circuit, there is sufficient buffer zone that additional temperature correction as required by the 2011 NEC 310.15(B)(c)(3) or 2014 NEC Proposal 6-29 is unnecessary.
Since the testing performed by the CDA to add these temperature correction factors does not reflect real world installations, Proposal 6-29 should not have been accepted.
A full report of the test methods and data collected by the Southern Nevada Chapter of IAEI is being submitted for review by the panel members.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: Technical substantiation has been provided during the 2008 and 2011 NEC code cycles to support the ambient adjustment factors to conduit exposed to sunlight on rooftops. The original testing and a subsequent Underwriters Laboratories Fact-Finding Report has been accepted by the panel. CMP-6 requests the Correlating Committee appoint a task group to review the basis for ambient temperature correction factors.
The submitter has presented additional data but it was not persuasive enough to change the panel's position.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 6 Negative: 3 Abstain: 1
Explanation of Negative:
HUDDLESTON, JR., R.: See my explanation of negative vote on Comment 6-16
STACEY, J.: The panel action should have been "Accept". The Southern Nevada Chapter of IAEI performed testing on an actual rooftop in Las Vegas, NV with both loaded and unloaded conductors. The testing proves that the adders reported by the Copper Development Association are unrealistically high. Additionally, even with fully loaded conductors feeding an air conditioner (located on the same rooftop) during the hottest summer on record, the conductor and termination temperatures never exceeded those allowable by the conductor or equipment manufacturers. The conductor used was the minimum size allowable for the ampacity while keeping the voltage drop under 3%, but without the adders required by Section 310.15(B)(3)(c). The testing submitted by the CDA to support these adders was simulation testing, supposedly designed to reflect real world conditions. However, the real world testing performed to support this comment shows that actual installations do not approach the predicted temperatures required by this Code requirement. If simulation testing does not reflect the real world results, it must be rejected. The requirements in Section 310.15(B)(3)(c) are unnecessary and simply add cost without benefit.
WALL, C.: See my explanation on comments 6-14a and 6-16.
Explanation of Abstention:
PICARD, P.: The Aluminum Association could not reach consensus.

6-35 Log #1424 NEC-P06 **Final Action: Reject**
(310.15(B)(3)(c))

Submitter: Pete Fergen, Mojave Electric
Comment on Proposal No: 6-37
Recommendation: Delete 310.15(B)(3)(c) and Table 310.15(B)(3)(c).
Substantiation: This proposal should have been accepted to delete this requirement. This requirement adds significant cost without adding safety to rooftop installations. It also adds complexity to jobs since the oversized conductors this provision requires often do not fit in the equipment terminations. I work for Mojave Electric in Las Vegas, NV. Mojave Electric is an IBEW INECA contractor doing a variety of electrical work in Las Vegas, including service work. We have never found a rooftop conductor failure due to sunlight exposure. Conductors operate just fine on rooftops for decades if they are not overloaded or physically damaged during installation or operation.
I was told by CDA representative Travis Lindsey that when the wire is sized larger than the equipment manufacturers termination point that the contractor would have to splice the wire reducing it down to the size necessary. I do have an example of what happens when that is done. I have a splice that was cut out of a run due to overheating and Phase loss for a business. Every splice that is inserted into a wire run increases the cost of maintenance and the chance of mechanical breakdown or
fire hazard.
I also belong to the Southern Nevada Chapter of IAEI. Our Chapter funded a study to determine the temperature experienced in rooftop electrical

installations. The
test site was installed by Mojave Electric employees and located on a building owned by Mojave Electric. The results we found indicate that in real installations, the
high temperatures reported by the copper industry do not occur. I've never seen an installation with surgical cotton stuffed in the conduit, so maybe that affected their
results.
We ran an analysis of the cost of installing a 225 amp panel with rooftop feeders under different conditions. With this temperature adder, it would cost anywhere from
50% more to 400% more than the cost of an installation without this requirement, depending on the height of the conductors above the roof. With no showing of
failures in the field, and this new study that shows the temperatures aren't anywhere near what the copper industry claims, there is no justification for keeping this
requirement in the code.

Panel Meeting Action: Reject

Panel Statement: Technical substantiation has been provided during the 2008 and 2011 NEC code cycles to support the ambient adjustment factors to conduit exposed to sunlight on rooftops. The original testing and a subsequent Underwriters Laboratories Fact-Finding Report has been accepted by the panel. CMP-6 requests the Correlating Committee appoint a task group to review the basis for ambient temperature correction factors.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 6 Negative: 3 Abstain: 1

Explanation of Negative:

HUDDLESTON, JR., R.: See my explanation of negative vote on Comment 6-16.

STACEY, J.: The panel action should have been "Accept". The submitter has experienced first-hand the difficulties and hazards created by the unnecessary upsizing of conductors required by Section 310.15(B)(3)(c). The upsizing of conductors required by this code requirement result in conductors that are too large to terminate on normal equipment, increasing the chance of failure due to the more numerous connections that are required. Not only does this code requirement increase cost (by significant amounts, as shown by this submitter and in Comment 6-16), it may actually decrease safety and reliability of our systems.

WALL, C.: See my explanation on comments 6-14a and 6-16.

Explanation of Abstention:

PICARD, P.: The Aluminum Association could not reach consensus.

6-36 Log #1425 NEC-P06 **Final Action: Reject**
(310.15(B)(3)(c) and Table 310.15(B)(3)(c))

Submitter: Howard Herndon, South West Electritech Services / Rep. Southern Nevada Chapter IAEI

Comment on Proposal No: 6-31

Recommendation: Delete 310.15(B)(3)(c) and Table 310.15(B)(3)(c).

Substantiation: To test the hypothesis that the testing performed by the Copper Development Association and later observed by UL was not representative of real world electrical rooftop installations, the Southern Nevada Chapter of IAEI designed and installed a test setup to determine if real world electrical installations on rooftops experienced the temperatures reported to Code-Making Panel 6.
In short, the temperatures measured on an actual rooftop in Las Vegas in an actual installation of conduits with wires (both loaded and unloaded) did not approach the temperatures reported to CMP-6 by the Copper Development Association. On the contrary, the average temperature differential recorded was 15 degrees Fahrenheit for unloaded conductors in conduit. Since the conduits were installed approximately 6" above the rooftop, the adjustment factors required by CMP-6 would require an adder of 50 degrees F, over three times the actual measured values.
Additionally, it was observed during this real world rooftop test that the loaded conductors never exceeded the operating temperature of the conductors or terminations during the testing. Since the whole reason this additional temperature adjustment was added to the code was the premise that conductors would exceed their rated temperature, this testing shows that the premise was false. The highest recorded temperature was 148 degrees F for loaded conductors. The ambient temperature on that day was 114 degrees F according to NOAA, resulting in a differential of 34 degrees Fahrenheit for loaded conductors in conduit operating at the maximum load recorded on the circuit (37 amps). The conductors are rated at 194 degrees F and the connections are limited to 167 degrees F.
This indicates that even should the temperature be more extreme or if there was additional load on the circuit, there is sufficient buffer zone that additional temperature correction as required by the 2011 NEC 310.15(B)(c)(3) or 2014 NEC Proposal 6-29 is unnecessary.
Since the testing performed by the CDA to add these temperature correction factors does not reflect real world installations, proposal 6-29 should not have been accepted.
A full report of the test methods and data collected by the Southern Nevada Chapter of IAEI is being submitted for review by the panel members.

Panel Meeting Action: Reject

Panel Statement: Technical substantiation has been provided during the 2008 and 2011 NEC code cycles to support the ambient adjustment factors to conduit exposed to sunlight on rooftops. The original testing and a subsequent Underwriters Laboratories Fact-Finding Report has been accepted by the panel. CMP-6 requests the Correlating Committee appoint a task group to review the basis for ambient temperature correction factors.

The submitter has presented additional data but it was not persuasive enough to change the panel's position.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 6 Negative: 3 Abstain: 1

Explanation of Negative:

HUDDLESTON, JR., R.: See my explanation of negative vote on Comment 6-16.

STACEY, J.: The panel action should have been "Accept". See my comment on 6-34.

WALL, C.: See my explanation on comments 6-14a and 6-16.

Explanation of Abstention:

PICARD, P.: The Aluminum Association could not reach consensus.

6-37 Log #1430 NEC-P06 **Final Action: Accept in Principle**
(310.15(B)(3)(c) Exception (New))

Submitter: Christel K. Hunter, Alcan Cable, a General Cable Company

Comment on Proposal No: 6-41

Recommendation: Add new exception that states:

<u>Exception: Conductors with thermoset insulation rated at 90C or higher are not subject to this ampacity adjustment.</u>

Substantiation: This proposal should have been accepted. Technical substantiation was provided at the ROP meeting supporting the claim that thermoset insulation is superior to thermoplastic insulation in high heat applications. Industry standards from IEEE, ICEA and NEMA indicate that thermoset insulation is adequate for much higher temperatures than those experienced on rooftops for the period of time indicated.
In response to the request of several code panel members, testing was performed to validate the assertion that thermoset insulated conductors are more resistant to high
heat conditions than thermoplastic. Two rounds of testing were performed. For the first test, General Cable performed a comparative test of thermoplastic and thermoset insulated wires at high temperature under physical stress. The test was based on an industry recognized test method called Heat Shock found in UL 83, Thermoplastic-insulated Wires and Cables. The test is normally run for one hour during wire certification testing, but this test was run for 60 days to better emulate the expected lifetime exposure of conductors to high heat over many decades. The results show that thermoset insulation is far more resistant to high heat than thermoplastic, even when under physical stress. The thermoplastic conductors showed significant aging (evidenced by insulation cracking when unwound from a steel mandrel). The report is included for the panel's review.
Additionally, to substantiate these results, the same test was performed by UL. UL also performed additional testing such as tensile and elongation, flexibility, and dielectric voltage withstand and breakdown. The report is included as supporting material. The conductors tested at UL show very similar cracking of the thermoplastic conductors and no detectable cracking of the thermoset insulation.
Based on published industry standards and testing submitted with this comment, commonly used thermoset insulation is clearly more resistant to high heat applications than thermoplastic. Even in the hottest areas of the country with fully loaded conductors, this information demonstrates that there is no safety concern with thermoset insulation in these installations.
Note: Supporting material is available for review at NFPA Headquarters.

Panel Meeting Action: Accept in Principle

Add new exception to read as follows:

Exception: Type XHHW-2 insulated conductors shall not be subject to this ampacity adjustment.

Panel Statement: CMP-6 edits the submitter's text to comply with the 2011 NEC Style Manual.

CMP-6 changes "thermoset insulation" to "XHHW-2" to limit the wire type to the submitted data and results from two testing laboratories. CMP-6 deletes "rated at 90°C or higher" as XHHW-2 is so rated.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 6 Negative: 3 Abstain: 1

Explanation of Negative:

FRIEDMAN, S.: A full Fact-Finding Investigation should be provided to take into account all aspects of the conductors installed on roof tops.

XERRI, M.: The testing performed on 6 AWG THHN employing PVC insulation and 6 AWG XHHW-2 employing XLPE insulation seems to indicate that XHHW-2 with XLPE insulation performs better than the THHN with PVC insulation based on the limited tests performed.
Since this proposal is to allow the use of a 900 C rated cable to be used for a limited time frame above its' rated temperature, it is important that all insulation materials that XHHW-2 can be extruded with should have been tested. As XHHW-2 can also employ EPCV type insulation, this should also have been subjected to an appropriate test program.
In addition, based on the test program requested by the submitter, because the cable is being subjected to temperatures above its' temperature rating, a cycling

of heating and cooling (dry and humid?) of the cable would provide more pertinent data than just constant heating. The effects of heating and cooling can cause stresses that heating alone will not show.

Also, the samples subjected to the test program requested by the submitter consisted of one sample of cable from the two different manufacturers. Additional samples from other manufacturers should be included in any investigation.

The submitter also stated in the presentation that the oven aging time of 60 days that was performed on the cable represented 32.7 years of exposure to the elevated temperatures. In the Roof Top Wiring Study that was performed by Robert Huddleston, that was provided to the panel, he makes reference to cables that were installed in 1972, making them 40 years old and still in use. This would infer that the cable should have been aged longer to represent a time period of longer than 32.7 years.

Based on the limited testing performed by the submitter and requested of UL, the action taken by the Panel was not correct. We would recommend revisiting during the next code cycle. An independent Fact-Finding Investigation Report would allow the Code Panel to review additional needed data and other pertinent facts regarding all aspects of XHHW-2 cable when subjected to sunlight on rooftops.

ZIMNOCH, J.: The supporting information presented in support of the comment was very limited in scope. A full Fact-Finding Investigation should be provided to take into account all aspects of the conductors installed on roof tops. The UL letter specifically states: "UL Verification Services did not select the samples, determine whether the samples were representative of production samples, witness the production of the test samples, nor were we provided with information relative to the formulation or identification of component materials used in the test samples. The test results apply only to the actual samples tested. " XHHW with cross-linked polyethylene insulation is not the only way to manufacture XHHW; for example, XHHW-2 can be made with EPR rubber or made with a PVC (thermoplastic) jacket over a single conductor.

The ambient temperature on the roof tops does not change the fact that if the added ambient is ignored, the conductor temperature will exceed the 90C limit regardless if it is thermoset or thermoplastic. There is a precedent being set where exception from a temperature limitation in the code is being introduced. This being the case, there should be a more comprehensive test report to support this concept since the same type exception could be applied to any of the temperature correction tables in the code.

1. Only 1 size of cables (#6) was tested using two insulations. Other insulations and wire types were not considered.
2. Tests were indoors and not related to real world.
3. Were oven tests on a mandrill, not real installation conditions
4. Tests were at continuous temperature, not daily temperature cycles, thus not heating and cooling at frequent intervals
5. The testing was performed in free air, not conduits in sunlight
6. Testing does not consider friction from expansion and contraction due to heating and cooling. In a larger sense, wear and tear due to expansion and contraction has more of an effect than simply temperature, and was not considered in the testing.
7. Code is written for all cables in all sizes. This test was not comprehensive and thorough
8. The concluding statement was very specifically worded "XHHW sample can better withstand the 212 C temperatures for a 60 day period." Electrical equipment is expected to last 40 years or more.
9. Thermoset insulation is not the only way to make XHHW; for example, XHHW-2 can be made with EPR rubber.
10. The UL letter is not a Fact Finding and has little meaning

The UL letter specifically states: UL Verification Services did not select the samples, determine whether the samples were representative of production samples, witness the production of the test samples, nor were we provided with information relative to the formulation or identification of component materials used in the test samples. The test results apply only to the actual samples tested.

11. UL is basically not certifying anything other than that a report of the testing was submitted by General Cable
12. The test report and UL letter were not reviewed or available to the public. Both the report and letter are dated in the Fall of 2012. They were not available for Public Comment.

Explanation of Abstention:

PICARD, P.: The Aluminum Association could not reach consensus.

Comment on Affirmative:

CLINE, S.: In support of the Panel's action:

The testing results submitted clearly showed significant differences between insulation degradation, and showed that the XHHW-2 type was much more resistant to the effects of heat. Further testing of all modern insulation types is recommended - see 6-14a.

KENT, G.: No explanation provided.

LAIDLER, W.: We are voting with the panel to Accept this Comment in Principle. The Submitter of the comment provided substantiation that showed that a No. 6 XHHW-2 conductor was more resistive to a high heat condition and showed no apparent damage to the conductor.

The language in the Code that requires the ampacity of the conductor to be corrected when the ambient temperature is higher than 30C or 86F was added to the document before the newer types of conductor insulations were developed. We think that the time has come to take into consideration the types of insulations we are currently using and how they measure up with the existing ampacity and ambient temperature correction factor tables. A recommendation was made during the panel's discussion that the TCC appoint a Task Group to look into the effectiveness of the high temperature rated insulation and its use with current ambient temperature correction factor tables: we strongly support that recommendation. Until that time comes, we will continue to support the application of ambient temperature correction factors including the air inside raceways. Although accepting the proposed exception to 310.15(B)(3) is in conflict with the previous statement, this action sends a message that the panel recognizes that the insulation types used today are more robust and resilient than the insulation types used when the ambient temperature correction tables were first developed.

STACEY, J.: Although it is our position that 310.15(B)(3)(c) be deleted in its entirety, it appears unlikely that the panel will agree. Therefore, we accept this submitter's language as it provides a compromise that allows installers to use conductors that are sized to fit the equipment on which they must terminate. Thermoset insulation has been proven in laboratory testing and field installations to be far more resistant to high heat than thermoplastic. The panel's limitation to XHHW-2 only was unnecessary, as all thermosets (like XHHW) have better performance in high heat applications than thermoplastics (like THHN)

6-38 Log #1557 NEC-P06 **Final Action: Reject**
(Table 310.15(B)(3)(a))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 6-40
Recommendation: Accept the proposal in principle. In addition to making the changes as accepted to the table note, delete the phrase "current-carrying" from 310.15(B)(3) from the two locations where it occurs in the first paragraph.
Substantiation: This action is essential to remove a direct conflict between the table note and the provisions of the parent text in the section text that gives rise to the table. This has been a problem ever since the panel removed the phrase in the table note for the 2011 NEC, and this is the time to remove the conflict.
Panel Meeting Action: Reject
Panel Statement: The adjustment factors are on conductors which are or may be normally current carrying conductors. Not all conductors need to be subject to the adjustment factors.

CMP-6 disagrees with the submitter that there is a conflict.

Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

6-39 Log #97 NEC-P06 **Final Action: Accept**
(310.15(B)(7))

Submitter: Technical Correlating Committee on National Electrical Code®,
Comment on Proposal No: 6-49a
Recommendation: The Correlating Committee directs that the panel clarify their action on this proposal.

The Correlating Committee also directs the panel to revise the Informational Note as it contains permissive language, i.e. the word "may".

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-6 accepts the direction of the Correlating Committee to clarify the action on Proposal 6-49a. See panel action and statement on Comment 6-52.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

6-40 Log #293 NEC-P06 **Final Action: Reject**
(310.15(B)(7))

Submitter: Lowell Reith, Interstates Construction Services Inc.
Comment on Proposal No: 6-49a
Recommendation: Revise text to read as follows:

(7) 120/240 Volt, Single-Phase Dwelling Services and Feeders. For service and feeder conductors of 120/240-volt, single-phase, individual dwelling unit one-family, two-family, and multifamily service ratings from 100 through 400 amperes, an adjustment factor of 0.83 of the service ampere rating shall be permitted to be used to determine the size of the ungrounded conductors. The grounded conductor shall be permitted to be smaller than the ungrounded conductors, provided that the requirements of 215.2, 220.61, and 230.42 are met.

Substantiation: The revising of 310.15 (B) (7) makes no sense if it does not change the result of the conductor size that can be used for 120/240 volt services for Residential dwellings. The use of the table is very clear to those who use it. Taking 83% times the amperage of the minimum service sized based on the standard calculation for dwelling as shown in Informational Annex D1. It also lets the field decide which insulation that they would use to apply the 83% to. THHN has a higher amperage then a THWN in the 75 degree column. Field people would also have to work better with 110.14 (C) to

apply the correct wire size based on the terminal rating of the panel. I feel the table provides the base way of sizing the conductors for the residential service from 100 amp to 400 amp.
Panel Meeting Action: Reject
Panel Statement: The intent of the submitter is unclear. It seems that the substantiation does not support his proposed text.
See panel action and statement on Comment 6-52.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

6-41 Log #383 NEC-P06 **Final Action: Reject**
(310.15(B)(7))

Submitter: Carl Timothy Wall, Alabama Power Company
Comment on Proposal No: 6-49a
Recommendation: Reject Proposal 6-49a.
Substantiation: Removal of the table does not add clarity or usability to the NEC. The electrical industry that includes designers, installers and inspectors is better served by the long standing code Table 310.15(B)(7) rather than a narrative text that requires an equation with calculations. The table adds clarity, facilitates and expedites the installation and inspection process.
Panel Meeting Action: Reject
Panel Statement: Use of the table does improve usability of the NEC if conditions of use don't require correction factors. The problem of using the table is that the user has no way to apply the required adjustment factors to the types of insulation dependent upon conditions of installation.
The panel affirms that the new language accepted in Comment 6-52 is a compromise to address the misuse of prior published table.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9 Negative: 1
Explanation of Negative:
STACEY, J.: The panel action should have been "Accept". The existing table is descriptive, adequate, and is well understood in the field. As stated in Mr. Walls substantiation, (Removal of the table does not add clarity or usability to the NEC. The electrical industry that includes designers, installers and inspectors is better served by the long standing code Table 310.15(B)(7) rather than a narrative text that requires an equation with calculations. The table adds clarity, facilitates and expedites the installation and inspection process). There were no proposals from the public to remove the table only, and put in a calculation. Proposal 6-49a was created by the panel and is a step backwards as stated in ROC 6-45.
An Inspector is not going to stop at each residential inspection with a new service and do a calculation. This easy to use time proven ampacity table is needed and used daily. There is no proof of any failures to show that the table is broken? Both ROC 6-43 and 6-45 tried to fix the broken text. The panel concerns of issues where a feeder ran through an attic or insulation requiring some correction factors be applied are addressed in 6-45. ROC 6-52 new part (c) appears to allow a feeder to run through the same attic with no correction factor required, only Info Note 1 that is not enforceable. There is no need to get rid of the Table310.15(B)(7).
Comment on Affirmative:
WALL, C.: I support the panel action to clarify 310.15(B)(7); however, I believe a table increases usability and should be included, subject to requirements to apply adjustment factors.

6-42 Log #977 NEC-P06 **Final Action: Reject**
(310.15(B)(7))

Submitter: Charles J. Palmieri, Town of Norwell
Comment on Proposal No: 6-49a
Recommendation: Delete the panel action on this proposal and accept proposal 6-50 by deleting this section in its entirety.
Substantiation: Code panel 6 is to be applauded for the work it performed on the 12 proposals submitted for deletion or modification to this section. Unfortunately the panel action is still lacking on two issues. The panel action language still contains the term feeder. 1. The example in the statement by panel member Cline cites a 100 A feeder from a 200 A panel. If one wishes to use the 83 percent this feeder must be sized to 166 A. Under this scenario it is agreed that a 100 feeder will most likely be selected from Table 310.15(B)(16). What about a 300 or 400A Service where the installer chooses to use a meter enclosure with factory installed double barrel lugs on the load terminals and feed two 150A or 200 A panels. This is very common. For example consider a 300 A service 1 meter with 2 150 A load centers. The conductors from the meter are not feeders. There is no overcurrent protection at the meter enclosure. The service conductors to the meter to each load center must each must have an ampacity of 249 A (300 x.83=249A). These conductors are not allowed to use 240.21(B). I believe there is still confusion in the application of the 83 percent, installers may attempt to install conductors sized at 83 percent of the individual panels' overcurrent protection. I am not sure this was the intent of the panel's action. There were several proposals to delete this table that were rejected by CMP-6 see Proposals 6-50 thru 56. 2. The panel statement for each rejected proposal indicated a lack of technical substantiation to delete this section. I disagree. In P-56 Mr. Mercier points to an increase of electrical loads. This is a statement of fact. Both P 6-50 and 55 list a problem of voltage sag under the existing installation requirements. This also is factual. The panels' substantiation statement to its action of Proposal 49a also does not provide technical documentation to support retention of this permissive language allowing reduced size service conductors. It simply states that the multiplier essentially accomplishes the same end as applying the 301.15(B)(7) the Table
Panel Meeting Action: Reject
Panel Statement: The submitter has not provided substantiation that electric loads have increased. Nor has he provided substantiation that voltage sag conditions referenced are relevant to this section. CMP-6 requests the submitter provide documented failures due to use of these calculations/tables.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9 Negative: 1
Explanation of Negative:
KENT, G.: Clearly by our actions of providing a percentage we have clarified this is a calculation of derating the service based on diversity. Calculations of the necessary service amperage requirement should be found in Article 220 not Article 310.
Comment on Affirmative:
HUDDLESTON, JR., R.: I find it fascinating that the Panel requested documented failures in their Panel Statement to substantiate this Comment, when all of the Comments for ampacity adjustments for rooftop wiring have had ZERO documented failures and many documented cases demonstrating NO FAILURES - yet the Panel accepted the drastic temperature adjustments and consequent MUCH LARGER CONDUCTORS on rooftops. Rather inconsistent? Indeed.

6-43 Log #1014 NEC-P06 **Final Action: Reject**
(310.15(B)(7))

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 6-19
Recommendation: Revise text to read as follows:
(7) 120/240-Volt, 3-Wire, Single-Phase Dwelling Services and Feeders. For individual dwelling units of one-family, two-family, and multifamily dwellings, conductors, as listed in Table 310.15(B)(7), shall be permitted as
120/240-volt, 3-wire, single-phase service-entrance conductors, service-lateral conductors, and feeder conductors that serve as the main power feeder<u>(s)</u> to each dwelling unit and are installed in raceway or cable with or without an equipment grounding conductor. For application of this section, the main power feeder<u>(s)</u> shall be the feeder between the main disconnect and the panelboard<u>(s)</u> ~~that supplies, either by branch circuits or by feeders, or both, all loads that are part or associated with the dwelling unit~~. The feeder conductors to a dwelling unit shall not be required to have an allowable ampacity rating greater than their service-entrance conductors. The grounded conductor shall be permitted to be smaller than the ungrounded conductors, provided the requirements of Sections 215.2, 220.61, and 230.42 are met.
Substantiation: This proposal seeks to fix an issue that was created in the 2008 edition of the NEC. Up until that point, this table could be used for multiple feeder circuits in a dwelling. This concept was changed with no real substantiation, and the change allowed for absurd installation requirements. For example, a 150A feeder circuit that serves a single panelboard can use this table. Imagine that this panelboard contains the circuits for two air conditioners. I can still use this table. Now imagine removing those two circuits and placing them outside at the service equipment. The feeder circuit has much, much less load on it, and yet it would now have to be sized larger! This obviously makes no sense, and is really an indefensible concept.
Considering the amount of proposals to fix this in the last Code cycle, it is obvious that the industry wants a change in this section. Please consider this proposal, which, for the most part, reverts this text back to the 2005 language, which was clear and consistent.
Panel Meeting Action: Reject
Panel Statement: CMP-6 does not accept the submitter's recommendation. CMP-6 addressed the submitter's concerns noted in his substantiation.
See panel action and statement on Comment 6-52.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9 Negative: 1
Explanation of Negative:
STACEY, J.: The panel action should have been "Accept in principle" The submitter's substantiation is correct, the entire load should not be required to use this section or table. There is no proof that this is an issue only concerns. This is where diversity begins by dropping off or cycling of loads. In addition to the submitter's comment it is an industry practice to install a 400 amp service with 2-200 amp panels fed from the meter socket using this table with no issues only concerns.
See my comments on 6-41, 6-45 and 6-52.

6-44 Log #1045 NEC-P06 **Final Action: Reject**
(310.15(B)(7))

Submitter: George M. Stolz, II, Quicksilver Electrical Training
Comment on Proposal No: 6-49a
Recommendation: This proposal should be rejected.
Substantiation: One difficult to understand section is being replaced with another, and the proposed language disallows using the reduced wire size in

anything but a single family dwelling unit. For example, an apartment served by an 800A service disconnect and a 100A feeder disconnect in series would not be permitted to use a #2 AL as allowed in previous editions of the NEC. The proposed text is bound to a service disconnect rating that may not be relevant to the installation at hand, as is the case with most apartments. The panel seems to have been fixated on single family installations when they drafted the proposed language, as shown by the "200A service to 200A feeder" example given. It is common to have a few high-amperage service disconnects supplying dozens of small amperage feeders supplying each unit.

The panel's action in proposal 6-49a still has an additional fundamental problem. Conductors connected to circuit breakers are required to be sized to 125% of the continuous load in order for the conductor to draw heat away from the breaker as a heat sink. By the panel's action, undersized conductors are still allowed to be connected to overcurrent devices. By accepting this proposal and leaning on CMP-2 to accept a load diversity factor in lieu of 310.15(B)(7), this basic problem is averted while meeting the intentions of CMP-6. It is the right way to put this issue to bed, forever.

Panel Meeting Action: Reject

Panel Statement: CMP-6 has addressed the submitter's concerns noted in his substantiation relative to apartments in Comment 6-52. The submitter has not provided evidence that undersized conductors are allowed.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

6-45 Log #1088 NEC-P06 **Final Action: Reject**
(310.15(B)(7) and Table 310.15(B)(7))

Submitter: L. Keith Lofland, International Association of Electrical Inspectors (IAEI)

Comment on Proposal No: 6-49a

Recommendation: Revise text at 310.15(B)(7) as follows and revive Table 310.15(B)(7) to 2011 NEC format:

<u>**(7) Conductors Supplying Individual Dwellings.** Conductors supplying individual dwelling units shall be permitted to be sized in accordance with (a) through (d). Use of Table 310.15(B)(7) shall not be permitted where ampacity correction or adjustment for service or feeder conductors is required elsewhere in this Code.</u>

<u>**(a) Service Conductors.** Where connected to a 120/240-volt, 3-wire, single-phase system, service conductors that supply the entire load associated with a one-family dwelling, or the entire load associated with the individual units of two-family and multifamily dwellings shall be permitted to be sized in accordance with Table 310.15(B)(7).</u>

<u>**(b) Feeder Conductors.** Where connected to a 120/240-volt, 3-wire, single-phase system, feeder conductors that supply the entire load associated with a one-family dwelling, or the entire load associated with the individual units of two-family and multifamily dwellings shall be permitted to be sized in accordance with Table 310.15(B)(7).</u>

<u>**(c) Not Larger than Service Conductors.** Unless ampacity correction or adjustment is required, feeder conductors installed between the service equipment and panelboards or similar distribution equipment shall not be required to be sized larger than the service conductors.</u>

<u>**(d) Grounded Conductor Reduction.** Grounded conductors shall be permitted to be smaller than the ungrounded conductors, provided the requirements of 215.2 and 220.61 for feeders or the requirements of 220.61 and 230.42 for services are met.</u>

Substantiation: Over the past 3 Code cycles, CMP-6 has worked hard to satisfy all concerned parties in conjunction to 310.15(B)(7) and the companion Table 310.15(B)(7). I believe the removal in its entirety of Table 310.15(B)(7) is a step backward in this process. By removing the table and adding a 17% adjustment factor formula (0.83 of the service ampacity rating) will only add confusion to sizing requirements for dwelling unit services and the main power feeder. The main argument in dealing with Table 310.15(B)(7) seems to be ampacity adjustment factors (such as temperature or number of conductors in the same raceway or bundled together). Does Table 310.16(B)(7) override any ampacity adjustment factors or does any ampacity adjustment factors render Table 310.15(B)(7) noncompliant? The proposed text in this comment will make it clear that Table 310.15(B)(7) is not to be used where ampacity adjustment factors are required for the service or feeder conductors elsewhere in the Code. This proposed text makes 310.15(B)(7) more "user-friendly" in breaking up a large level 2 subdivision paragraph into (4) level 3 subdivisions. The existing Table 310.15(B)(7) has worked well and be part of the Code of 21 Code cycles. Its removal will not add clarity or aid in the usability of the NEC to the user of the NEC.

Panel Meeting Action: Reject

Panel Statement: Changing to text as in Comment 6-52 allows the 83% adjustment factor to continue to be used with the adjustments, where accepting this proposal prohibits the use of the table when subject to other adjustments. The panel affirms the intent to require the application of adjustments or corrections as required, and that the text given in the panel's action and statement on Comment 6-52 addresses the prior misuse of the table.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 9 Negative: 1

Explanation of Negative:

STACEY, J.: The panel action should have been "Accept". The submitter is correct with the substantiation and has provided text that would not allow the use of the Table where correction or adjustments are required. The public will be more confused with an 83% calculation than an easy to use time proven table. See my comments on 6-41 and 6-5.2

6-46 Log #1095 NEC-P06 **Final Action: Reject**
(310.15(B)(7) and Table 310.15(B)(7))

Submitter: Ron B. Chilton, Rep. NC Code Clearing Committee

Comment on Proposal No: 6-55

Recommendation: This Proposal should have been accepted.

Substantiation: This is the proper step to begin to address deficiencies in services for dwellings due to reductions in connected loads by the "diversity" theory of Article 220 and substituting calculated loads based on a 50 year old diversity assumption. When the diversity factor was introduced, prior to the 1959 NEC, this was given as reasons for exaggerating the ampacities for dwelling services. There was no scientific study or electrical engineering data that could be used to compare to what loads may be imposed on dwellings constructed at the present, not an indication of the variations of electrical appliances beyond a range and refrigerator. This theory permitting overloading of service conductors was based on annual load data of residential utility use at the time, not to mention how the reasoning allowing reductions in actual loads for a dwelling were surmised. The Panel could recognize that any diversity is already considered in the permitted reduction of loads used as the method of calculation. To permit the continued practice of overloading conductors just due to being dwelling service conductors is not consistent with the goal of practical safeguarding of persons and property from hazards of the use of electricity.

Panel Meeting Action: Reject

Panel Statement: The submitter has not provided substantiation that electric loads have increased. CMP-6 requests the submitter provide documented failures due to use of these calculations/tables. The submitter has not provided evidence of the overloading of conductors.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 9 Negative: 1

Explanation of Negative:

KENT, G.: Clearly by our actions of providing a percentage we have clarified this is a calculation of derating the service based on diversity. Calculations of the necessary service amperage requirement should be found in Article 220 not Article 310.

6-47 Log #1118 NEC-P06 **Final Action: Reject**
(310.15(B)(7) and Table 310.15(B)(7))

Submitter: Phil Simmons, Simmons Electrical Services

Comment on Proposal No: 6-49a

Recommendation: Reject the Proposal.

Substantiation: There are many problems with the Panel action on this Proposal. These include:

1. The section now simply refers to a feeder without qualification. The Panel in the past has consistently required that a feeder carry the entire load of the service to qualify for the diversity. With the accepted language, a single branch circuit, for a heating load requiring a 125% factor could be supplied by a feeder sized at 83% of the rating of the load. This would obviously be unsafe.
2. The Table allows a conductor to be used at a calculated load that has always been greater than what we know to be the maximum rating of the conductor from Table 310.15(B)(16).
3. No reference is made to the sizing rules for the neutral in 250.24(C).
4. The first sentence is really confusing.

If there is any validity to the assertion that the service conductors are oversized, the load calculations in Article 220 should be revised. This section gets changed every NEC cycle and should simply be eliminated. Surely, we all have better things to do that try to fix this section over and over!

Panel Meeting Action: Reject

Panel Statement: The panel action in Comment 6-52 addresses the submitter's concern relative to his item 1. The submitter's item 2 is technically incorrect. Rules for grounded conductors are retained which addresses the submitter's concern in item 3.
CMP-6 refers the submitter to Comment 6-52.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

6-48 Log #1119 NEC-P06 **Final Action: Reject**
(310.15(B)(7) and Table 310.15(B)(7))

Submitter: Phil Simmons, Simmons Electrical Services

Comment on Proposal No: 6-50

Recommendation: Accept the Proposal to delete 310.15(B)(7) and Table 310.15(B)(7).

Substantiation: Over the last 30 years or better this antiquated paragraph and Table has been a contentious issue, more recently due to changes in the definition of a main power feeder, the reference to the 60-degree ampacity required for service cable passing through thermal insulation, and that the Table allows a conductor to be used at a calculated load that has always been greater than what we know to be the maximum rating of the conductor from Table 310.15(B)(16).

There are several assumptions as to why this Table was allowed to be used, most commonly a perceived diversity of electrical loads in the dwelling. When complaints are being made by homeowners, who have recently purchased a brand new dwelling, that when the heat pump starts the lights go dim, we realize that the perceived diversity has evaporated. Responding to those complaints that the home meets minimum National Electrical Code standards does not ease their concerns, it only amplifies the fact that we should not permit this situation any longer, and as we strive to eliminate other Sections the Code that permit deliberate overloading of a system.

If there is any validity to the assertion that the service conductors are oversized, the load calculations in Article 220 should be revised. This additional table that gets changed every NEC cycle should be eliminated. Surely, we all have better things to do that try to fix this section over and over!

Panel Meeting Action: Reject

Panel Statement: The submitter has not provided substantiation that electric loads have increased. Nor has he provided substantiation that light dimming conditions referenced are relevant to this section. CMP-6 requests the submitter provide documented failures due to use of these calculations/tables.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 9 Negative: 1

Explanation of Negative:

KENT, G.: While I do not agree on the substation, I do support deletion. Clearly by our actions of providing a percentage we have clarified this is a calculation of derating the service based on diversity. Calculations of the necessary service amperage requirement should be found in Article 220 not Article 310.

6-49 Log #1210 NEC-P06 **Final Action: Reject**
(310.15(B)(7))

Submitter: Leo F. Martin, Sr., Martin Electrical Consulting

Comment on Proposal No: 6-49a

Recommendation: Delete section 310.15(B)(7) and Table 310.15(B)(7).

Substantiation: Dwellings are increasing in square footage. This may be of no significance when a minimum service/feeder demand load is calculated in accordance with Article 220, parts III and/or IV, but consumer habits are leaning heavily towards an increase in appliances/products that use electricity. Many homes today have a swimming pool, air conditioning, garage door openers, spa/hot tub, as well as others. Not all jurisdictions require licensed individuals perform electrical installations. In many areas AHJ's are not afforded the opportunity to perform a plan review for dwellings. This section and table are antiquated and need to be deleted. The ampacity of conductors should be in accordance with Table 310.15(B)(16).

Panel Meeting Action: Reject

Panel Statement: If qualified individuals are not employed and buildings are not inspected, requiring one table over another is not going to make a difference. The submitter has not provided technical substantiation to support his recommendation.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 9 Negative: 1

Explanation of Negative:

KENT, G.: Clearly by our actions of providing a percentage we have clarified this is a calculation of derating the service based on diversity. Calculations of the necessary service amperage requirement should be found in Article 220 not Article 310.

6-50 Log #1324 NEC-P06 **Final Action: Reject**
(310.15(B)(7))

Submitter: James F. Williams, Fairmont, WV

Comment on Proposal No: 6-49a

Recommendation: Revise text to read as follows:

310.15 Ampacities for Conductors Rated 0–2000 Volts.

(B) Tables.

(7) 120/240 <u>or 208Y/120</u> Volt, Single-Phase Dwelling Services and Feeders. For service and feeder conductors of 120/240 <u>or 208Y/120</u>-volt, single-phase, individual dwelling unit one-family, two-family, and multifamily service ratings from 100 amperes through 400 amperes, an adjustment factor of 0.83 of the service ampere rating shall be permitted to be used to determine the size of the ungrounded conductors. The grounded conductor shall be permitted to be smaller than the ungrounded conductors, provided that the requirements of Sections 215.2, 220.61, and 230.42 are met. **[ROP 6–49a]**

Substantiation: Parallel usage in 220.82(A), 220.83, 250.140<exc>(1), 551.4(A) and (B), 551.31(C), 551.73(A), 552.47, and Annex D.

Panel Meeting Action: Reject

Panel Statement: This section has never applied to 208Y/120-volt single phase systems. The neutral conductor in this case carries significant current. The submitter has not provided adequate technical substantiation to effect this change.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

6-51 Log #1368 NEC-P06 **Final Action: Accept in Principle**
(310.15(B)(7))

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)

Comment on Proposal No: 6-49a

Recommendation: Replace the language in 310.15(B)(7) with the following:

(7) **120/240 Volt, Single-Phase Dwelling Services and Feeders.** For one-family dwellings and the individual dwelling units of two-family and multifamily dwellings, service and feeder conductors supplied by a single phase, 120/240-volt system shall be permitted be sized in accordance with 310.15(B)(7)(a) through (c).

(a) For a service rated 100 through 400 amperes, the service conductors supplying the entire load associated with a one-family dwelling or the service conductors supplying the entire load associated with an individual dwelling unit in a two-family or multifamily dwelling shall be permitted to have an ampacity not less than 83% of the service rating.

(b)For a feeder rated 100 through 400 amperes, the feeder conductors supplying the entire load associated with a one-family dwelling or the feeder conductors supplying the entire load associated with an individual dwelling unit in a two-family or multifamily dwelling shall be permitted to have an ampacity not less than 83% of the feeder rating.

Exception: In no case shall a feeder originating at the service equipment be required to have an ampacity greater than that of the service conductors supplying a one-family dwelling or an individual dwelling unit of a two-family or multifamily dwelling.

(c) Grounded conductors shall be permitted to be sized smaller than the ungrounded conductors provided the requirements of 220.61 and 230.42 for service conductors or the requirements of 215.2 and 220.61 for feeder conductors are met.

<u>Informational No. 1: The conductor ampacity may require other correction or adjustment factors applicable to the conductor installation.</u>

<u>Informational No. 2: See example DXXX in Annex D.</u>

Substantiation: The language developed by CMP-6 does not adequately address multifamily dwellings and is somewhat confusing. The proposed language is clearer and easier to understand.

Panel Meeting Action: Accept in Principle

Panel Statement: See panel action and statement on Comment 6-52.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 9 Negative: 1

Explanation of Negative:

STACEY, J.: The panel action should have been "Reject." See my comments on 6-41 and 6-52

6-52 Log #1428 NEC-P06 **Final Action: Accept in Principle**
(310.15(B)(7))

Submitter: Christel K. Hunter, Alcan Cable, a General Cable Company

Comment on Proposal No: 6-49a

Recommendation: Replace the language in 310.15(B)(7) with the following:

<u>(7) **120/240 Volt, Single-Phase Dwelling Services and Feeders.** For one-family dwellings and the individual dwelling units of two-family and multifamily dwellings, service and feeder conductors supplied by a single phase, 120/240-volt system shall be permitted be sized in accordance with 310.15(B)(7)(a) through (c).</u>

<u>(a) For a service rated 100 through 400 amperes, the service conductors supplying the entire load associated with a one-family dwelling or the service conductors supplying the entire load associated with an individual dwelling unit in a two-family or multifamily dwelling shall be permitted to have an ampacity not less than 83% of the service rating.</u>

<u>(b) For a feeder rated 100 through 400 amperes, the feeder conductors supplying the entire load associated with a one-familydwelling or the feeder conductors supplying the entire load associated with an individual dwelling unit in a two-family or multifamily dwelling shall be permitted to have an ampacity not less than 83% of the feeder rating.</u>

<u>Exception: In no case shall a feeder originating at the service equipment be required to have an ampacity greater than that of the service conductors supplying a one-family dwelling or an individual dwelling unit of a two-family or multifamily dwelling.</u>

<u>(c) Grounded conductors shall be permitted to be sized smaller than the ungrounded conductors provided the requirements of 220.61 and 230.42 for service conductors or the requirements of 215.2 and 220.61 for feeder conductors are met.</u>

<u>Informational No. 1: The conductor ampacity may require other correction or adjustment factors applicable to the conductor installation.</u>

<u>Informational No. 2: See example DXXX in Annex D.</u>

Substantiation: The panel proposal goes a long way toward addressing the difficulties in application this code allowance has generated over the last few years. CMP-6 Chairman Scott Cline came up with the idea to provide a simple multiplier and accompanying language that would allow this code section to remain in effect, while also addressing concerns raised since the original language and table did not allow for applications where the service entrance and feeder conductor ampacities might need to be adjusted for temperature or number of conductors. After further review of the language, the proposed

language is submitted to further clarify the requirements and to address the inadvertent exclusion of feeders to individual units in multifamily buildings.
Panel Meeting Action: Accept in Principle
Revise text to read as follows:

(7) **120/240 Volt, Single-Phase Dwelling Services and Feeders.** For one-family dwellings and the individual dwelling units of two-family and multifamily dwellings, service and feeder conductors supplied by a single phase, 120/240-volt system shall be permitted be sized in accordance with 310.15(B)(7)(a) through (d).

(a) For a service rated 100 through 400 amperes, the service conductors supplying the entire load associated with a one-family dwelling or the service conductors supplying the entire load associated with an individual dwelling unit in a two-family or multifamily dwelling shall be permitted to have an ampacity not less than 83% of the service rating.

(b) For a feeder rated 100 through 400 amperes, the feeder conductors supplying the entire load associated with a one-family dwelling or the feeder conductors supplying the entire load associated with an individual dwelling unit in a two-family or multifamily dwelling shall be permitted to have an ampacity not less than 83% of the feeder rating.

(c) In no case shall a feeder for an individual dwelling unit be required to have an ampacity greater than that of its 310.15(B)(7)(a) or (b) conductors.

(d) Grounded conductors shall be permitted to be sized smaller than the ungrounded conductors provided the requirements of 220.61 and 230.42 for service conductors or the requirements of 215.2 and 220.61 for feeder conductors are met.

Informational Note No. 1: It is possible that the conductor ampacity will require other correction or adjustment factors applicable to the conductor installation.

Informational Note No. 2: See example DXXX in Annex D.

Panel Statement: CMP-6 accepts the submitter's text but modifies the exception to become new (B)(7)(c).

CMP-6 edits Informational Note No. 1 to delete "may."

Number Eligible to Vote: 10
Ballot Results: Affirmative: 9 Negative: 1
Explanation of Negative:

STACEY, J.: The panel action should have been "Reject". Table 310.15(B)(7) should stay in place. There where no request from the public to turn this table into a calculation. There is no proof of any failures or deficiencies with the table. It appears that the new text part (c) is in conflict with note Info Note 1.

See my comments on 6-41 and 6-45.

Comment on Affirmative:

KENT, G.: Although deletion is the proper action but does not appear to have the support of the committee, this option at least offers some clarity to the wording.

6-53 Log #1558 NEC-P06 **Final Action: Accept in Principle**
(310.15(B)(7))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 6-49a
Recommendation: Accept the proposal in principle. Revise text to read as follows:

For service or feeder conductors of 120/240-volt single phase systems rated 100 through 400 amperes and used to supply all loads that are part of or associated with an individual dwelling unit of a single-family, two-family, or multifamily dwelling, an adjustment factor of 0.83 shall be permitted to be applied to the service or feeder ampere rating for the purpose of determining the size of the ungrounded conductors.

Substantiation: This is a largely editorial comment that flows better and resolves the problem that the panel text refers to two-family and multi-family service ratings, and often the relevant rating will not be a service rating but a feeder rating instead. Although not intended, the panel text does support an interpretation that this provision applies to a multifamily service rating, since the individual dwelling unit rating in such an occupancy would be supplied by a feeder and would not have a "service rating". The comment also retains the important concept that the provision only applies to conductors that see the entire load and therefore benefit from the diversity present is such a load.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and statement on Comment 6-52.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9 Negative: 1
Explanation of Negative:

STACEY, J.: The panel action should have been "Reject." See my comments on 6-41, 6-45 and 6-52.

Comment on Affirmative:

KENT, G.: See statement in 6-52.

6-54 Log #1590 NEC-P06 **Final Action: Accept in Principle**
(310.15(B)(7))

Submitter: Scott Cline, Monterey Park, CA
Comment on Proposal No: 6-49a
Recommendation: Revise the first sentence of Proposal 6-49a Accepted text as follows: delete "an adjustment factor of 0.83" and replace with "83 percent" instead.
Substantiation: Examples of text elsewhere in the Code, such as 310.60©(2)(b), 430122(A), 630.31(A)(1), etc, utilize the percentage wording. It is consistent with existing NEC usage.

Three Comments are submitted for this sentence. Combined they would read: "For service and feeder conductors of 120/240-volt, single-phase, individual dwelling unit one-family, two-family, and multifamily service ratings from 100 amperes through 400 amperes, 83 percent of the 230.79 service ampere rating shall be permitted to be used as the minimum load to determine the size of the ungrounded conductors."

Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and statement on Comment 6-52.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9 Negative: 1
Explanation of Negative:

STACEY, J.: The panel action should have been "Reject." See my comments on 6-41, 6-45 and 6-52.

Comment on Affirmative:

KENT, G.: See statement in 6-52.

6-55 Log #1591 NEC-P06 **Final Action: Reject**
(310.15(B)(7))

Submitter: Scott Cline, Monterey Park, CA
Comment on Proposal No: 6-49a
Recommendation: Revise the first sentence of the 6-49a Accepted text as follows: add "230.79" between the words "of the" and "service ampere rating" within the sentence.
Substantiation: 230.79 is the direct reference to the NEC source of the "Service Rating" value.

Three Comments are submitted for this sentence. Combined they would read: "For service and feeder conductors of 120/240-volt, single-phase, individual dwelling unit one-family, two-family, and multifamily service ratings from 100 amperes through 400 amperes, 83 percent of the 230.79 service ampere rating shall be permitted to be used as the minimum load to determine the size of the ungrounded conductors."

Panel Meeting Action: Reject
Panel Statement: The service rating of 230.79 is not necessarily applicable to all the conditions of 310.15(B)(7).
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9 Negative: 1
Explanation of Negative:

STACEY, J.: The panel action should have been "Reject." See my comments on 6-41, 6-45 and 6-52.

6-56 Log #1592 NEC-P06 **Final Action: Accept in Principle**
(310.15(B)(7))

Submitter: Scott Cline, Monterey Park, CA
Comment on Proposal No: 6-49a
Recommendation: Revise the first sentence of the 6-49a Accepted text as follows: add "as the minimum load" between "to be used" and "to determine" within the sentence.
Substantiation: This will proactively state the mathematically obvious result of scientific units which results from the service rating (amps) times 0.87 (87%), and that it is a minimum load value still subject to the other adjustments of 310.15(B).

Three Comments are submitted for this sentence. Combined they would read: "For service and feeder conductors of 120/240-volt, single-phase, individual dwelling unit one-family, two-family, and multifamily service ratings from 100 amperes through 400 amperes, 83 percent of the 230.79 service ampere rating shall be permitted to be used as the minimum load to determine the size of the ungrounded conductors."

Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and statement on Comment 6-52.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9 Negative: 1
Explanation of Negative:

STACEY, J.: The panel action should have been "Reject." See my comments on 6-41, 6-45 and 6-52.

Comment on Affirmative:

KENT, G.: See statement in 6-52.

6-57 Log #1594 NEC-P06 **Final Action: Reject**
(310.15(B)(7))

Submitter: Scott Cline, Monterey Park, CA
Comment on Proposal No: 6-49a
Recommendation: Add an Informational Note and Annex item as follows:
Informational Note No. 4: See example DXXX in Annex D.
The example would show a restructured form of the 2011 Table 310.15(B)(7). Its content would be:
Example DXXX : Partial listing of possible conductor AWG or kcmil sizes for 310.15(B)(7) applications, showing only 75°C (167°F) conductors, under conditions of installation which do not require any other adjustments.
The Table's title and title heading would be unused. Only the portion of the existing Table 310.15(B)(7) below the double line would be used, and one column heading must be edited: the heading of the first column would need to have "or Feeder" deleted since the relationship is always to the "Service Rating" even for feeders. It should read "Service Rating (Amperes)" The rest of the Table to be used as-is.
Substantiation: The purpose would be as a helpful transition from the Table method to 6-49a's easier adjustment factor method. The Info Note and Annex could be removed after a couple of cycles.
The wording "AWG or kcmil" are used purposely instead of "size" to avoid the ambiguity of the term "size" as it relates to conductors. Does "size" mean "physical size" or "ampacity"?
Panel Meeting Action: Reject
Panel Statement: The addition of the table will add more confusion than clarity.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9 Negative: 1
Explanation of Negative:
WALL, C.: Inclusion of a table adds clarity and usability. Inclusion of a table in the example along with a reference to 310.15(B)(7) new informational note 1, added by comment 6-52, would make note of the need to consider adjustment factors.
Comment on Affirmative:
LAIDLER, W.: The panel was correct in the action to include an example in the annex to provide the code user a reference to apply the revised code language to 310.15(B)(7). This 83% permitted adjustment factor for the services and feeders described in 310.15(B)(7) is simply a conversion of the 2011 Table 310.15(B)(7). This action was taken to ensure that conductors that are being installed with the permitted 83% adjustment factor are still subject to the correction and adjustment factors required in Article 310. The panel made a commitment to remove the table from 310.15(B)(7) for the 2014 NEC and the inclusion of the table or any resemblance to the table is in conflict with that action.

6-58 Log #589 NEC-P06 **Final Action: Accept in Principle**
(310.15(B)(7), Informational Note 2)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 6-49a
Recommendation: Revise text to read as follows:
310.15 Ampacities for Conductors Rated 0–2000 Volts.
(B) Tables.
(7) 120/240 Volt, Single-Phase Dwelling Services and Feeders.
Informational Note No. 2: See example D~~XXX~~ <correct reference> in Annex D.
Substantiation: I was unable to find a reference to 6-49a in Annex D.
Panel Meeting Action: Accept in Principle
Panel Statement: CMP-6 directs the submitter to the A2013 ROP Draft Annex D7, Page 70–857. The A2013 ROP Draft is correct.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

6-59 Log #1593 NEC-P06 **Final Action: Reject**
(310.15(B)(7), Informational Note 3 (New))

Submitter: Scott Cline, Monterey Park, CA
Comment on Proposal No: 6-49a
Recommendation: Add an Informational Note No. 3:
Informational Note No. 3: Section 310.15(B)(7) excludes 208Y/120-Volt systems (single or three phase) due to the additional heat from the presence of a third current carrying conductor.
Substantiation: I realize that the NEC is not a design manual, but this issue is so often misunderstood that it seems worth the print space to help assure that AHJs have proper and easy tools to use, and to help avoid all the repeated proposals and comments.
Panel Meeting Action: Reject
Panel Statement: The submitter's text does not add clarity.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9 Negative: 1
Explanation of Negative:
CLINE, S.: In opposition to the Panel's action:
This Comment should have been accepted.
I believe that without a note such as this, incorrect interpretations by AHJs and installers applying this section for 208Y/120-Volt derived systems will continue.
I believe that it is a disservice to the usability of the users of the NEC to not have this added Informational Note. Over and over again, NFPA get requests to edit this section to include the 208Y/120-Volt systems, and we hear of or read about people who are sure that the section applies to 208Y/120-Volt Single Phase systems as if they were the same.
People are constantly confused by this seeming inconsistency. They do not think of, or they do not comprehend, the physics differences between the two systems.

6-60 Log #1120 NEC-P06 **Final Action: Accept**
(Table 310.15(B)(21))

Submitter: Phil Simmons, Simmons Electrical Services
Comment on Proposal No: 6-64
Recommendation: Continue to Reject the Proposal.
Substantiation: The submitter has failed to provide sufficient technical justification for the Proposal. A fact finding report that demonstrates that this product is suitable for the proposed application has not been provided. There is no indication how one would determine whether the conductor is 30% or 40% conductivity material. In addition, there is no indication that terminals on equipment are designed, tested and suitable for terminating copper-clad steel conductors.
Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

6-61 Log #833 NEC-P06 **Final Action: Accept**
(310.15(C))

Submitter: Robert Huddleston, American Chemistry Council
Comment on Proposal No: 6-66
Recommendation: Accept proposal 6-66 as worded by the submitter.
Substantiation: This proposal should have been accepted by the Panel. The equation shown under 310.15(C) has units shown for Tc and Ta, and yet there are no units shown for Rdc. The units submitted with this proposal are correct. The Panel should include these units, or should completely eliminate the equation from the text of the Code, as without the units it is basically useless.
Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

6-62 Log #98 NEC-P06 **Final Action: Accept**
(310.60(C)(1))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 6-68
Recommendation: The Correlating Committee directs that the panel clarify the panel action on this proposal, and notes that the first sentence is not written in mandatory language as required by the NEC Style Manual.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise text to read as follows:
(1) **Grounded Shields.** Ampacities shown in Table 310.60(C)(69), Table 310.60(C)(70), Table 310.60(C)(81), and Table 310.60(C)(82) shall apply for cables with shields grounded at one point only. Where shields for these cables are grounded at more than one point, ampacities shall be adjusted to take into consideration the heating due to shield currents.
Informational Note: Tables other than those listed contain the ampacity of cables with shields grounded at multiple points.
Panel Statement: CMP-6 accepts the direction of the Correlating Committee to clarify the panel action on Proposal 6-68. CMP-6 adds an informational note for clarity.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

6-63 Log #716 NEC-P06 **Final Action: Accept**
(310.104)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 6-70
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.
The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for

uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

6-64 Log #834 NEC-P06 **Final Action: Accept in Part**
(310.104)

Submitter: Robert Huddleston, American Chemistry Council
Comment on Proposal No: 6-71
Recommendation: Delete Informational Note at end of 310.104.
Substantiation: This proposal should have been accepted in principal by the Panel. The submitter is correct in that electroendosmosis is not the correct word to describe the phenomenon in question. However, this Informational Note is not worthy of inclusion in the NEC as it does nothing to assist users of the Code in their application, and describes a very atypical circumstance that the vast majority of Code users will never experience. The Informational Note should be deleted completely.
Panel Meeting Action: Accept in Part
Panel Statement: CMP-6 accepts retaining part of the informational note. CMP-6 does not accept deletion of the first two sentences of the informational note. CMP-6 affirms that the first two sentences are still valid and useful for users of the code.

See panel action and statement on Comment 6-65.

Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

6-65 Log #1429 NEC-P06 **Final Action: Accept**
(310.104)

Submitter: Christel K. Hunter, Alcan Cable, a General Cable Company
Comment on Proposal No: 6-71
Recommendation: Revise text to read as follows:
310.104 Conductor Constructions and Applications.
Insulated conductors shall comply with the applicable provisions of Table 310.104(A) through Table 310.104(E).
Informational Note: Thermoplastic insulation may stiffen at temperatures lower than -10°C (+14°F). Thermoplastic insulation may also be deformed at normal temperatures where subjected to pressure, such as at points of support. ~~Thermoplastic insulation, where used on dc circuits in wet locations, may result in electroendosmosis may result in the migration of plasticizer between the conductor and insulation. Equipment exposed to conductor terminations should be compatible with plasticizer.~~
Substantiation: This last part of this informational note does not provide useful information. There is controversy about the effects of both electroendosmosis and plasticizer migration, and this note does not provide any actionable information to the users of the Code. Instead, it is likely to lead to more questions and confusion.
Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

6-66 Log #145 NEC-P06 **Final Action: Accept**
(Table 310.104(A))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-15h
Recommendation: The Correlating Committee understands that the panel action in this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7.

It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 6 for action.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-6 accepts the direction of the Correlating Committee to review and consider. CMP-6 agrees with the action of the addition of "and switchgear" in Table 310.104(A).
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

ARTICLE 312 — CABINETS, CUTOUT BOXES, AND METER SOCKET ENCLOSURES

9-22 Log #1559 NEC-P09 **Final Action: Accept**
(312.5(C) Exception (g))

TCC Action: The Correlating Committee understands that the panel statement on this comment erroneously renamed from the preliminary panel discussion. The TCC directs that the phrase "where installed as conduit or tubing" be left in the final text for this subsection.
Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 9-24
Recommendation: Accept the proposal in principle. Revise text to read as follows:

(g) Where installed as conduit or tubing, the ~~allowable~~ cable fill does not exceed <u>the amount</u> that <u>would be</u> permitted for complete conduit or tubing systems by Table 1 of Chapter 9 of this Code and all applicable notes thereto.

Substantiation: This exception was never intended to apply to a conventional raceway system that is complete from box to box, etc. The basic rule is that every cable must have its own direct connection to the cabinet. The exception applies only to a method of bringing multiple cables into the cabinet without those individual connections. The requirements then constrain this permission in a number of ways, including a raceway fill limitation that is more severe than the usual Table 1 Note 2 permission to stuff a raceway cable sleeve to the limits of its physical capacity. The revision suggested in this comment, by making the reference to complete systems subjunctive, clarifies that item (g) does not imply that the cable sleeve covered in the exception is a complete system. The word "allowable" is deleted as redundant because the limitation is simply one on actual fill.
Panel Meeting Action: Accept
Panel Statement: Accept the changes proposed by the submitter and delete the following text: "Where installed as conduit or tubing". This portion of the text is not clear. It leads the reader to believe that the installation described in "g" is somehow different than described in "a through f". Since all of the conditions of the must be met in order to use the installation described in the exception the installation must be the same.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.
Comment on Affirmative:

HARTWELL, F.: The reported panel action conflicts with the reported panel statement, which would support a action to accept in principle. The panel first entertained a motion to accept in principle with the introductory part of the sentence deleted, but finally changed the action to a straight accept, in part because the various allowable "nonflexible raceways" include non-circular raceways such as surface metal raceways. Apparently the panel statement for the accept in principle erroneously remained in the staff report even though the Final Action was to accept. This could easily happen because no statement is required for a motion to accept, and the panel had moved on at this point.

OSBORNE, R.: The panel statement is not reflective of the panel's action to

"Accept". While there was discussion to remove the noted text, the decision to proceed with the text as presented in Comment 9-22 was the point of final agreement.

9-23 Log #723 NEC-P09 **Final Action: Accept**
(312.11(A)(3))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 9-27
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:

FERRARO, J.: It is recognized that increasing voltage from 600 volts to 1000 volts may be applicable to specific installations. However, adequate technical substantiation has not been provided to support the change in this Article.

ARTICLE 314 — OUTLET, DEVICE, PULL, AND JUNCTION BOXES; CONDUIT BODIES; FITTINGS; AND HANDHELD ENCLOSURES

9-24 Log #1282 NEC-P09 **Final Action: Reject**
(314, 404, 408, and 490)

Submitter: Elliot Rappaport, Electro Technology Consultants
Comment on Proposal No: 9-29
Recommendation: Accept proposal.
Substantiation: The Panel Statement indicates that the issue is one of education and not terminology. When the terminology does not reflect the core requirement, then education becomes difficult.

The term "equipment grounding conductor" has a definite purpose that is not uniquely expressed in the term, i.e. "bond the equipment to a terminal at the source of voltage". As a result, there is a misconception that "grounding", without bonding to the source, will make a system safe. On the contrary, connecting equipment to ground without providing the bonding connection back to the source can make equipment less safe by increasing the time to clear the fault.

There is generally insufficient significance placed on the importance of bonding over grounding. Bonding provides sufficient ground fault current back to the source of voltage to operate an overcurrent device and clear the fault quickly. Connection to ground limits the voltage to ground on normally non-current-carrying parts during non-fault conditions. During fault conditions, the value of grounding is minimal since the primary safety concern is to remove the fault voltage as quickly as possible. A path to ground for fault current is not necessary since ground fault current must return to the source of voltage, not to ground.

Renaming this conductor as an "Equipment Bonding Conductor (EBC)" will clarify that the primary purpose of this conductor is to bond to the source in order to provide a known path for ground fault current that will facilitate rapid fault clearing.

It is recognized that the term "EGC" has been in use for a long time and that changing it to EBC will cause some concerns including changing written literature that uses the EGC term. After the initial period of understanding, users will correctly understand the purpose of this conductor and this will enhance the safety of personnel.

Reference to a "nightmare of revisions and changes" is not appropriate where safety is concerned. Documents need only be changed when revisions become necessary. Having the bonding conductor connected to the ground rather than to the source, as implied by the terminology, is a safety issue that is not "thoroughly ingrained" as witnessed by the number of questions raised at inspectors' code sessions and code classes.

The fundamental purpose of this and companion proposals is to clearly state that "systems" are "grounded" and "equipment" is "bonded". The fact that the bonding conductor may be grounded also is secondary to the primary function of bonding.
Panel Meeting Action: Reject
Panel Statement: The submitter suggests that there is a misconception in the industry as to the purpose of equipment grounding conductors, due to the words used in the NEC, without providing any substantive proof or evidence. This debate has been recently completed with no desired change as a result. Proper education of the installer will prove worthy over a modification of terms in the NEC. The panel concludes that CMP 5 should take the lead on this issue.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 9 Negative: 2
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:

SENGUPTA, S.: The submitter's substantiation clearly addresses the requirement of a conductor to provide an effective ground fault current path. Equipment Bonding Conductor (EBC) establishes the path for fault clearance.

YOUNG, R.: The term "equipment grounding conductor" should be replaced with the term "equipment bonding conductor" throughout the NEC - it's a better definition of what is being done. The definition in Art 100 would have to be changed. This conductors purpose is primarily a bonding function and should be described as such. We need to moved towards wording used by the international community and that also will be better understood by those who are new to the electrical industry where the use of these existing terms can be confusing. There has been been no technical reason for rejecting this change. This conductor has always provided a bonding function but does not necessarily always provide a grounding function (such as in the case of a portable generator installed on a separately derived system).

9-25 Log #1252 NEC-P09 **Final Action: Reject**
(314.15)

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 9-32
Recommendation: I recommend the following changes be made to article 314.15 for the issue described in proposal 9-32.
314.15 Damp or Wet Locations. In damp ~~or wet~~ locations, <u>drainage openings not larger than 6 mm (1/4 in.) shall be permitted to be installed in the field in accordance with the manufacturer's instructions. In wet locations,</u> boxes, conduit bodies, and fittings shall be placed or

equipped so as to prevent moisture from entering or accumulating within the box, conduit body, or fitting. Boxes, conduit bodies, and fittings installed in wet locations shall be listed for use in wet locations.
Substantiation: Article 314.15 as it presently stands is very confusing and misleading. When a product is tested by a testing laboratory there is a very different interpretation for "Suitable for Damp Locations" and Suitable for "Wet Locations" Currently article 314.15 appears to treat both damp and wet the same.
Panel Meeting Action: Reject
Panel Statement: The comments suggests drainage openings are only relevant to damp locations, and concerns related to locating or placing boxes, conduit bodies, and/or fittings to prevent moisture from entering or accumulating is only relevant to wet locations. While damp and wet locations are different environments, each require consideration to concerns related to drainage and selection and placement of boxes, conduit bodies, and fittings. The application of these requirements to both damp and wet locations is appropriate.
See panel action and statement on Comment 9-26
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-26 Log #1560 NEC-P09 **Final Action: Accept in Principle**
(314.15)

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 9-35
Recommendation: Accept the proposal wording in principle. Revise text to read as follows:
In damp or wet locations, boxes, conduit bodies, and fittings shall be placed or equipped so as to prevent moisture from entering or accumulating within the box, conduit body, or fitting. <u>Approved drainage openings not larger than 6 mm (¼ in.) shall be permitted to be installed in the field.</u> Boxes, conduit bodies, <u>outlet box hoods,</u> and fittings installed in wet locations shall be listed for use in wet locations.
Substantiation: The panel action is too restrictive. Very few manufacturers adequately address field condensation issues with instructions that will comply with the provision as CMP 9 worded it. However, some control may be needed. This comment adds a requirement to install in "approved" locations, thereby requiring an express finding on the part of the inspector. It is strongly suggested that NEMA companies and testing laboratories review instructions and relevant product standards in this area. After, say two cycles, this topic could then be revisited and the "approved" parameter could be changed to match the ROP wording. Anyone who has opened an outdoor aluminum threaded box and seen the effects of standing water (from condensation and not from inadequate sealing) within understands the necessity for practical relief now, instead of waiting for instructions to catch up to this. CMP 9 did the right thing in the 1996 cycle when it expressly allowed this practice and should do so again. This comment includes the outlet box hood wording accepted as part of proposal 9-33 for completeness.
Panel Meeting Action: Accept in Principle
Revise the wording to read as follows:
"In damp or wet locations, boxes, conduit bodies, and fittings shall be placed or equipped so as to prevent moisture from entering or accumulating within the box, conduit body, or fitting. Boxes, conduit bodies, outlet box hoods, and fittings installed in wet locations shall be listed for use in wet locations. <u>Approved drainage openings not larger than 6 mm (1/4 in.) shall be permitted to be installed in the field in boxes or conduit bodies listed for use in damp or wet locations. For installation of listed drain fittings, larger openings are permitted to be installed in the field in accordance with manufacturer's instructions."</u>
Panel Statement: CMP-9 accepts the submitter's revision to requirement text but determined the new text should be placed at the end of the section and added the text "in boxes or conduit bodies for use in damp and wet locations". This ensures that holes are not drilled in listed fittings and listed outlet box hoods. There is no substantiation provided for allowing such openings to be drilled in listed fittings and listed outlet box hoods. This would introduce many more variables that would need further consideration. An additional statement was added for Listed drain fittings which may require larger holes according to manufacturer's instructions. Drain fittings have been customized for use in certain installations, such as the food and beverage industry, that cannot permit moisture to simply drain out of a box. It must be drained away to a suitable location. When such a fitting is used, limiting the opening hole size to 6mm (1/4 in.) can result in too much constriction that would inhibit flow.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-27 Log #1091 NEC-P09 **Final Action: Reject**
(314.16)

Submitter: Gregory J. Steinman, Thomas & Betts Corporation
Comment on Proposal No: 9-37
Recommendation: This proposal should be held for further study.
Substantiation: Reference Proposal 3-70 for Section 300.15. CMP 3 in their panel statement to support their reject position noted a fact finding study is needed to allow new technology into the NEC. CMP 9 needs to coordinate their position and obtain all the implications of the new technology before allowing this "connector fitting" as an option.
Panel Meeting Action: Reject
Panel Statement: The new text provides a limitation that a clamp assembly be listed and marked for use with a specific nonmetallic box. The new rule then provides guidance on box fill requirements that apply to such listed assemblies. The listing of the assembly with its integral enclosure for the terminal (which is a separate housing from the outlet box, but is an ancillary part of the overall listed assembly) addresses the efficacy of the system to provide a suitable wiring method. See Panel Action on Comment 9-20.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-28 Log #356 NEC-P09 **Final Action: Accept**
(314.16(A))

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 9-37a
Recommendation: Delete the proposed text for new 314.16(A)(3).
Substantiation: This Panel proposal should be rejected. See NEMA comments to the Panel Actions on Proposals 17-30 and 18-68 and the explanation of negative from T. Blewitt on the Panel Action to Proposal 17-30.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-29 Log #1561 NEC-P09 **Final Action: Reject**
(314.16(A)(3) (New))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 9-37a
Recommendation: Accept the proposal in principle. Revise text to read as follows:
(3) Luminaire Canopies. Where a luminaire or paddle fan canopy is marked with its volume in accordance with 410.20 or 422.19, the marked volume shall not be counted as part of the volume of the box to which it is mounted. The marked canopy volume shall be compared with the volume required for the luminaire or ceiling-suspended (paddle) fan supply wires in accordance with Table 314.16(B) in order to determine whether additional volume in the box is required to accommodate the luminaire supply wires.
Substantiation: CMP 17 is imposing similar rules in Article 422 and this provision needs to be correlated with that action. This wording lines up with the panel proposal that addressed luminaires, but includes paddle fans.
Panel Meeting Action: Reject
Panel Statement: NEMA recognizes that 314.16(B)(1) already addresses the accommodation of fixture wires that are part of the construction of luminaires and ceiling-suspended (paddle) fans. See panel actions and statements on Comments 9-28, 17-10, & 18-32.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-30 Log #17 NEC-P09 **Final Action: Reject**
(314.16(B)(4))

Submitter: Jericho Housman, SD Housing Development Authority
Comment on Proposal No: 9-38
Recommendation: Revise text to read as follows:
For each yoke or strap containing one or more devices or equipment, a double volume allowance in accordance with Table 314.16(B) shall be made for each yoke or strap based on largest conductor connected to a device(s) or equipment supported by that yoke or strap.
<u>Where a Ground-Fault Circuit Interrupter receptacle device is used, a triple volume allowance in accordance with Table 314.16(B) shall be made based on largest conductor connected to device.</u>
Substantiation: The existing language is modified to eliminate box over-fill based on the large size of the Ground-Fault Circuit Interrupter receptacle device(s).
Panel Meeting Action: Reject
Panel Statement: The double volume allowance placed in the NEC in the 1990 cycle was originally intended to only apply to dimmers and ground-fault receptacles. However, subsequent discussion substantiated that the final device installed in a box was often determined after the rough inspection and final wall finish was complete. Therefore the decision was made to make the allowance apply generally. The substantiation in this proposal, and in countless other similar proposals over the years, supports the concept of a single allowance for all but certain devices, as was originally proposed in the 1987 cycle. It does not support a triple allowance for devices.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-31 Log #1166 NEC-P09 **Final Action: Reject**
(314.17(E))

Submitter: Carlo Compagnone, Jr., Compa Covers, Inc.
Comment on Proposal No: 9-41
Recommendation: This proposal should be accepted.
Substantiation: The NEC contains provisions for protecting the wiring at all points of vulnerability throughout the construction process. Blatantly, however, the NEC fails to ensure the integrity of the wiring once it reaches the outlet box. At this point, wires sit exposed for months, while various tradesmen work, subjecting the wiring in the outlet boxes to damage from plaster, power routers, insulation and paint contamination. This is a problem that must be addressed by the NEC with specificity that includes a mandatory provision for protecting wiring within the electrical outlet box.

The Panel statement acknowledges the vulnerability of electrical equipment during the construction phase and the need to protect this equipment. The Panel states that the focus should be on compliance of the final installation, and not on how to protect this vulnerable electrical equipment, however this proposal is not in regard to equipment- it is in regard to the unprotected wiring inside the outlet box.

While there are broad provisions contained in the NEC for safequarding all electrical equipment and connections from damage and contamination, these provisions are not specific enough. For instance, Section 110.12, which provides that the equipment must be installed in a "neat and workmanlike manner," and states that 'there shall be no damaged parts that may adversely affect safe operation or mechanical strength of the equipment...." The concept that electrical equipment be neat and workmanlike is unenforceable, and ultimately meaningless. In addition, despite its use of the word "equipment," Section 110.12 is not broad enough to address the concerns raised in Proposal 9-41. Nowhere in Section 110.12 is there a reference to wiring or the protection of wiring within electrical outlet boxes during the construction phase. The section only refers to equipment, including, "busbars, wiring terminals, insulators, and other surfaces...." It is not enough to assume Section 110.12 requires the protection of wiring in electrical boxes.

The concept of providing specific solutions for the protection of wiring is not foreign to the NEC, which mandates prescriptive requirements upon all areas of the wiring, except for wiring within the electrical outlet box. For example, Article 300 provides for very detailed methods of safeguarding cables which are subject to damage during the construction phase. Article 300.4 requires the installation of a nail plate where cable wiring is subject to nail or screw penetration. Article 300.4(B)(1) requires installation of bushings or grommets on all metal edges of punched out or factory-installed holes. If an electrician does not meet these Code requirements, wires are damaged and the inspection is deemed a failure.

The Panel indicates that they do not want inspectors to go out of their way during inspections, showing more concern for the comfort of the inspector than for safety. The Panel completely disregards the actual practice of inspectors, who do not inspect each and every box. Unless there is a specific method imposed for protecting the interior of the electrical box, there will continue to be safety issues.

In essence, the Panel is simply hoping for the best, rather than requiring it. Unfortunately, in reviewing the statistics, this is not good enough. Specifically, many home fires arise from faulty premises wiring group equipment resulting from damage to wiring within the electrical outlet box. According to statistics provided by the national Fire Protection Association ("NFPA"), there was no improvement over three (3) years relative to non-confined home structure fires. In 2006, there were 16,380 reported U.S. non-confined home structure fires, with 145 civilians dead and 458 civilians injured. (Please see "Home Electrical Fires," John R. Hall, Jr., March 2009, National Fire Protection Association) In 2009, there were 13,080 reported U.S. non-confined home structure fires, with 113 civilian deaths and 438 civilians injured. (Please see "Home Electrical Fires," John R. Hall, Jr., January 2012, National Fire Protection Association) Despite the decrease in the number of reported non-confined home structure fires, just 32 less civilian deaths and 20 less civilian injuries were reported.

In leaving this area of the NEC open to interpretation, with no specific mandate for how to protect the integrity of the electrical wiring within the outlet box during construction, the NEC simply fails to safeguard persons and property. This is unacceptable.
Panel Meeting Action: Reject
Panel Statement: See panel statement on comment 9-18.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-32 Log #1373 NEC-P09 **Final Action: Accept**
(314.28(A)(3))

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 9-67
Recommendation: Accept the panel action but replace the text for clarity and editorially revise the entire subsection:
(3) Smaller Dimensions. Listed ~~B~~boxes or listed conduit bodies of dimensions less than those required in 314.28(A)(1) and (A)(2) shall be permitted for installations of combinations of conductors that are less than the maximum conduit or tubing fill (of conduits or tubing being used) permitted by Table 1 of Chapter 9~~,~~. ~~provided the box or conduit body has been listed for, and is permanently marked with, the maximum number and maximum size of conductors permitted.~~
~~The conductor fill for listed conduit bodies of dimensions less than those required in 314.28(A)(2) and having a radius of the curve to the centerline not less than as indicated in Table 2, Chapter 9 for one shot and full shoe benders shall be limited only to Table 1 Chapter 9 as applied to entering raceways. These conduit bodies shall be marked to show they have been specifically evaluated in accordance with this provision.~~
Listed conduit bodies of dimensions less than those required in 314.28(A)(2) having a radius of the curve to the centerline not less than as indicated in Table 2, Chapter 9 for one shot and full shoe benders, shall be permitted for installations of combinations of conductors permitted by Table 1 of Chapter 9. These conduit bodies shall be marked to show they have been specifically evaluated in accordance with this provision.
Where the permitted combinations of conductors for which the box or conduit body has been listed are less than the maximum conduit or tubing fill permitted by Table 1 of Chapter 9, the box or conduit body shall be permanently marked with the maximum number and maximum size of conductors permitted.
Substantiation: The text proposed by the panel action is difficult to interpret and may introduce unintended confusion.
The term "conductor fill", if introduced into this Section could create confusion with the requirement in Section 314.16(B)(1). The term "combinations of conductors" is used in the present text of 314.28(A)(3) and is appropriate as the subject for this new text.
Use of the strong terminology "shall be limited only by", could be interpreted as precluding the requirement in 314.16(B)(1) for these conduit bodies. The qualifier "as applied to entering raceways" does not sufficiently mitigate the risk of potentially widespread misinterpretation.
Finally, the panel's action eliminated, without explanation, the important provision that relieves conduit bodies having this provision from the marking requirement included in the present text. The recommended text maintains the present requirement for conduit bodies without this unique provision and editorially isolates its application in order to avoid the potential for misinterpretation that that marking applies in all cases of conduit bodies having smaller dimensions.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-33 Log #725 NEC-P09 **Final Action: Accept**
(314.30(A))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 9-68
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:

FERRARO, J.: It is recognized that increasing voltage from 600 volts to 1000 volts may be applicable to specific installations. However, adequate technical substantiation has not been provided to support the change in this Article.

9-34 Log #1015 NEC-P09 **Final Action: Hold**
(314.30(A))

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 9-68
Recommendation: Revise text to read as follows:
(A) Size. For conductors sized 4 AWG and larger, ~~H~~handhole enclosures shall be sized in accordance…(remainder unchanged)
Substantiation: The enclosures covered in this article are typically only required to comply with Section 314.28 when the conductors in the enclosure are 4 AWG and larger. This section seems to require compliance with those provisions regardless of size.
Panel Meeting Action: Hold
Panel Statement: The comment contains information hat has not had public review. This is not in compliance with the NEC Style Manual.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.
Comment on Affirmative:

HARTWELL, F.: The panel statement was reported incorrectly. The compliance violation was with respect to the Regulations Governing Committee Projects. This was the statement from the floor, with the expectation that someone would look up the specific provision.

9-35 Log #724 NEC-P09 **Final Action: Accept**
(314, Part IV, Title)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 9-28
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:

FERRARO, J.: It is recognized that increasing voltage from 600 volts to 1000 volts may be applicable to specific installations. However, adequate technical substantiation has not been provided to support the change in this Article.

9-36 Log #811 NEC-P09 **Final Action: Reject**
(314, Part IV, Title)

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 9-28
Recommendation: Proposal 9-28 should be rejected.
Substantiation: Panel 9 should reconsider accepting this proposal. Panel Member Ferraro is correct in his negative ballot and statement. There was not technical substantiation to allow wiring methods over 600 volts to 1000 volts 10 become a part of 314 Part I, II and III. Leaving 314 Part IV at 600 volts does not affect unique applications in later articles of the NEC.
Panel Meeting Action: Reject
Panel Statement: The panel disagrees with the submitter's assertion of insufficient substantiation which is contrary to the work of the task group working on this issue.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:

FERRARO, J.: It is recognized that increasing voltage from 600 volts to 1000 volts may be applicable to specific installations. However, adequate technical substantiation has not been provided to support the change in this Article.

9-37 Log #726 NEC-P09 **Final Action: Accept**
(314.70(A))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 9-70
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in

Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:

FERRARO, J.: It is recognized that increasing voltage from 600 volts to 1000 volts may be applicable to specific installations. However, adequate technical substantiation has not been provided to support the change in this Article.

9-38 Log #727 NEC-P09 **Final Action: Accept**
(314.70(B))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 9-71
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:

FERRARO, J.: It is recognized that increasing voltage from 600 volts to 1000 volts may be applicable to specific installations. However, adequate technical substantiation has not been provided to support the change in this Article.

9-39 Log #728 NEC-P09 **Final Action: Accept**
(314.70(C))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 9-72
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:

FERRARO, J.: It is recognized that increasing voltage from 600 volts to 1000 volts may be applicable to specific installations. However, adequate technical substantiation has not been provided to support the change in this Article.

ARTICLE 320 — ARMORED CABLE: TYPE AC

7-1 Log #1280 NEC-P07 **Final Action: Reject**
(320 through 340, and 396)

Submitter: Elliot Rappaport, Electro Technology Consultants
Comment on Proposal No: 7-19
Recommendation: Accept proposal.
Substantiation: The Panel Statement refers to the "accuracy to the intended functionality of the circuit". The term "equipment grounding conductor" cannot represent accuracy of the function of the conductor because "grounding" is not its primary function.

The term "equipment grounding conductor" has a definite purpose that is not uniquely expressed in the term, i.e. "bond the equipment to a terminal at the source of voltage". As a result, there is a misconception that "grounding", without bonding to the source, will make a system safe. On the contrary, connecting equipment to ground without providing the bonding connection back to the source can make equipment less safe by increasing the time to clear the fault.

There is generally insufficient significance placed on the importance of bonding over grounding. Bonding provides sufficient ground fault current back to the source of voltage to operate an overcurrent device and clear the fault quickly. Connection to ground limits the voltage to ground on normally non-current-carrying parts during non-fault conditions. During fault conditions, the value of grounding is minimal since the primary safety concern is to remove the fault voltage as quickly as possible. A path to ground for fault current is not necessary since ground fault current must return to the source of voltage, not to ground.

Renaming this conductor as an "Equipment Bonding Conductor (EBC)" will clarify that the primary purpose of this conductor is to bond to the source in order to provide a known path for ground fault current that will facilitate rapid fault clearing.

It is recognized that the term "EGC" has been in use for a long time and that changing it to EBC will cause some concerns including changing written literature that uses the EGC term. After the initial period of understanding, users will correctly understand the purpose of this conductor and this will enhance the safety of personnel.

The fundamental purpose of this and companion proposals is to clearly state that "systems" are "grounded" and "equipment" is "bonded". The fact that the bonding conductor may be grounded also is secondary to the primary function of bonding.
Panel Meeting Action: Reject
Panel Statement: The primary purpose of an equipment grounding conductor is to provide that primary path for fault current in case of a ground fault but can have a secondary purpose to also provide some bonding of the metal. The primary and most important part of the equipment grounding conductor, as evidenced by the sizing requirements in 250.134(A), 250.118, and 250.122, is to provide an appropriately sized conductor so a ground fault will trip the overcurrent protective device.

CMP-7 agrees with the submitter that "equipment bonding conductor" is technically correct, particularly in an ungrounded system. However, CMP-5 has jurisdiction over this term and has rejected the change.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 12 Negative: 2
Explanation of Negative:

NIELSEN, D.: The IEEE agrees with the panel statement that the prime purpose of this conductor is equipment bonding to allow overcurrent devices to operate during a ground fault condition. This panel with qualified and knowledgeable personnel has very astutely recognized what other panels missed. The responsibility of CMP7 is to state or to provide an official statement to CMP5 recommending this change.

RUNYON, G.: The term "equipment grounding conductor" needs to be replaced with "equipment bonding conductor" throughout the NEC. Yes, the term equipment grounding conductor in Article 100 would need to be changed to the term equipment bonding conductor.
Some have argued that it is just a problem of education. Having the word "grounding" in a term describing conductor that is used primarily for a bonding function is not a problem to be solved by education.
The use of the term "equipment grounding conductor" is confusing both for those new to the electrical industry and even for some experienced users. The problem is compounded when dealing with other international standards.
No technical reason has been provided for not making the change. This conductor always provides a bonding function but does not always provide a grounding function such as in the case of a portable generator installed as a separately derived system.
The panel acknowledged that this is technically correct, but rejected it because Panel 5 had not accepted it.

7-2 Log #1237 NEC-P07 **Final Action: Reject**
(320.108, 324.56(B), 324.60, 330.108, 332.108, 334.15(C), 334.108, 335.10(7), 340.10(2), 340.108, 342.2, and 342.60)

Submitter: Gregory L. Runyon, American Chemistry Council
Comment on Proposal No: 7-19
Recommendation: Revise text to read as follows:
"equipment ~~grounding~~ <u>bonding</u> conductor"
Substantiation: The term Equipment Grounding Conductor needs to be replaced. Those opposed have no technical reason for their opposition or any other valid reason. "It is not worth the effort" and "everyone understands what is meant" are common responses to this change.
It is very simple: Grounding electrode conductors are the connection to the earth and accomplish grounding. In the present NEC, Equipment Grounding Conductors and bonding jumpers provide a "path back" to the source. Both are always performing a bonding function. If the Grounding Electrode connection is removed or broken, the bonding function remains intact.
Section 250.4 does not permit the earth (ground) to be used as an effective ground fault current path but the term equipment grounding conductor inherently incorrectly contains the word "ground".
Visualize equipment supplied by a portable generator. The generator frame is not required to be connected to the earth. The "green" wire in the flexible cord is not performing a grounding function but is performing a bonding function.
Visualize building one supplied by a service, having the grounded conductor connected to the grounding electrode system by a grounding electrode conductor. A feeder supplies a second building and a grounding electrode conductor is required for grounding any equipment in the second building. An equipment grounding conductor is required to be installed from building 1 to building 2. Not for grounding, but for bonding, providing an effective fault current path.
Making this change has the added benefit of being more harmonized with other international standards and usage of terminology.
Experienced NEC users have to ignore other concepts in other definitions and requirements to use the existing term. This does not help the future NEC user or provide clarity in the existing NEC. Changing the term is the right thing to do and should be supported.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 7-1.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 12 Negative: 2
Explanation of Negative:

NIELSEN, D.: See my statement on 7-1.

RUNYON, G.: See comment on 7-1.

ARTICLE 324 — FLAT CABLE CONDUCTOR: TYPE FCC

7-3 Log #467 NEC-P07 **Final Action: Accept in Principle**
(324.2.FCC System)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 7-22
Recommendation: Revise text to read as follows:
FCC System. A complete wiring system for branch circuits that is designed for installation under carpet squares. ~~The FCC~~ <u>Such a</u> system includes Type FCC cable and associated shielding, connectors, terminators, adapters, boxes, and receptacles.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term and the NEC manual of style does not permit the definition to contain the defined term. Definitions are not requirements. The proposed changes eliminate the defined term. An alternative, if CMP 7 believes this is a requirement is to place the information somewhere else in Article 324, where it would serve as a valid requirement.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Alternate approach, could be as follows (by eliminating the second sentence):
<u>**Informational Note:** The FCC system includes Type FCC cable and associated shielding, connectors, terminators, adapters, boxes, and receptacles.</u>
Panel Meeting Action: Accept in Principle

Revise text to read as follows:
FCC System. A complete wiring system for branch circuits that is designed for installation under carpet squares. ~~The FCC system includes Type FCC cable and associated shielding, connectors, terminators, adapters, boxes, and receptacles.~~

<u>**Informational Note:** The FCC system includes Type FCC cable and associated shielding, connectors, terminators, adapters, boxes, and receptacles.</u>
Panel Statement: CMP-7 agrees with the submitter that definitions should not include requirements. CMP-7 relocates the second sentence of the definition to an informational note. CMP-7 notes that this complies with the 2011 NEC Style Manual, Section 2.2.2.2.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

ARTICLE 330 — METAL-CLAD CABLE: TYPE MC

7-4 Log #941 NEC-P07 **Final Action: Reject**
(330.2(A)(11)(c))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 7-26a
Recommendation: Revise text to read as follows:
330.10 Uses Permitted.
(A) General Uses. Type MC cable shall be permitted as follows:
(11) In wet locations where a corrosion resistant jacket is provided over the metallic covering and any of the following conditions are met: **[ROP 7–27]**
a. The metallic covering is impervious to moisture.
b. A jacket resistant to moisture is provided under the metal covering. **[ROP 7–27, ROP 7–26a]**
c. The insulated conductors under the metallic covering are ~~listed~~ <u>suitable</u> for use in wet locations. **[ROP 7–27, ROP 7–26a]**
Substantiation: It is not clear to me that the conductors in MC cable are separately listed apart from the cable. The same situation exists for NM cable for sure.
UL White Book 2012:
METAL-CLAD CABLE (PJAZ)
This category covers Type MC metal-clad cable. The cable is rated for use up to 2000 V, and Listed in sizes 18 AWG through 2000 kcmil for copper, 12 AWG through 2000 kcmil for aluminum or copper-clad aluminum, and employs *thermoset or thermoplastic insulated conductors*. It is intended for installation in accordance with Article 330 of ANSI/NFPA 70, ‘‘National Electrical Code’’ (NEC).
NONMETALLIC-SHEATHED CABLE (PWVX) USE
This category covers Types NM-B and NMC-B nonmetallic-sheathed cable, rated 600 V, intended for use in accordance with Article 334 of ANSI/NFPA 70, ‘‘National Electrical Code’’ (NEC), and Listed in copper sizes 14 to 2 AWG inclusive and aluminum or copper-clad aluminum sizes 12 to 2 AWG inclusive. This cable contains *conductors rated 90°C*; however, the ampacities of the cable are those of 60°C conductors as specified in Article 334 and Table 310.16 of the NEC.
Panel Meeting Action: Reject
Panel Statement: It is not up to this panel to determine whether it is suitable for the application or not. Only the AHJ can make that determination based on the installation. To ensure proper installation, the term “listed” should remain in the article.
The 2011 NEC Style Manual provides a list of unenforceable terms which includes “suitable”; see Table 3.2.1.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

7-4a Log #1609 NEC-P07 **Final Action: Reject**
(330.12(1))

Submitter: Phil Simmons, National Armored Cable Manufacturers Assoc.
Comment on Proposal No: 7-28
Recommendation: Accept the proposal. Revise 330.12(1) as follows;
(1) Where subject to severe physical damage
Substantiation: The terms “Physical Damage” and “Severe Physical Damage” are not defined in the NEC. As a result, the differences between the terms will continue to be subject to varying interpretation by the Authority Having Jurisdiction.
The requirements in 300.4 are intended to provide protection against ordinary “Physical Damage” but not against “Severe Physical Damage.” The present prohibition in 330.12(1) against use in locations subject to Physical Damage basically says that Type MC cable cannot be used in any of the conditions where 300.4 provides the protection methods. The present prohibition in 330.12(1) should be corrected.
Addition of the word “severe” to the Uses Not Permitted for Type MC cable provides recognition and guidance that the metal covered cable provides a greater level of protection against physical damage and is differentiated from other wiring methods such as SE and UF that presently have the same limitation of use where subject to physical damage.
Types SE, UF cable, and MC cables contain the same type of insulated conductor. The difference between the cables is the mechanical protection against physical damage provided by the outer metal covering of Type MC cable over the insulated conductors.
The insulated conductors of nonmetallic cables are covered with 0.030 inch of PVC with a typical UL requirement for Tensile Strength of 1,500 PSI. The conductors of MC cable are covered with a 0.012 to 0.025 inch thickness of steel or aluminum with a UL required Tensile Strength of 38,000 to 40,000 PSI. The difference in requirements is substantial as is the difference in mechanical protection provided by a metallic covering.
The protection against physical damage provided by the metallic covering of Type MC will offer more than adequate protection against normal physical damage and differentiate the use of Type MC cable from Types UF and SE where subject to Severe Physical damage.
Panel Meeting Action: Reject
Panel Statement: The submitter has not shown that there is a clear delineation between “physical damage” and “severe physical damage.” No evidence was presented that adding the word “severe” aids the AHJ in determining that Type MC Cable is suitable for one installation in preference to another where the degree of physical damage must be determined.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 11 Negative: 2
Ballot Not Returned: 1 Schumacher, D.
Explanation of Negative:
HUNTER, C.: Section 358.12 for EMT already uses the term “severe physical damage” without concern for delineating between physical damage and severe physical damage. Since there is no aid for the AHJ in the use of either term in 358.12, the term severe physical damage should be preferred for 330.12(1) to delineate MC from less robust non-metallic cable constructions.
STRANIERO, G.: While there may be no clear delineation between the terms “physical damage” and “severe physical damage” it should be acknowledged that there is a clear delineation between the protection afforded to insulated conductors by non-metallic covered cables and metallic covered cables. Adding the term “severe physical damage” will aid the AHJ and designers in judgment calls and enforcement on the use of MC in place of a nonmetallic cable that is not suitable due to exposure to damage.

7-5 Log #1236 NEC-P07 **Final Action: Accept in Principle in Part**
(330.30(B))

TCC Action: The Correlating Committee directs the Panel action be revised for clarity as follows:
“In vertical installations, listed cables with ungrounded conductors 250 kcmil and larger shall be permitted to be secured at intervals not exceeding 3 m (10 ft.).”
Submitter: Dave Mercier, Southwire Company
Comment on Proposal No: 7-29
Recommendation: Proposal 7-29 proposed added text should be revised to limit conductors sizes to 1/0 AWG and larger.
“In vertical installations, cables with ungrounded conductors 1/0 AWG and larger shall be allowed to be secured at intervals not exceeding 3 m (10 ft.) when listed and identified for the use.”
Substantiation: Restricting the wire size to 1/0 AWG and larger addresses the concern of maintaining spacing, limiting movement during fault conditions and complying with the requirements in 110.12 for mechanical execution of work. Supporting test data from a third party is underway and will be provided to the panel with a Fact-Finding Report.
Panel Meeting Action: Accept in Principle in Part
Add new last sentence to read as follows:
In vertical installations, cables with ungrounded conductors 250 kcmil and larger shall be allowed to be secured at intervals not exceeding 3 m (10 ft.) where listed.
Panel Statement: CMP-7 changes “1/0 AWG” to “250 kcmil” and removes “and identified for the use” based on review of the UL Fact-Finding Report, Project 12ME07391, dated November 30, 2012.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

7-6 Log #717 NEC-P07 **Final Action: Accept**
(330.112(A) and (B))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 7-34
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.
The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.
The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that

UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

ARTICLE 332 — MINERAL-INSULATED, METAL-SHEATHED CABLE: TYPE MI

7-7 Log #1173 NEC-P07 **Final Action: Reject**
(332.25)

Submitter: Rick Breezee, Metropolitan Airport Commission / Rep. NFPA Building Code Development Committee (BCDC)
Comment on Proposal No: 7-35
Recommendation: Accept the proposal as originally submitted:

332.25 Performance testing. Where installed as power conductors for fire pumps, emergency systems and legally required standby systems in accordance with Articles 695, 700 and 701, the completed cable installation shall be Insulation Resistance (IR) tested in accordance with the manufacturer's installation instructions and a report shall be submitted to the AHJ.

Substantiation: Similar to the requirements found in NFPA 110 (section 7.13.4.6), components of critical life safety systems should be tested and documentation should be submitted to the AHJ. The panel statement did not address the submission of documentation of the test results to the AHJ. We are not contesting the requirement for these tests that are already in the NEC, but we are asking that documentation of the tests noted should be required to be provided to the AHJ.
Panel Meeting Action: Reject
Panel Statement: The AHJ has the right to request this documentation on critical life safety systems. The original panel statement from the ROP is still applicable: "Manufacturer's instructions address installation of MI with regard to moisture mitigation and IR performance. 110.3(B) requires that instructions from the manufacturer be followed."
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

ARTICLE 334 — NONMETALLIC-SHEATHED CABLE: TYPES NM, NMC, AND NMS

7-8 Log #106 NEC-P07 **Final Action: Accept**
(334.40(B))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 7-49
Recommendation: The Correlating Committee directs the panel to clarify the action on this proposal with respect to the panel action on Proposals 7-50 and 7-51.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept

Revise text to read as follows:

(B) Devices of Insulating Material. Self-contained switches, self-contained receptacles, and nonmetallic sheathed
cable interconnector devices of insulating material that are listed shall be permitted to be used without boxes in exposed cable wiring and for repair wiring in existing buildings where the cable is concealed. Openings in such devices shall form a close fit around the outer covering of the cable, and the device shall fully enclose the part of the cable from which any part of the covering has been removed. Where connections to conductors are by binding screw terminals, there shall be available as many terminals as conductors.

Panel Statement: CMP-7 accepts the direction of the Correlating Committee to clarify the action on this proposal with respect to the panel action on Proposals 7-50 and 7-51.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

7-9 Log #107 NEC-P07 **Final Action: Accept**
(334.40(B))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 7-50
Recommendation: The Correlating Committee directs the panel to clarify the action on this proposal with respect to the panel action on Proposals 7-49 and 7-51.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-7 accepts the direction of the Correlating Committee to clarify the action on this proposal with respect to the panel action on Proposals 7-50 and 7-51.

See panel action and statement on Comment 7-8.

Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

7-10 Log #108 NEC-P07 **Final Action: Accept**
(334.40(B))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 7-51
Recommendation: The Correlating Committee directs the panel to clarify the action on this proposal with respect to the panel action on Proposals 7-49 and 7-50.

The action will be considered as a public comment.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-7 accepts the direction of the Correlating Committee to clarify the action on this proposal with respect to the panel action on Proposals 7-50 and 7-51.

See panel action and statement on Comment 7-8.

Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

7-11 Log #590 NEC-P07 **Final Action: Reject**
(334.40(B))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 7-49
Recommendation: Revise text to read as follows:

334.40 Boxes and Fittings.

(B) Devices of Insulating Material. Self-contained switches, self-contained receptacles, and nonmetallic-sheathed cable interconnector devices of insulating material that are listed shall be permitted to be used without boxes in exposed cable wiring and for repair wiring in existing buildings where the cable is concealed. Openings in such devices shall form a close fit around the outer covering of the cable, and the device shall fully enclose the part of the cable from which any part of the covering has been removed. ~~Where connections to conductors are by binding-screw terminals, there shall be available as many terminals as conductors.~~

<u>Only listed nonmetallic-sheathed cable interconnector devices are allowed to be concealed.</u>

Substantiation: The last sentence in the first paragraph is unnecessary. It is covered by the general rule found in UL White Book AALZ and is not repeated whenever binding screws are referenced in the rest of the NEC.

The second paragraph addresses my concern about concealed switches and receptacles that the original text would appear to allow.

The fewer concealed splices the better.

Panel Meeting Action: Reject
Panel Statement: CMP-7 inserted "that are listed" in Proposal 7-50 and Comment 7-8. The change addresses the submitter's concern.

CMP-7 rejects the deletion of the last sentence as proposed. The language in the UL Product Guide Card "AALZ" does not require that a nonmetallic sheath cable interconnector provide a listed termination for each conductor of the cables intended to be joined. The guide card only requires "Product terminals, including wire connectors and terminal screws, are acceptable for connection

of only one conductor, unless there is marking or a wiring diagram indicating the number of conductors which may be connected". The sentence which this submitter proposes deleting requires that there shall be a terminal available for all conductors. CMP-7 rejects the new wording of this proposal. The language as accepted by panel action on Proposal 7-50 clearly states that only listed nonmetallic sheath cable interconnectors are acceptable ("nonmetallic sheathed cable interconnector devices of insulating material that are listed shall be permitted to be used").
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

ARTICLE 338 — SERVICE-ENTRANCE CABLE: TYPES SE AND USE

7-12 Log #287 NEC-P07 **Final Action: Accept in Principle**
(338.10(B)(4)(b))

TCC Action: The panel action on the comment placed a requirement in an Informational Note which is not permitted by the NEC Style Manual. The Correlating Committee directs the panel action on this comment be revised as follows:
Exception: Single conductor Type USE and multi-rated USE conductors shall not be subject to the ampacity limitations of Part II of Article 340.
Submitter: Dennis Alwon, Alwon Electric Inc.
Comment on Proposal No: 7-59
Recommendation: Add Exception as follows:
(b) Exterior Installations. In addition to the provisions of this article, service entrance cable used for feeders or branch circuits, where installed as exterior wiring, shall be installed in accordance with Part I of Article 225. The cable shall be supported in accordance with 334.30. Type USE cable installed as underground feeder and branch circuit cable shall comply with Part II of Article 340.
Exception: Type USE installed as underground feeders shall not be restricted by 340.80.
Substantiation: The problem is that I don't believe the board read my proposal correctly. Here is your comment
"The submitter is referring to single conductor USE per Table 310.104(A), whereas 338.10(B)(4)(b) is referring to a USE cable assembly with a plastic covering as defined in 338.2. Single conductor USE is not limited to the ampacity in 340.80."
338.2 does not define USE cable only as an assembly with a plastic covering as you state. It states with or without an overall covering so single conductor, triplex or quadruplex cable is relevant to this article.
The last sentence states that USE cable shall comply with Part II of article 340. USE cable can be a triplex, quad or individual cable and as written art. 340.80 states that UF shall be 60C. Thus if USE must follow part II of 340 then it must be rated at 60C when used as a feeder or branch circuit. I don't believe this is the intent but it is how it reads. Thus with the words "excluding 340.80" USE cable would not be limited to 60C as intended.
I have shown this proposal to many respected members of the electrical community and they all agreed that the board did not read the proposal or the section correctly.
I do not understand how your comment about this section only pertains to jacketed cable as it clearly states USE.
Panel Meeting Action: Accept in Principle
Add informational note to read as follows:
Informational Note. Single conductor Type USE and multi rated USE conductors are not subject to the ampacity limitations of Part II of Article 340. Requirements for single conductor USE are in Table 310.104(A).
Panel Statement: CMP-7 does not accept adding an exception to 338.10(B)(4)(b). Instead, CMP-7 adds an informational note for clarity.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

7-13 Log #1058 NEC-P07 **Final Action: Accept in Principle**
(338.10(B)(4)(b))

Submitter: George M. Stolz, II, Quicksilver Electrical Training
Comment on Proposal No: 7-59
Recommendation: Accept the proposal.
Substantiation: Last I checked, USE cable comes in both single and multiconductor styles. The last sentence clearly refers to Part II of Article 340, which clearly includes 340.80.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and statement on Comment 7-12.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

7-14 Log #1229 NEC-P07 **Final Action: Reject**
(338.10(B)(4)(a))

Submitter: Christel K. Hunter, Alcan Cable, a General Cable Company
Comment on Proposal No: 7-61
Recommendation: Revise text as follows:
~~Where installed in thermal insulation, the ampacity shall be in accordance with the 60°C (140°F) conductor temperature rating.~~ The maximum conductor temperature rating shall be permitted to be used for ampacity adjustment and correction purposes~~, if the final derated ampacity does not exceed that for a 60°C (140°F) rated conductor~~.
Substantiation: The language restricting SE cable to 60C in thermal insulation should be deleted. No technical substantiation was submitted to the panel to support this
restriction, and technical substantiation was submitted to the panel during the 2014 ROP meeting to support the deletion of this requirement.
SE cable is listed according to UL854 and is typically listed at 75C with 90C insulated conductors. SE cable is commonly available in copper 8 AWG and larger and aluminum 6 AWG and larger. The smaller sizes are often used in residential applications to feed large appliances such as stoves and dryers. Applicance receptacles sized 30 amps and larger are listed and marked for use at 75C with both copper and aluminum. Therefore, the breaker, cable and receptacles are all suitable for use at 75C. NM cable is frequently used for smaller devices such as receptacles and switches that are listed for use at 60C. Non-metallic sheathed cable (NM-B) was limited to 60C in the 1980s because of the overheating that occurred in lighting fixtures in ceilings after thermal insulation was blown on top of the conductors and fixtures in the 1970s. The trapped heat from the light fixtures (which were commonly overlamped) caused heat related damage to the 60C insulation in NM cable. Therefore, the industry decided to require 90C insulation but still limit NM cable to 60C. SE cable is not used for residential light fixtures, therefore the reason for the limitation to 60C in place for NM cable does not exist for SE cable.
Research titled "Thermally Induced Failure of Low-Voltage Electrical Nonmetallic-Sheathed Cable Insulation" was presented during the 2014 ROP meeting and is included again as supporting material. This research was conducted by Robert W. Armstrong, Ph.D. (Armstrong Engineering), James Mason, Ph.D. (SEAL Laboratories), Arun Kumar, Ph.D. (SEAL Laboratories), and James E. Hall (James Hall & Associates, Fire Investigations). The research concluded that even when installed in typical thermal insulation and subjected to 190% of its NEC allowable ampacity, nonmetallic sheathed cable barely exceeded its insulation temperature (205 F vs 194 F) under continuous loading conditions. Even at these temperatures, the researchers concluded that "The test results presented here show that chemical and electrical breakdown do not occur at temperatures below the autoignition temperatures of most common structural materials." This testing was done with individual cables, not bundled cables.
The NEC has already placed limits on bundled SE cable. NEC 310.15(B)(3)(a) directs that multiconductor cables installed without maintaining spacing for a continuous length longer than 24 inches (and not installed in raceways) must have their ampacity reduced in accordance with Table 310.15(B)(3)(a). This requirement is supported by a National Bureau of Standards report issued in 1978 titled "Exploratory Study of Temperatures Produced by Self-Heating of Residential Branch Circuit Wiring When Surrounded by Thermal Insulation." The study found that when groups of cables were tightly installed in thermal insulation, they would
overheat when operated for extended periods at their maximum allowable ampacity. Therefore, when multiple cables are installed in contact with each other for longer distances, the conductors must have ampacity adjustment. However, the study also found that single conductors installed in thermal insulation and operating at their maximum ampacity (12 AWG, 20 amps) never exceeded 152F, which is below the listed temperature of SE cable and the terminations used for these interior branch circuits. This report is public information, and relevant pages are included as supporting material.
In summary, there is no safety concern with a single SE cable operating in thermal insulation, yet we are limiting it to an ampacity below its Listed value. Some panel members have indicated that since SE looks like NM, it should be treated the same, but this is an emotional argument, not a technical argument. We have many examples in the electrical industry of items that look the same but perform differently. Fuses, circuit breakers, and transformers come to mind. The same is true of wire and cable products. As an example, AC and MC cable may look alike, but we still have separate installation requirements and listing requirements. Schedule 40 and Schedule 80 PVC may look alike, but we allow them to be used in different applications. Likewise, SE cable is constructed to a different standard than NM cable and should be allowed to be used in accordance with its listing.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: This proposal does not present statistical data indicating the effects of thermal exposure to Type SE Cable when installed and operated as a interior wiring method and installed in thermal insulation. The laboratory test results submitted indicating the effects of thermal damage on interior branch circuit conductors contained within a factory cable assemblies only evaluates Type NM Cable. CMP-7 would like to see additional testing on Type SE Cable embedded in thermal insulation.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 11 Negative: 2 Abstain: 1
Explanation of Negative:
NIELSEN, D.: The IEEE agrees with the substantiation provided by the submitter that SE cable should be allowed to be used in accordance with its listing. Overcurrent protection protects Type SE conductors where conductors are adjusted for ampacity and correction based on maximum temperature

rating. The exclusion of Article 334.80 is applicable since Type SE is not Type NM/NMC/NMS. The present language was added in the 2011 cycle. Technical documentation was submitted at the meeting supporting the basis for thermal insulation not posing an issue. The proposal should have been approved as Accept in Principal with the text to read as follows:

~~Where installed in thermal insulation, the ampacity shall be in accordance with the 60°C (140°F) conductor temperature rating.~~ The maximum conductor temperature rating shall be permitted to be used for ampacity adjustment and correction purposes~~, if the final derated ampacity does not exceed that for a 60°C (140°F) rated conductor~~.

RUNYON, G.: The panel should have accepted this comment. SE cable is not NM cable. It is constructed, tested and listed differently and it should not be required to be installed with the same limitations as NM cable. The standard used to test and list SE type cable is ANSI/UL854 which is a minimum 75 degree Centigrade outer jacket and 90 degree Centigrade conductors.

Explanation of Abstention:

HUNTER, C.: The Aluminum Association could not reach consensus.

7-15 Log #1562 NEC-P07 **Final Action: Reject**
(338.10(B)(4)(a))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 7-63
Recommendation: Accept the proposal in part. Do not accept the deletion of "excluding 334.80". Accept the remainder of the proposal.
Substantiation: The technical substantiation clearly shows that the provision added by CMP 7 in the 2011 cycle was on the correct track, but did not go far enough. Embedding these cables in thermal insulation actually reduces their ampacity even below the 60°C column, and no allowance for mutual conductor heating or ambient temperature derating should even begin in the 90°C column. CMP 7 clearly reviewed this information because it refers to the 1987 NEC Proposal 4-97 in its statement. The fact that CMP 4 rejected it at the time is irrelevant; what is relevant is the uncontradicted report of what happens to wiring embedded in thermal insulation. In fact, the same substantiation (in form of a reference to the same Proposal 4-97!) was used by CMP 7 to insert, also in the 1987 code cycle, what are now the informational notes that follow 334.10(4), 336.10(8), 338.10(B)(4), and 340.10(8). The panel's assertion of a lack of technical substantiation on this issue is frankly preposterous.

The submitter agrees that 334.80 need not apply because the new paragraph added in the 2011 cycle adequately incorporates the relevant provisions without dragging in additional baggage about passage through bored holes, etc.

Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 7-14.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:

STRANIERO, G.: The comment should be accepted. Section 334.80 includes several requirements to adjust the ampacity depending on how the cable is installed. Deletion of the requirement to comply with 334.80 will permit SE to be installed under conditions where the necessary ampacity correction will not be made.

ARTICLE 342 — INTERMEDIATE METAL CONDUIT: TYPE IMC

8-6 Log #1082 NEC-P08 **Final Action: Reject**
(342 through 392)

Submitter: Michael C. Martin, American Chemistry Council
Comment on Proposal No: 8-43
Recommendation: Replace the phrase "equipment grounding conductor" with the phrase "equipment bonding conductor" in the Articles and Sections identified in Proposal 8-43.
Substantiation: The Panel should have accepted Proposal 8-43. In the present NEC, Equipment Grounding Conductors and bonding jumpers provide a "path back" to the source. Both are always performing a bonding function. If the Grounding Electrode connection is removed or broken, the bonding function remains intact.

Section 250.4 does not permit the earth (ground) to be used as an effective ground fault current path but the term equipment grounding conductor inherently incorrectly contains the word "ground".

Visualize equipment supplied by a portable generator. The generator frame is not required to be connected to the earth.

The "green" wire in the flexible cord is not performing a grounding function but is performing a bonding function.

Visualize building one supplied by a service, having the grounded conductor connected to the grounding electrode system by a grounding electrode conductor. A feeder supplies a second building and a grounding electrode conductor is required for grounding any equipment in the second building. An equipment grounding conductor is required to be installed from building 1 to building 2. Not for grounding, but for bonding, providing an effective fault current path.

Making this change has the added benefit of being more harmonized with other international standards and usage of terminology.

Experienced NEC users have to ignore other concepts in other definitions and requirements to use the existing term. This does not help the future NEC user or provide clarity in the existing NEC. Changing the term is the right thing to do and should be supported.

Panel Meeting Action: Reject
Panel Statement: CMP-8 reaffirms its position to reject Proposal 8-43. The submitter has not demonstrated a need in the field to change electrical grounding conductor to electrical bonding conductor.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:

MARTIN, M.: The term "equipment grounding conductor" needs to be replaced with "equipment bonding conductor" throughout the NEC. Yes, the term equipment grounding conductor in Article 100 would need to be changed to the term equipment bonding conductor.

Some have argued that it is just a problem of education. Having the word "grounding" in a term describing conductor that is used primarily for a bonding function is not a problem to be solved by education.

The use of the term "equipment grounding conductor" is confusing both for those new to the electrical industry and even for some experienced users. The problem is compounded when dealing with other international standards.

No technical reason has been provided for not making the change. This conductor always provides a bonding function but does not always provide a grounding function such as in the case of a portable generator installed as a separately derived system.

MYERS, P.: The correct terminology will assist the training of new practitioners of the Code on the purpose of this conductor. This change will minimize field errors. Several Proposals and several Comments have pointed out the difference in function between grounding and bonding and it should be clear to all members of the Panel (and, indeed, any Panel receiving similar Proposals and Comments) that the function of the subject conductor is bonding. Thus, the requests to change its name to "equipment bonding conductor". In the Panel Statement during the Proposal stage, the Panel indicated that the issue was felt to be "one of education and not terminology". IEEE respectfully disagrees and believes that the use of terminology consistent with the conductors function will enhance education.

8-7 Log #1281 NEC-P08 **Final Action: Reject**
(342 through 392)

Submitter: Elliot Rappaport, Electro Technology Consultants
Comment on Proposal No: 8-43
Recommendation: Accept proposal.
Substantiation: The Panel Statement indicates that the issue is one of education and not terminology. When the terminology does not reflect the core requirement, then education becomes difficult.

The term "equipment grounding conductor" has a definite purpose that is not uniquely expressed in the term, i.e. "bond the equipment to a terminal at the source of voltage". As a result, there is a misconception that "grounding", without bonding to the source, will make a system safe. On the contrary, connecting equipment to ground without providing the bonding connection back to the source can make equipment less safe by increasing the time to clear the fault.

There is generally insufficient significance placed on the importance of bonding over grounding. Bonding provides sufficient ground fault current back to the source of voltage to operate an overcurrent device and clear the fault quickly. Connection to ground limits the voltage to ground on normally non-current-carrying parts during non-fault conditions. During fault conditions, the value of grounding is minimal since the primary safety concern is to remove the fault voltage as quickly as possible. A path to ground for fault current is not necessary since ground fault current must return to the source of voltage, not to ground.

Renaming this conductor as an "Equipment Bonding Conductor (EBC)" will clarify that the primary purpose of this conductor is to bond to the source in order to provide a known path for ground fault current that will facilitate rapid fault clearing.

It is recognized that the term "EGC" has been in use for a long time and that changing it to EBC will cause some concerns including changing written literature that uses the EGC term. After the initial period of understanding, users will correctly understand the purpose of this conductor and this will enhance the safety of personnel.

The fundamental purpose of this and companion proposals is to clearly state that "systems" are "grounded" and "equipment" is "bonded". The fact that the bonding conductor may be grounded also is secondary to the primary function of bonding.

Panel Meeting Action: Reject
Panel Statement: CMP-8 reaffirms its position to reject Proposal 8-43. See panel action and Statement on Comment 8-6.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 2
Explanation of Negative:

MARTIN, M.: See my explanation of negative vote on Comment 8-6.

MYERS, P.: See IEEE statement opposing the Panel action on comment 8-6.

ARTICLE 344 — RIGID METAL CONDUIT: TYPE RMC

8-8 Log #110 NEC-P08 **Final Action: Accept**
(344.100 (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 8-52a
Recommendation: The Correlating Committee directs the panel to clarify the action on this proposal based on 3.1.1 of the NEC Style Manual to require mandatory text.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-8 accepts the Correlating Committee's direction to clarify. See panel action on Comment 8-9.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-9 Log #812 NEC-P08 **Final Action: Accept**
(344.100)

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 8-52a
Recommendation: Section 344.100 per Proposal 8·52a should be revised to read as follows:
344.100 Construction. RMC shall be made of one of the following:
(1) Steel (ferrous), with or without protective coatings
(2) Aluminum (nonferrous)
(3) Red Brass
(4) Stainless Steel
Substantiation: This comment is submitted to address the TCC Comment pertaining to the NEC Style of Manual for mandatory text.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-10 Log #439 NEC-P08 **Final Action: Accept**
(344.120)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 1-114
Recommendation: 110.21 Marking.
(A) Manufacturer Markings. The manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified shall be placed on all electrical equipment. Other markings that indicate voltage, current, wattage, or other ratings shall be provided as specified elsewhere in this *Code*. The marking or label shall be of sufficient durability to withstand the environment involved. **[ROP 1–114]**
344.120 Marking. Each length shall be clearly and durably identified in every 3 m (10 ft) as required in the first sentence of 110.21<u>(A)</u>. Nonferrous conduit of corrosion-resistant material shall have suitable markings.
Substantiation: Accepted ROP 1-114 moved the text in 110.21 from 2008 to 110.21(A) in 2014. 110.21 is now devoid of text and has no first sentence. The first sentence is in 110.21(A).
Panel Meeting Action: Accept
Panel Statement: CMP-8 recognizes that CMP-1 "accept in principle in part" Proposal 1-114 that created new Sections 110.21(A) and (B). CMP-8 is treating this comment as editorial and this comment and section will need to be correlated by the Correlating Committee if any action by CMP-1 occurs to Proposal 1-114 and section 110.21 during the ROC meeting.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ARTICLE 348 — FLEXIBLE METAL CONDUIT: TYPE FMC

8-11 Log #1016 NEC-P08 **Final Action: Accept**
(348.30(A) Exception No. 4)

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 8-54
Recommendation: Accept the proposal in principal by changing the word "section" to "exception" in the added text, as follows:
Exception No. 4: Lengths not exceeding 1.8 m (6 ft) from the last point where the raceway is securely fastened for connections within an accessible ceiling to luminaire(s) or other equipment. For the purposes of this <u>exception</u> ~~section~~, listed Flexible Metal Conduit fittings shall be permitted as a means of support.
Substantiation: As proposed, the fittings are considered support for all of Section 348.30. I believe the intent is for this to apply only as it relates to this exception.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ARTICLE 350 — LIQUIDTIGHT FLEXIBLE METAL CONDUIT: TYPE LFMC

8-12 Log #111 NEC-P08 **Final Action: Accept**
(350.42)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 8-59
Recommendation: The Correlating Committee directs the panel to clarify the action on this proposal based on the fact that 3.1.3 of the NEC Style Manual does not permit requirements in Informational Notes.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-8 Accepts the Correlating Committee's direction to clarify and to remove the requirement from the informational note. See panel action on Comment 8-13.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-13 Log #813 NEC-P08 **Final Action: Accept in Principle**
(350.42)

TCC Action: The Correlating Committee understands that the Informational Note was removed from Proposal 8-59 by the Panel's action on Comments 8-12 and 8-13.
Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 8-59
Recommendation: Section 350.42 per Proposal 8-59 should be revised to delete the Informational Note and to read as follows:
350.42 Couplings and Connectors. Only fittings listed for the use with LFMC shall be used. Angle connectors shall not be concealed.
Substantiation: This comment is submitted to address the TCC Comment pertaining to the NEC Style with requirements in Informational Notes and the negative ballot comment.
Panel Meeting Action: Accept in Principle
Revise 350.42 to read as follows:
350.42 Couplings and Connectors. Only fittings listed for the use with LFMC shall be used. Angle connectors shall not be concealed. <u>Straight LFMC fittings shall be permitted for direct burial where marked.</u>
Panel Statement: CMP-8 accepts in principle the comment, but includes the last sentence per Proposal 8-58.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

(Sequence #8-14 was not used)

11-2 Log #112 NEC-P11 **Final Action: Accept**
(350.60)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 8-60
Recommendation: It was the action of the Correlating Committee that this proposal be reported as "Reject" to correlate with the action taken on Proposal 11-83.
The Correlating Committee directs that this proposal be sent to Code-Making Panel 11 for action in Article 440.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
MISSILDINE, JR., J.: Acceptance of this comment was only to accept responsibility for Proposal 8-60 as directed by the TCC. The panel's action appears to accept the change as written in the proposal. See the negative ballot statement on Comment 11-32 for reasons why no wire type ground conductor should be required.

11-3 Log #1253 NEC-P11 **Final Action: Reject**
(350.60)

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 8-60
Recommendation: I ask the panel to approve proposal 8-60 dealing with article 350.60. Below is the article from Proposal 8-60.
350.60 Grounding. <u>Grounding and bonding for LFMC shall be installed in accordance with 350.60(A) and (B).</u>
<u>(A)</u> If used to connect equipment where flexibility is necessary to minimize

the transmission of vibration from equipment or to provide flexibility for equipment that requires movement after installation, an equipment grounding conductor shall be installed.

Where flexibility is not required after installation, LFMC shall be permitted to be used as an equipment grounding conductor when installed in accordance with 250.118(6).

Where required or installed, equipment grounding conductors shall be installed in accordance with 250.134(B).

Where required or installed, equipment bonding jumpers shall be installed in accordance with 250.102.

Informational Note: See 501.30(B), 502.30(B), 503.30(B), 505.25(B), and 506.25(B) for types of equipment grounding conductors.

<u>(B) Where Air Conditioning or Refrigerating Equipment is installed outdoors, an equipment grounding conductor per 250.118(1) shall be provided within the raceway and shall be sized per 250.122.</u>

Substantiation: In a recent survey conducted by IEC over 50% of the respondents said they had observed or heard of non- threaded conduit, to HVAC and refrigerator equipment, that came apart after being installed on rooftops. Also, over 7% indicated they knew of or received a serious electrical shock as a result of the separation of the conduit.

Panel Meeting Action: Reject

Panel Statement: CMP 11 accepts responsibility for taking action on this comment. The requirement belongs in Article 440 and not section 350.60. Article 440 deals specifically with HVAC equipment. See the panel action and statement on Comment 11-32.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

Comment on Affirmative:

MISSILDINE, JR., J.: The panel's action to reject the comment is appropriate; but not with the panel statement. The proposed change in proposal 8-60 should not be accepted. If the wire type ground conductor is necessary in outdoor LFMC supplying air conditioning and refrigeration equipment, it should be applied to all outdoor applications of this material. Article 350 would be the appropriate place for the change, not Article 440. See the negative ballot statement on Comment 11-32 for reasons why no wire type ground conductor should be required.

11-3a Log #1370 NEC-P11 **Final Action: Accept**
(350.60)

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)

Comment on Proposal No: 8-60

Recommendation: Continue to Reject the proposed requirement for an equipment grounding conductor in Liquidtight Flexible Metal Conduit.

Substantiation: It is not reasonable to simply require a grounding conductor on a product that has an excellent record of performance. Manufacturers of this product have not had issues or complaints about problems with either the armor opening or with grounding. The substantiation submitted with the proposal provides a single incident and does not provide any information on the construction of the raceway, whether or not it was listed, or if listed fittings were used or properly installed.

The construction of LFMC requires that it be provided with a bonding strip wound into the conduit convolutions throughout its entire length. It is required to withstand a 300 pound tension, and up to a 750 Amp fault current. The raceway is required to be terminated in listed fittings and required to be protected by overcurrent devices rated a maximum 20 or 60 amps, depending on the size of the raceway. In addition the use of the raceway as a ground fault path is limited to six feet.

The Panel 11 Technical Committee should require more substantive substantiation. There are many non-listed, off-shore sourced Liquid tight products in the marketplace, was the product in this incident listed? Were the fittings used also listed for the application? Were all of the metal components properly bonded? Was the installation compliant with the NEC®?

In light of the construction, listing, and installation requirements in place for this wiring method and the excellent record of performance when installed in accordance with the requirements of the NEC®, the requirement for an equipment grounding conductor in this application should not be required.

Panel Meeting Action: Accept

Panel Statement: CMP 11 agrees with the recommended action of the submitter but disagrees with the submitter's substantiation. The requirement belongs in Article 440 and not section 350.60. See the panel action and statement on Comment 11-3.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

Comment on Affirmative:

MISSILDINE, JR., J.: Agree with the panel's action to accept Comment 11-3a which rejects Proposal 8-60. This proposal should be rejected for the reasons stated in the negative ballot statement for comment 11-31.

THOMPSON, J.: I support the position provided by the submitter, but disagree with the panel statement.

WRIGHT, J.: While NEMA votes affirmative on this Panel Action, which Rejects the requirement for an equipment grounding conductor in Liquidtight Flexible Metal Conduit in Section 350.60, NEMA does not agree that the requirement belongs in Article 440. The requirement should not be contained in either Section 350.60 or Article 440.

ARTICLE 352 — RIGID POLYVINYL CHOLOIDE CONDUIT: TYPE PVC

8-15 Log #440 NEC-P08 **Final Action: Accept**
(352.120)

Submitter: James F. Williams, Fairmont, WV

Comment on Proposal No: 1-114

Recommendation: 110.21 Marking.

(A) Manufacturer Markings. The manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified shall be placed on all electrical equipment. Other markings that indicate voltage, current, wattage, or other ratings shall be provided as specified elsewhere in this *Code*. The marking or label shall be of sufficient durability to withstand the environment involved. **[ROP 1–114]**

352.120 Marking. Each length of PVC conduit shall be clearly and durably marked at least every 3 m (10 ft) as required in the first sentence of 110.21<u>(A)</u>. The type of material shall also be included in the marking unless it is visually identifiable. For conduit recognized for use aboveground, these markings shall be permanent. For conduit limited to underground use only, these markings shall be sufficiently durable to remain legible until the material is installed. Conduit shall be permitted to be surface marked to indicate special characteristics of the material.

Substantiation: Accepted ROP 1-114 moved the text in 110.21 from 2008 to 110.21(A) in 2014. 110.21 is now devoid of text and has no first sentence. The first sentence is in 110.21(A).

Panel Meeting Action: Accept

Panel Statement: See panel statement on Comment 8-10.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

ARTICLE 355 — REINFORCED THERMOSETTING RESIN CONDUIT: TYPE RTRC

8-16 Log #441 NEC-P08 **Final Action: Accept**
(355.120)

Submitter: James F. Williams, Fairmont, WV

Comment on Proposal No: 1-114

Recommendation: 110.21 Marking.

(A) Manufacturer Markings. The manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified shall be placed on all electrical equipment. Other markings that indicate voltage, current, wattage, or other ratings shall be provided as specified elsewhere in this *Code*. The marking or label shall be of sufficient durability to withstand the environment involved. **[ROP 1–114]**

355.120 Marking. Each length of RTRC shall be clearly and durably marked at least every 3 m (10 ft) as required in the first sentence of 110.21<u>(A)</u>. The type of material shall also be included in the marking unless it is visually identifiable. For conduit recognized for use aboveground, these markings shall be permanent. For conduit limited to underground use only, these markings shall be sufficiently durable to remain legible until the material is installed. Conduit shall be permitted to be surface marked to indicate special characteristics of the material.

Substantiation: Accepted ROP 1-114 moved the text in 110.21 from 2008 to 110.21(A) in 2014. 110.21 is now devoid of text and has no first sentence. The first sentence is in 110.21(A).

Panel Meeting Action: Accept

Panel Statement: See panel statement on Comment 8-10.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 12

ARTICLE 356 — LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT: TYPE LFNC

8-17 Log #469 NEC-P08 **Final Action: Accept in Part**
(356.2.Liquidtight Flexible Nonmetallic Conduit (LFNC) and 356.3 Installation of Conductors in LFNC (New))

Submitter: Marcelo M. Hirschler, GBH International

Comment on Proposal No: 8-81

Recommendation: Revise text to read as follows:

Liquidtight Flexible Nonmetallic Conduit (LFNC). A<u> flame-resistant</u> raceway<u>, with fittings,</u> of circular cross section of various types as follows:

(1) A smooth seamless inner core and cover bonded together and having one or more reinforcement layers between the core and covers, designated as Type LFNC-A

(2) A smooth inner surface with integral reinforcement within the raceway wall, designated as Type LFNC-B

(3) A corrugated internal and external surface without integral reinforcement

within the conduit wall, designated as LFNC-C
~~LFNC is flame resistant and with fittings and is approved for the installation of electrical conductors~~
Informational Note: FNMC is an alternative designation for LFNC.
356.3 Installation of conductors in LFNC. The installation of electrical conductors in LFNC shall be permitted.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term in the last sentence and also contains requirements and the NEC manual of style does not permit the definition to contain the defined term. Definitions are not requirements. The proposed changes eliminate the defined term and the requirements.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Alternate approach, could be as follows (by eliminating the second sentence):
Informational Note: LNFC is a flame resistant raceway which can have fittings and is approved for the installation of electrical conductors.
Panel Meeting Action: Accept in Part
Panel Statement: CMP-8 accepts in part Comment 8-17. CMP-8 accepts only the deletion of "LFNC is flame resistant and with fittings and is approved for the installation of electrical conductors". CMP-8 agrees to remove requirements from the definition of LFNC.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12
Comment on Affirmative:
LOYD, R.: The committee should have clarified in the panel action, that the only part accepted was to delete the last paragraph as follows;
"LFNC is flame-resistant and with fittings is approved for the installation of conductors"

8-18 Log #1017 NEC-P08 **Final Action: Reject**
(356.12(4))

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 8-81a
Recommendation: Reject this proposal.
Substantiation: This wiring method is little more than a piece of garden hose. Please let me know where in the world people are using this for over 600V (as indicated by the substantiation) so that I can keep myself, my family, and my friends as far away as possible. I agree with Mr. Loyd's statement regarding the UL White Book as well. Refer to product category DXOQ in the white book.
Panel Meeting Action: Reject
Panel Statement: CMP-8 reaffirms its position to accept Proposal 8-81a. LFNC is Listed and is required to meet or exceed the very rigorous physical requirements such as impacts and crush per UL1660, Liquid-Tight Flexible Nonmetallic Conduit. In addition, UL Certification Guide Information, DXOQ, does not limit LFNC to 600 volts.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11 Negative: 1
Explanation of Negative:
LOYD, R.: CMP-8 acted inconsistently in rejecting 8-26 for lack of substantiation to and continuing to accept ROP 8-81a on this exact same subject.
LFNC is produced in three types, Type (B) and (A) may pass 3rd party testing to safely protect conductors of circuits over 600 volts for specific purposes. Type(C) likely would not be suitable for enclosing circuit conductors over 600 volts. No substantiation was submitted or provided to support this change. This committee action sets a precedent that that substantiation is no longer required for changing the code! This comment should have been accepted to be consistent with 826.

8-19 Log #1254 NEC-P08 **Final Action: Accept**
(356.12(4))

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 8-82
Recommendation: Continue to reject this proposal which would change 600 volts to 1000 volts.
Substantiation: Replacing 600 volts with 1000 volts will have a major impact on installers, component manufacturers, and industry standards. Increased spacing must be considered when going from 600 volts to 1000 volts. Personal safety must also be considered.
Because the proposer has not provided enough information to the public to justify and understand all the ramifications of the proposal, the committee should continue to reject the original submitters proposal.
Panel Meeting Action: Accept
Panel Statement: CMP-8 reaffirms its position to reject Proposal 8-82. However, CMP-8 recognizes that LFNC is currently permitted to be used in voltages over 600 volts and that the standard and listing does not restrict the product to 600 volts. See CMP-8 Action on Proposal 8-81a.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11 Negative: 1
Explanation of Negative:
LOYD, R.: See my Statement on negative vote 8-18.

8-20 Log #1018 NEC-P08 **Final Action: Accept in Principle**
(356.60)

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 8-84
Recommendation: Reject the proposal, or revise it by deleting the entire first paragraph.
Substantiation: This is a nonmetallic wiring method. It can't be used as an equipment grounding conductor regardless of vibration, movement, etc.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action on Comment 8-21.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-21 Log #1059 NEC-P08 **Final Action: Accept**
(356.60)

Submitter: George M. Stolz, II, Quicksilver Electrical Training
Comment on Proposal No: 8-84
Recommendation: Accept the proposal in principle in part by harmonizing 356.60 with 352.60 instead:
352.60 Grounding. Where equipment grounding is required, a separate equipment grounding conductor shall be installed in the conduit.
Exception No. 1: As permitted in 250.134(B), Exception No. 2, for dc circuits and 250.134(B), Exception No. 1, for separately run equipment grounding conductors.
Exception No. 2: Where the grounded conductor is used to ground equipment as permitted in 250.142.
Substantiation: Since LFNC is not a recognized equipment grounding conductor per 250.118, the wording should match other **nonmetallic** raceways.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ARTICLE 358 — ELECTRICAL METALLIC TUBING: TYPE EMT

8-22 Log #1142 NEC-P08 **Final Action: Accept**
(358.44 (New))

Submitter: William A. Wolfe, Steel Tube Institute
Comment on Proposal No: 8-87
Recommendation: Delete the proposed new text
~~358.44 Expansion Fittings. Expansion fittings for EMT shall be provided to compensate for thermal expansion and contraction where the length is expected to be 6 mm (1/4 inch) or greater in a straight run between securely mounted items such as boxes, cabinets, elbows, or other conduit terminations.~~
~~Informational Note: The coefficient of expansion for steel electrical metallic tubing is 1.170 × 10E-5 (0.0000117 mm per mm of tubing for each degree C in temperature change) [0.650 × 10E-5 (0.0000065 in. per inch of tubing for each degree F in temperature change)]. The coefficient of expansion for aluminum electrical metallic tubing is 2.34 × 10E-5 (0.0000234 mm per mm of tubing for each degree C in temperature change) [1.30 × 10-E5 (0.000013) in. per inch of tubing for each degree F in temperature change].~~
Substantiation: This should be a reject. This proposal requires an expansion fitting to compensate for thermal expansion and contraction "…where the length is expected to be 6 mm (1/4 inch) or greater in a straight run…" but it only considers the expansion of the Steel EMT and not the relative change between the steel EMT and the thermal coefficient of expansion of the material it is mounted to. It is the "relative" change of 6 mm (1/4 inch) that we are concerned with. Steel EMT securely mounted on a steel building should expand and contract at the same relative rate and therefore not require an expansion fitting. If we consider a 100 degree F change between the Summer high and the Winter low it would require an expansion fitting at 32 feet. But if the steel EMT was mounted on a steel building or structure, the relative change would be zero. Why require an expansion fitting? Other common building materials that have a thermal coefficient of expansion less than that of steel are shown on the attached chart (Exhibit "A") with the linear distance in feet before achieving a relative change of 6 mm (1/4 inch).
The informational note information is already contained in the Information Note following 300.7(B) and is not need.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

(Sequence #'s 8-23 and 8-24 were not used)

11-4 Log #113 NEC-P11 **Final Action: Accept**
(358.60)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 8-90
Recommendation: It was the action of the Correlating Committee that this proposal be reported as "Reject" to correlate with the action on Proposal 11-83. The Correlating Committee directs that this proposal be sent to Code-Making Panel 11 for action in Article 440.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
MISSILDINE, JR., J.: Acceptance of this comment was only to accept responsibility for Proposal 8-90 as directed by the TCC. The panel's action appears to accept the change as written in the proposal. See the negative ballot statement on Comment 11-32 for reasons why no wire type ground conductor should be required.

11-4a Log #1255 NEC-P11 **Final Action: Reject**
(358.60)

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 8-90
Recommendation: I ask the panel to accept proposal 8-90 to read as submitted below.
358.60 Grounding. <u>Grounding and bonding EMT shall be installed in accordance with 358.60(A) and (B).</u>
<u>(A)</u> EMT shall be permitted as an equipment grounding conductor.
<u>(B) Where Air Conditioning or Refrigerating Equipment is installed outdoors, an equipment grounding conductor per 250.118(1) shall be provided within the raceway and shall be sized per 250.122.</u>
Substantiation: In a recent survey conducted by IEC over 50% of the respondents said they had observed or heard of non- threaded conduit, to HVAC and refrigerator equipment, that came apart after being installed on rooftops. Also, over 7% indicated they knew of or received a serious electrical shock as a result of the separation of the conduit.
Panel Meeting Action: Reject
Panel Statement: CMP 11 accepts responsibility for taking action on this comment. The requirement belongs in Article 440 and not section 358.60. Article 440 deals specifically with HVAC equipment. See the panel action and statement on Comment 11-32.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14
Comment on Affirmative:
MISSILDINE, JR., J.: The panel's action to reject the comment is appropriate; but not with the panel statement. The proposed change in proposal 8-90 should not be accepted. If the wire type ground conductor is necessary in outdoor EMT supplying air conditioning and refrigeration equipment, it should be applied to all outdoor applications of this material. Article 358 would be the appropriate place for the change, not Article 440. See the negative ballot statement on Comment 11-32 for reasons why no wire type ground conductor should be required.
WRIGHT, J.: While NEMA votes affirmative on this Panel Action, which Rejects the requirement for an equipment grounding conductor in EMT in Section 358.60, NEMA does not agree that the requirement belongs in Article 440. The requirement should not be contained in either Section 358.60 or Article 440.

11-4b Log #1369 NEC-P11 **Final Action: Accept**
(358.60)

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 8-90
Recommendation: Whether the action of the TCC is accepted or rejected by Panel 8, the concept of Proposal 8-90 should be rejected.
Substantiation: The substantiation does not support this change. Neither the CPSC report nor the report of the Chicago incident indicates the wiring method was the cause of the electrocution. The photos enclosed with the substantiation show that EMT was not used. The CPSC report is dated 2002, five (5) years before the incident, and only shows the number of consumer product-related electrocutions by specific products involved, not the specific cause. The report shows a greater number of electrocutions were related to other components of the installed household wiring than to the wiring method. In the case of damaged or exposed wiring, the "exact nature of the wiring was unspecified". The use of a supplemental equipment grounding conductor should be a design decision based on the wiring method to be used and the unique installation environment in which the equipment is being installed. The NEMA/Georgia Tech research study on grounding validates that EMT is a proven equipment grounding conductor when installed in accordance with the NEC and with either set-screw or compression type fittings.
Panel Meeting Action: Accept
Panel Statement: CMP 11 agrees with the recommended action of the submitter but disagrees with the submitter's substantiation. The requirement belongs in Article 440 and not section 358.60. See the panel action and statement on Comment 11-4a.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14
Comment on Affirmative:
MISSILDINE, JR., J.: The panel's action to reject the comment is appropriate; but not with the panel statement. If the wire type ground conductor is necessary in outdoor EMT for HVAC, it should be applied to all outdoor applications of this material. Article 358 would be the appropriate place for the change, not Article 440. See negative ballot statement on Comment 11-31 for reasons why no wire type ground conductor should be required.
THOMPSON, J.: I support the position provided by the submitter, but disagree with the panel statement.
WRIGHT, J.: See my Affirmative comment on Comment 11-4a.

8-25 Log #442 NEC-P08 **Final Action: Accept**
(358.120)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 1-114
Recommendation: 110.21 Marking.
(A) Manufacturer Markings. The manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified shall be placed on all electrical equipment. Other markings that indicate voltage, current, wattage, or other ratings shall be provided as specified elsewhere in this *Code*. The marking or label shall be of sufficient durability to withstand the environment involved. **[ROP 1–114]**
358.120 Marking. EMT shall be clearly and durably marked at least every 3 m (10 ft) as required in the first sentence of 110.21<u>(A)</u>.
Substantiation: Accepted ROP 1-114 moved the text in 110.21 from 2008 to 110.21(A) in 2014. 110.21 is now devoid of text and has no first sentence. The first sentence is in 110.21(A).
Panel Meeting Action: Accept
Panel Statement: See panel statement on Comment 8-10.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ARTICLE 362 — ELECTRICAL NONMETALLIC TUBING: TYPE ENT

8-26 Log #814 NEC-P08 **Final Action: Reject**
(362.12(5))

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 8-93
Recommendation: Section 362.12(5) per Proposal 8·93 should be revised to reads as follows:
(5) Where subject to voltages over 600 volts unless approved
Substantiation: This comment is submitted to address the TCC Comment and allows ENT to be used in unique applications over 600 volts when approved.
Panel Meeting Action: Reject
Panel Statement: No substantiation was provided to support the expanded use of the product.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-27 Log #443 NEC-P08 **Final Action: Accept**
(362.120)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 1-114
Recommendation: 110.21 Marking.
(A) Manufacturer Markings. The manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified shall be placed on all electrical equipment. Other markings that indicate voltage, current, wattage, or other ratings shall be provided as specified elsewhere in this *Code*. The marking or label shall be of sufficient durability to withstand the environment involved. **[ROP 1–114]**
362.120 Marking. ENT shall be clearly and durably marked at least every 3 m (10 ft) as required in the first sentence of 110.21<u>(A)</u>. The type of material shall also be included in the marking. Marking for limited smoke shall be permitted on the tubing that has limited smoke-producing characteristics.
Substantiation: Accepted ROP 1-114 moved the text in 110.21 from 2008 to 110.21(A) in 2014. 110.21 is now devoid of text and has no first sentence. The first sentence is in 110.21(A).
Panel Meeting Action: Accept
Panel Statement: See panel statement on Comment 8-10.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ARTICLE 366 — AUXILIARY GUTTERS

8-28 Log #815 NEC-P08 **Final Action: Reject**
(366.1)

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 8-96
Recommendation: Reject the TCC Comment. Article 366 per Proposal 8-96 should be ACCEPTED as stated in the Panel Action.
Substantiation: This comment is submitted to address the TCC Comment pertaining to the NEC Style Manual and the reference to “metal”. “Metallic” is also an acceptable term per the NEC Style Manual and is found in the same list as “metal”. “Metallic” is used to describe the material and is used in 366.2.
Panel Meeting Action: Reject
Panel Statement: CMP-8 reaffirms its position to accept Proposal 8-96. CMP-8 rejects the Correlating Committee’s comment pertaining to “metal” vs “metallic”. Not only is “metallic” currently being used in 366.2 for the definition of a “metallic auxiliary gutter” but “metallic” is also an acceptable term per the NEC Style Manual and is found in the same list as “metal”.
It is noted that “metallic” appears in 375 locations and CMP-8 is supportive of a task group to correlate the terms “metal” and “metallic” for consistency throughout the entire NEC, per the style manual.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-28a Log #CC800 NEC-P08 **Final Action: Accept**
(366.2)

Submitter: Code-Making Panel 8,
Comment on Proposal No: 8-98
Recommendation: Revise 366.2 to read as follows:
Metallic Auxiliary Gutter. A sheet metal enclosure used to supplement wiring spaces at meter centers, distribution centers, switchgear, switchboards, and similar points of wiring systems. The enclosure has hinged or removable covers for housing and protecting electrical wires, cable, and busbars. The enclosure is designed for conductors to be laid or set in place after the enclosures have been installed as a complete system.
Nonmetallic Auxiliary Gutter. A flame retardant, nonmetallic enclosure used to supplement wiring spaces at meter centers, distribution centers, switchgear, switchboards, and similar points of wiring systems. The enclosure has hinged or removable covers for housing and protecting electrical wires, cable, and busbars. The enclosure is designed for conductors to be laid or set in place after the enclosures have been installed as a complete system.
Substantiation: CMP-8 accepts Comment 8-29 for Proposal 9-73a. Proposal 9-73a revises “metal-enclosed switchgear” to “switchgear”. CMP-8 recognizes that the submitter incorrectly referenced Proposal 8-98 instead of Proposal 9-73a.
CMP-8 accepts Comment 8-31 and Proposal 9-73a. Proposal 9-73a revises “metal-enclosed switchgear” to “switchgear”.
CMP-8 accepts to reconsider Proposal 8-98, however, rejects the deletion of the term “distribution centers” from Section 366.2, per Comment 8-30 and Proposal 8-98 since it is utilized throughout the NEC. CMP-8 also rejects revising “Metallic” to “metal” per Comment 8-30 and Proposal 8-96. CMP-8 continues to support Proposal 8-96 and the revision of metal to metallic. The TCC stated that “metal” is the correct term to used based on the NEC Style Manual. “Metallic” is also an acceptable term per the NEC Style Manual and is found in the same list as “metal”.
It is noted that “metallic” appears in 375 locations and CMP-8 is supportive of a task group to correlate the terms “metal” and “metallic” for consistency throughout the entire NEC, per the Style Manual.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-29 Log #816 NEC-P08 **Final Action: Accept**
(366.2)

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 8-98
Recommendation: Continue to Accept in Principle and Part Proposal 8-98 per the Panel Action and Statement. See companion Comment on Proposal 8-96.
Also, per the Accept in Principle, revise the “metal-enclosed switchgears” to ·”switchgear” for both the Metallic and Nonmetallic Auxiliary definitions. This revision will address the TCC Action for Proposal 9-73a.
Substantiation: This comment is submitted to address the TCC Comment reconsider and correlate with Proposal 8-96 and the TCC Comment on Proposal 8-96. The Panel should Accept the TCC Comment for Proposal 9-73a.
Panel Meeting Action: Accept
Panel Statement: See panel action and statement on 8-28a (Log #CC800).
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-30 Log #114 NEC-P08 **Final Action: Accept**
(366.2. Metallic Auxiliary Gutter and Nonmetallic Auxiliary Gutter)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 8-98
Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action taken on Proposal 8-96.
See the Correlating Committee action on Proposal 8-96.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-8 accepts to reconsider Proposal 8-98, however, rejects the deletion of the term “distribution centers” from Section 366.2, per Comment 8-30 and Proposal 8-98 since it is utilized throughout the NEC. CMP-8 also rejects revising “metallic” to “metal” per Comment 8-30 and Proposal 8-96. CMP-8 continues to support Proposal 8-96 and the revision of metal to metallic. The Correlating Committee stated that “metal” is the correct term to used based on the NEC Style Manual. “metallic” is also an acceptable term per the NEC Style Manual and is found in the same list as “metal”.
It is noted that “metallic” appears 375 locations and CMP-8 is supportive of a task group to correlate the terms “metal” and “metallic” for consistency throughout the entire NEC, per the Style Manual.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-31 Log #146 NEC-P08 **Final Action: Accept**
(366.2.Metallic Auxiliary Gutter, Nonmetallic Auxiliary Gutter)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-73a
Recommendation: The Correlating Committee understands that the panel action on this proposal incorporates the modified definition of “Metal Enclosed Power Switchgear” to “Switchgear” in Proposal 9-7. It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 8 for action in Article 366.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: See panel action and Statement on 8-28a (Log #CC800).
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-32 Log #592 NEC-P08 **Final Action: Hold**
(366.22 and 366.23)

TCC Action: The Correlating Committee directs that the panel action be reported as “Hold” in compliance with the NFPA Regulations Governing Committee Projects as the comment contains new material that has not had public review.
Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 8-96
Recommendation: Revise text to read as follows:
366.22 Number of Conductors.
~~**(A) Sheet Metal Auxiliary Gutters.**~~ The sum of the cross-sectional areas of all contained conductors at any cross section of ~~a sheet metal~~ an auxiliary gutter shall not exceed 20 percent of the interior cross-sectional area of the ~~sheet metal~~ auxiliary gutter. ~~The adjustment factors in 310.15(B)(3)(a) shall be applied only where the number of current-carrying conductors, including neutral conductors classified as current-carrying under the provisions of 310.15(B)(5), exceeds 30. Conductors for signaling circuits or controller conductors between a motor and its starter and used only for starting duty shall not be considered as current-carrying conductors.~~
~~**(B) Nonmetallic Auxiliary Gutters.** The sum of cross-sectional areas of all contained conductors at any cross section of the nonmetallic auxiliary gutter shall not exceed 20 percent of the interior cross-sectional area of the nonmetallic auxiliary gutter.~~
366.23 Ampacity of Conductors. The current carried continuously in bare copper bars in auxiliary gutters shall not exceed 1.55 amperes/mm2 (1000 amperes/in.2) of cross section of the conductor. For aluminum bars, the current carried continuously shall not exceed 1.09 amperes/mm2 (700 amperes/in.2) of cross section of the conductor.
(A) Sheet Metal Auxiliary Gutters. ~~Where the number of current-carrying conductors contained in the sheet metal auxiliary gutter is 30 or less, the adjustment factors specified in 310.15(B)(3)(a) shall not apply.~~ The adjustment factors in 310.15(B)(3)(a) shall be applied only where the number of current-carrying conductors, including neutral conductors classified as current-carrying under the provisions of 310.15(B)(5), exceeds 30. Conductors for signaling circuits
or controller conductors between a motor and its starter and used only for starting duty shall not be considered as current-carrying conductors. ~~The current carried continuously in bare copper bars in sheet metal auxiliary gutters shall not exceed 1.55 amperes/mm2 (1000 amperes/in.2) of cross section of~~

~~the conductor. For aluminum bars, the current carried continuously shall not exceed 1.09 amperes/mm2 (700 amperes/in.2) of cross section of the conductor.~~
(B) Nonmetallic Auxiliary Gutters. The adjustment factors specified in 310.15(B)(3)(a) shall be applicable to the current-carrying conductors in the nonmetallic auxiliary gutter.
Substantiation: 1: With the removal of the ampacity text in 366.22, (A) and (B) are essentially duplicate text and can be merged into a single sentence under 366.22 directly. (as is done 366.44 through 366.58 for example).
2: The ampacity rules for sheet metal auxiliary gutters are presently contained in 366.22 (which is labeled "Number of Conductors" and in 366.23(A). Further the rules differ in detail and could easily lead others into confusion (as it has for me).
3: The definitions for sheet metal and nonmetallic auxiliary gutters both reference bus bars, but the busbar ampacities in the original text only appear under sheet metal auxiliary gutters. Moving that information directly under 366.23 solves that problem.
Combining the ampacity rules in a single place for sheet metal auxiliary gutters and especially in a place labeled "Ampacity of Conductors" leads to easier correct application of the *NEC*. Placing the busbar ampacity directly in 366.23 makes it easier to find for nonmetallic auxiliary gutters.
Panel Meeting Action: Reject
Panel Statement: This comment contains new material that has not had public review. CMP-8 states that the proposed restructuring and wording does not improve the clarity or usability of the NEC.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ARTICLE 368 — BUSWAYS

8-33 Log #817 NEC-P08 **Final Action: Accept**
(368, Part IV)

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 8-109
Recommendation: Continue to Reject Proposal 8-109.
Substantiation: There was not technical substantiation to change the requirements for 600 volts to 1000 volts. Leaving 368 Part IV as is does not affect unique applications nor prohibits applications at or over 1000 volts.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ARTICLE 370 — CABLEBUS

8-34 Log #470 NEC-P08 **Final Action: Accept in Part**
(370.2.Cablebus and Informational Note 1 and 2 (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 8-113
Recommendation: Revise text to read as follows:
Cablebus. An assembly of insulated conductors with fittings and conductor terminations in a completely enclosed, ventilated protective metal housing. ~~Cablebus is ordinarily assembled at the point of installation from the components furnished or specified by the manufacturer in accordance with instructions for the specific job. This assembly is designed to carry fault current and to withstand the magnetic forces of such current.~~
<u>**Informational Note 1:** Cablebus is ordinarily assembled at the point of installation from the components furnished or specified by the manufacturer in accordance with instructions for the specific job.</u>
<u>**Informational Note 2:** This assembly is designed to carry fault current and to withstand the magnetic forces of such current.</u>
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term and the NEC manual of style does not permit the definition to contain the defined term. Definitions are not requirements. An alternative, if CMP 8 believes this is a requirement is to place the information somewhere else in Article 370, where it would serve as a valid requirement.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Alternate approach, could be as follows:
<u>**370.3 Cablebus assembly:**</u>
<u>**370.3.1** A cablebus shall be assembled at the point of installation from the components furnished or specified by the manufacturer in accordance with instructions for the specific job.</u>
<u>**370.3.2** A cable bus assembly shall be designed to carry fault current and to withstand the magnetic forces of such current.</u>
Panel Meeting Action: Accept in Part
Panel Statement: CMP-8 accepts Informational Note No. 1 and the deletion of the second sentence in the definition. CMP-8 rejects Informational Note No. 2 and the deletion of the third sentence, since it adds a requirement to an informational note which is in violation of the NEC Style Manual.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12
Comment on Affirmative:
LOYD, R.: **CMP-8 should have clarified the action by stating in the action "to read as follows:**
Cablebus. An assembly of insulated conductors with fittings and conductor terminations in a completely enclosed, ventilated protective metal housing. This assembly is designed to carry fault current and to withstand the magnetic forces of such current.
<u>**Informational Note 1:** Cablebus is ordinarily assembled at the point of installation from the components furnished or specified by the manufacturer in accordance with instructions for the specific job."</u>

8-35 Log #818 NEC-P08 **Final Action: Accept in Principle**
(370.4(B))

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 8-115
Recommendation: Accept in Principle ProposaI 8-115. Revise 370.4(B) to read as follows:
(B) Ampacity of Conductors. The ampacity of conductors in cablebus shall be in accordance with Table 310.15(B)(17) and Table 310.15(B)(19) <u>for installations up to and including 2000 volts</u>, or with Table 310.60(C)(69) and Table 310.60(C)(70) for installations over ~~600~~ <u>2001 to 35,000</u> volts.
Substantiation: Changing 600 volts to 1000 volts is not relevant for 370.4(B). Tables 310.15 are for voltages up to 2000 volts. Whereas Tables 310.60 are for 2001 to 35,000 volts.
Panel Meeting Action: Accept in Principle
Section 370.4(B) is revised as follows:
(B) Ampacity of Conductors. The ampacity of conductors in cablebus shall be in accordance with Table 310.15(B)(17) and Table 310.15(B)(19) for installations up to and including 2000 volts, or with Table 310.60(C)(69) and Table 310.60(C)(70) for installations 2001 to 35,000 volts.
Panel Statement: CMP-8 accepts in principle Comment 8-35. CMP-8 removes the word "over" from 370.4(B) since it does not apply.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-36 Log #819 NEC-P08 **Final Action: Accept**
(370.5 Exception)

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 8-117
Recommendation: Accept Proposal 8-117.
Substantiation: This is a correlation issue. Panel 10 Accept Proposal 10-60 to revise 240, Part IX and Sections 240.100 and 240.101 to apply for overcurrent protection over 1000 volts, nominal.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-37 Log #995 NEC-P08 **Final Action: Reject**
(370.80)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 8-109
Recommendation: Revise text to read as follows:
370.80 Ampacity of Conductors. The ampacity of conductors in cablebus shall be in accordance with Table 310.15(B)(17) ~~and, or~~ <u>for voltages below 2,000 and</u> with Table 310.60(C)(69) ~~and~~ <u>or</u> Table 310.60(C)(70) for installations ~~over 600~~ <u>2,000</u> Volts <u>and over</u>.
Substantiation: Typo and correlation with high voltages.
"and, or" typo
Table (17) for up to 2000 and (69) (70) for 2000 and more
Panel Meeting Action: Reject
Panel Statement: CMP-8 rejects the comment as the proposal was not referenced nor does the Section 370.80 exist. CMP-8 also directs the submitter to the action and statement on Comment 8-35.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ARTICLE 374 — CELLULAR METAL FLOOR RACEWAYS

8-38 Log #115 NEC-P08 **Final Action: Accept**
(374.11)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 8-120a
Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 8-126.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept
Panel Statement: See panel action on Comment 8-41.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-39 Log #116 NEC-P08 **Final Action: Accept**
(374.11)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 8-126
Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 8-120a.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: See panel action on Comment 8-41.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-40 Log #820 NEC-P08 **Final Action: Reject**
(374.11)

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 8-120a
Recommendation: Continue to Accept Proposal 8-120a.
Substantiation: This Comment is to address the TCC Comment requesting that Panel 8 reconsider and correlate with the panel action on Proposal 8-126. The language proposed in 8-120a is identical to the Panel Action in 8-126.
Panel Meeting Action: Reject
Panel Statement: See panel action on Comment 8-41. CMP-8 continues to support Proposal 8-120a with the deletion of the information note as revised in Comment 8-41.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-41 Log #593 NEC-P08 **Final Action: Accept**
(374.11, Informational Note)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 8-120a
Recommendation: Revise text to read as follows:
374.11 Connection to Cabinets and Extensions from Cells. Connections between raceways and distribution centers and wall outlets shall be made by means of liquidtight flexible metal conduit, flexible metal conduit where not installed in concrete, rigid metal conduit, intermediate metal conduit, electrical metallic tubing, or approved fittings. Where there are provisions for the termination of an equipment grounding conductor, rigid polyvinyl chloride conduit, reinforced thermosetting resin conduit, electrical nonmetallic tubing, or liquidtight flexible nonmetallic conduit shall be permitted. Where installed in concrete, liquidtight flexible metal conduit and liquidtight flexible nonmetallic conduit shall be listed and marked for direct burial.
~~Informational Note: Liquidtight flexible metal conduit and liquidtight flexible nonmetallic conduit that is suitable for installation in concrete is listed and marked for direct burial.~~
Substantiation: The informational note now just repeats the meaning of the last sentence of 374.11. It serves no purpose.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ARTICLE 376 — METAL WIREWAYS

8-42 Log #594 NEC-P08 **Final Action: Accept**
(376.56)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 8-142
Recommendation: Revise text to read as follows:
376.56 Splices, Taps, and Power Distribution Blocks.
(A) Splices and Taps. Splices and taps shall be permitted within a wireway, provided they are accessible. The conductors, including splices and taps, shall not fill the wireway to more than 75 percent of its area at that point.
(B) Power Distribution Blocks.
(1) Installation. Power distribution blocks installed in metal wireways shall be listed.
(2) Size of Enclosure. In addition to the wiring space requirement in 376.56(A), the power distribution block shall be installed in a wireway with dimensions not smaller than specified in the installation instructions of the power distribution block.
(3) Wire Bending Space. Wire bending space at the terminals of power distribution blocks shall comply with 312.6(B).
(4) Live Parts. Power distribution blocks shall not have uninsulated live parts exposed within a wireway, whether or not the wireway cover is installed.
(5) ~~Through~~ Conductors. ~~Where the wireway is used for conductors that do not terminate on the power distribution block(s), the through~~ Conductors shall be arranged so the power distribution block terminals are unobstructed following installation.
Substantiation: Suggest that obstruction by any conductors is bad.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-43 Log #556 NEC-P08 **Final Action: Accept in Principle**
(376.56(B)(1))

Submitter: Richard E. Loyd, Sun Lakes, AZ
Comment on Proposal No: 8-140
Recommendation: Reconsider and accept the proposal.
Substantiation: I agree with the negative voter comments. I do agree with 90.1(C) I also agree with 90.1(A). This change does add language that will reduce the likelihood of misapplication with could lead to shock hazard. Where safety is an issue redundancy is warranted.
Panel Meeting Action: Accept in Principle
Revise 376.56(B)(1) to read as follows:
(1) **Installation.** Power distribution blocks installed in metal wireways shall be listed. Power distribution blocks installed on the line side of the service equipment shall be listed for the purpose.
Panel Statement: CMP-8 recognizes that power distribution blocks may be suitable for line side of the installation if listed for the purpose.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11 Negative: 1
Explanation of Negative:
ZIELKE, L.: Comment 8-43 should be rejected. While the submitter's Comment is informative, there was no substantiation of a problem with the current use of the set screw type power distribution blocks. The safety and ease of installation is enhanced by the use of the power distribution blocks, rather than the previous methods with split-bolt connectors and tape. The Comment should be Rejected since it is unenforceable with no specifically listed product currently available.

ARTICLE 384 — STRUT-TYPE CHANNEL RACEWAY

8-44 Log #444 NEC-P08 **Final Action: Accept**
(384.120)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 1-114
Recommendation: 110.21 Marking.
(A) Manufacturer Markings. The manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified shall be placed on all electrical equipment. Other markings that indicate voltage, current, wattage, or other ratings shall be provided as specified elsewhere in this *Code*. The marking or label shall be of sufficient durability to withstand the environment involved. **[ROP 1–114]**
384.120 Marking. Each length of strut-type channel raceways shall be clearly and durably identified as required in the first sentence of 110.21<u>(A)</u>.
Substantiation: Accepted ROP 1-114 moved the text in 110.21 from 2008 to 110.21(A) in 2014. 110.21 is now devoid of text and has no first sentence. The first sentence is in 110.21(A).
Panel Meeting Action: Accept
Panel Statement: See panel statement on Comment 8-10.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ARTICLE 386 — SURFACE METAL RACEWAYS

8-45 Log #1426 NEC-P08 **Final Action: Reject**
(386)

TCC Action: The Correlating Committee does not agree with all of the Panel Statement and disagrees with referencing 90.2(C) as adequate substantiation for rejecting the comment.
Submitter: David A. Gerstetter, UL LLC
Comment on Proposal No: 8-154
Recommendation: Revise text as follows:
386.2 Definition.
Surface Metal Raceway. A metallic raceway that is intended to be mounted to the surface of a structure, <u>either directly or by suspension, along</u> with associated couplings, connectors, boxes, and fittings for the installation of electrical conductors.
<u>386.10(5) Surface or Suspension (Pendant) Mounted.</u>
386.30 Securing and Supporting. ~~Surface metal raceways shall be supported at intervals in accordance with the manufacturer's installation instructions.~~
<u>(A) Surface Mount. Surface metal raceways shall be secured to the mounting surface at intervals in accordance with the manufacturer's installation instructions.</u>

(B) Suspension Mount. Surface metal raceways shall be permitted to be suspension mounted at the manufacturer's recommended Intervals and by uslng mounting methods accordance with the manufacturer's installation instructions.
Substantiation: Perhaps a revision to either the definition and/or to the accepted installation practices for surface metal raceways is required in order to make the modified proposed revision, provided above, to the Securing and Supporting portion of Article 386 acceptable.
The securing and support portion of proposal 8-154 was simply an attempt to align the language in Article 386 with what has bee identified to UL by industry as a commonly accepted installation practice for surface metal raceways.
In 2010, UL proposed to revise the current definition of a surface metal raceway in the standard for Surface Metal Raceways and Fittings, ULS, to remove the word "pendant" when referring to how a surface raceway could be mounted. The belief was that by removing the pendant mounting option from the definition in the standard that the definition in the standard would better align with the definition in the NEC for a surface metal raceway. The message from industry was loud and clear that it is common practice for AHJs to accept the suspension/pendant mounting of surface metal raceways, by the use of all-thread or strut, and that the definition in the standard should continue to include the word "pendant" as it had since 1996.
As noted in the explanation of the negative ballot by Mr. Berman, the NEC definition of a surface metal raceway simply states that the raceway is to be mounted to the surface of a structure and makes no mention that the raceway must be in intimate contact with the surface of that structure. The current definition and accepted installation practices for surface metal raceways have been in Article 386 of the NEC since 2002.
Since it can be verified that industry believes that it is common prac ‘ce for AHJs to accept tbe suspension/pendant mounting of surface metal raceways, would respectfully request tbat the portion of proposal 8-154 to revise 386.30 Securing and Supporting surface metal raceways, as modified above, be considered and accepted in order to provide guidance to AHJs and installers when determining whether either surface mounted or suspension mounted surface metal raceways are being installed employing approved appropriate methods in accordance with the manufacturer's installation instructions. I would also request that at this time special consideration also be given to revising the definition and/or uses permitted portion of Article 386.
Panel Meeting Action: Reject
Panel Statement: CMP-8 reaffirms its position to accept in part Proposal 8-154. CMP-8 clearly stated that the scope of Article 386 states that surface metal raceways are intended to be mounted on the surface of the structure.
The submitter has given anecdotal statements of "commonly accepted installation practice" and "The message from industry was loud and clear that it is common practice for the authority having jurisdiction (AHJ) to accept the suspension/pendant mounting of surface metal raceways" without any technical supporting data to support the installation. AHJs are always permitted to accept the installation per 90.2(C). The submitter goes on to state that the application can be "verified" without supplying the verification.
CMP-8 would support revisiting this issue for the 2017 NEC and recommends that the submitter includes a fact finding report that technically supports the use of surface metal raceways in suspended applications.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11 Negative: 1
Explanation of Negative:
BERMAN, R.: As indicated in the comment substantiation, the NEC definition of a surface metal raceway simply states that the raceway is to be mounted to the surface of a structure and makes no mention that the raceway must be in intimate contact with the surface of that structure. The UL 5 Standard for Safety for Surface Metal Raceways and Fittings defines this product as "A raceway for surface or pendant mounting...." The UL 5 Standards Technical Panel, composed of manufacturers and other industry professionals, has previously gone on record supporting the pendant mounting means as an option. By rejecting this proposal and comment, and not clarifying this NEC definition with respect to the mounting method, there is potential for enforcement inconsistencies and for listed products to be rejected in the field.

ARTICLE 388 — SURFACE NONMETALLIC RACEWAYS

8-46 Log #1427 NEC-P08 **Final Action: Reject**
(388)

TCC Action: The Correlating Committee does not agree with all of the Panel Statement and disagrees with referencing 90.2(C) as adequate substantiation for rejecting the comment.
Submitter: David A. Gerstetter, UL LLC
Comment on Proposal No: 8-157
Recommendation: Revise text as follows:
388.2 Definition.
Surface Nonmetallic Raceway. A nonmetallic raceway that is intended to be mounted to the surface of a structure,either directly or by suspension, along with associated couplings, connectors, boxes, and fittings for the installation of electrical conductors.
388.10(3) Surface or Suspension (Pendant) Mounted.
388.30 Securing and Supporting. ~~Surface nonmetallic raceways shall be supported at intervals in accordance with the manufacturer's installation instructions~~
(A) Surface Mount. Surface nonmetallic raceways shall be secured to the mounting surface at intervals in accordance with the manufacturer's installation Instructions.
(B) Suspension Mount. Surface nonmetallic raceways shall be permitted to be suspension mounted at the manufacturer's recommended intervals and by using mounting methods in accordance with the manufacturer's installation instructions.
Substantiation: Perhaps a revision to either the definition and/or to the accepted installation practices for surface nonmetallic raceways is required in order to make the modified proposed revision, provided above, to the Securing and Supporting portion of Article 388 acceptable.
The securing and support portion of proposal 8-157 was simply an attempt to align the language in Article 388 with what has been identified to UL by representatives from NEMA, CSA, U.S. and Canadian industries as a commonly accepted installation practice for surface nonmetallic raceways when they worked together to develop and publish the Third Edition of UL SA, the bi-national standard for Nonmetallic Surface Raceways and Fittings. Requirements used to develop the third edition of the standard were derived from the First Edition of CSA C22.2 No. 62, Surface Raceway Systems, and the Second Edition of UL SA, Nonmetallic Surface Raceways and Fittings. The group included the following definition for a surface nonmetallic raceway: SURF ACE NONMETALLIC RACEWAY - a raceway for surface or suspension mounting with a nonmetallic base and a nonmetallic or metal cover. The group also included in the standard evaluation criteria for pendant type raceways.
As noted in the explanation of the negative ballot by Mr. Berman. the NEC definition of a surface nonmetallic raceway simply states that the raceway is to be mounted to the surface of a structure and makes no mention that the raceway must be in intimate contact with the surface of that structure. The current definition and accepted installation practices for surface metal raceways have been in Article 388 of the NEC since 2002.
Since it can be verified that NEMA, CSA, U.S. and Canadian industries all believe that it is common practice for AHJs to accept the suspension/pendant mounting of surface nonmetallic raceways, I would respectfully request that the portion of proposal 8-157 to revise 388.30 Securing and Supporting surface nonmetallic raceways as provided above, be considered and accepted in order to provide guidance to AHJs and installers when determining whether either surface mounted or suspension mounted surface nonmetallic raceways are being installed in accordance with the manufacturer's installation instructions. I would also request that at this time special consideration also be given to revising the definition and/or uses permitted portion of Article 388.
Panel Meeting Action: Reject
Panel Statement: CMP-8 reaffirms its position to accept in part Proposal 8-157. CMP-8 clearly stated that the scope of Article 388 states that surface metal raceways are intended to be mounted on the surface of the structure.
The submitter has given anecdotal statements of "commonly accepted installation practice" and "The message from industry was loud and clear that it is common practice for the authority having jurisdiction (AHJ) to accept the suspension/pendant mounting of surface nonmetallic raceways" without any technical supporting data to support the installation. AHJs are always permitted to accept the installation per 90.2(C). The submitter goes on to state that the application can be "verified" without supplying the verification.
It should also be noted that by revising the definition in the tri-national standard is not substantiation for changing the NEC. In fact, the revised definition is incorrect per the NEC and should be revisited.
CMP-8 would support revisiting this issue for the 2017 NEC and recommends that the submitter includes a fact finding report that technically supports the use of surface non-metallic raceways in suspended applications.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11 Negative: 1
Explanation of Negative:
BERMAN, R.: As indicated in the comment substantiation, the NEC definition of a surface nonmetallic raceway simply states that the raceway is to be mounted to the surface of a structure and makes no mention that the raceway must be in intimate contact with the surface of that structure. The UL 5A Standard for Safety for Nonmetallic Surface Raceways and Fittings defines this product as "A raceway for surface or suspension mounting...." The UL 5A Standards Technical Panel, composed of manufacturers and other industry professionals, has previously gone on record supporting the suspension mounting means as an option. By rejecting this proposal and comment, and not clarifying this NEC definition with respect to the mounting method, there is potential for enforcement inconsistencies and for listed product to be rejected in the field.

8-47 Log #595 NEC-P08 **Final Action: Accept**
(388.120)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 8-154
Recommendation: Revise text to read as follows
388.120 Marking. Surface nonmetallic raceways that have limited smoke-producing characteristics shall be permitted to be so identified. Each length of

surface nonmetallic raceways shall be clearly and durably identified as required in the first sentence of 110.21(A).
Substantiation: 110.21 is now devoid of text, the text is now in 110.21(A).
Panel Meeting Action: Accept
Panel Statement: See panel statement on Comment 8-10.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ARTICLE 392 — CABLE TRAYS

8-48 Log #311 NEC-P08 **Final Action: Accept in Principle**
(Table 392.10(A))

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 8-158a
Recommendation: Delete the rows "optical fiber raceways" and "signaling raceways".
Substantiation: CMP 16 actions on proposal 16-81 eliminated optical fiber raceways; they were replaced by communications raceways. CMP 3 action on proposal 3-156 eliminated signaling raceways; they too were replaced by communications raceways.
Panel Meeting Action: Accept in Principle
Panel Statement: CMP-8 continues to support Proposal 8-158a. Per Comment 8-48, the proposed Table 392.10(A) needs to delete rows "optical fiber raceways" and "signaling raceways". The "article" column for "communication raceways" needs to be revised to add "725" and "770" so that it reads "725, 770 and 800".
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-49 Log #1228 NEC-P08 **Final Action: Reject**
(392.10(B)(1)(a), Exception (New))

Submitter: Christel K. Hunter, Alcan Cable, a General Cable Company
Comment on Proposal No: 8-176
Recommendation: Add new exception to 392.10(B)(1)(a) that reads:
Exception: Where the cable tray system is not installed on, in or connected to a building, conductors installed in cable tray shall not be required to be identified for use in cable tray.
Substantiation: This proposal should have been accepted. The "CT" mark on a conductor is strictly based on how far flame is propagated on a conductor installed in a vertical cable tray; there are no other tests required for the "CT" mark. The purpose is to limit the spread of fire throughout a building by conductors and mitigate the flame spread ability of the conductors through fire-rated penetrations. The relevant language from UL 44 and UL 83.
Requiring this rating on conductors installed in open air installations that do not connect in any way to a building is unnecessary and does not improve safety. The panel statement included the sentence "These conductors could still be a fire risk even though not on or connected to a building." I'm not sure what that means in this context. Even "CT rated" conductors can burn, just more slowly. A common example of where this exception might be used is in large open air industrial-type ground-mount solar installations, where requiring a CT mark for conductors installed in cable tray does not increase safety. There is precedence for this in other areas of the code. For example, USE-2 conductors are not required to have any flame resistance when installed outside a building, even if they are not directly buried.
I have requested that the new language be included as an exception to 392.10(B)(1)(a) since that is the requirement that is specific to the cable tray requirement. I used the word "identified" in place of "listed and marked" in order to avoid any perception that this exception relaxes the requirement for a listed conductor.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: CMP-8 agrees that for some specific installations such as large open air industrial-type ground-mount solar installations, the CT rating may not be required in accordance with Article 690.
However, regarding other applications adequate substantiation has not been provided by the submitter to permit unlimited outdoor applications.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-50 Log #1602 NEC-P08 **Final Action: Reject**
(392.10(B)(1)(a))

Submitter: Mark Albers, SunPower Corp.
Comment on Proposal No: 8-176
Recommendation: Add new text to read as follows:
Exception: Where the cable tray system is not installed on, in or connected to a building, conductors installed in cable tray shall not be required to be of a type listed and marked on the surface for use in cable tray.
Substantiation: SunPower supports the comment submitted by Christel Hunter from General Cable on this proposal. SunPower uses single conductor cables in cable trays extensively in industrial scale ground mounted PV Systems. To date, our cable selection for these systems has been limited to cables with a CT rating. Unfortunately, this restriction offers no added value. The CT rating was designed for slowing the spread of fire inside of a building. This is particular important when the cable trays are in an environment where they could be the fastest means for spreading a fire when they do NOT have the CT rating. Whereas, in an outdoor application like a ground mounted PV system, there are other combustibles that allow a fire to spread more rapidly than the cables, such as grass or other vegetation. Thus, in the unlikely event of a fire, the CT rating has no affect on slowing the spread of fire. While, SunPower requires the use of fire retardant cables, such as PV Wire, in ground mounted PV Systems, the CT rating requires additional provisions beyond those of fire retardant cables to slow the spread of fire. As a result, we request that you include this important exemption in 392.10(B)(1)(a). This will allow single conductor cable types such as PV Wire to be used this application without modifications.
In this proposed text, we have used the same language that is used 392.10(B)(1)(a) to reference the certification in question. We believe this will improve clarity about the intended exemption for inspectors.
Panel Meeting Action: Reject
Panel Statement: See panel statement on Comment 8-49.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-51 Log #821 NEC-P08 **Final Action: Accept**
(392.18(H))

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 8-181
Recommendation: Continue to Reject Proposal 8-181.
Substantiation: This requirement pertains to marking and does not restrict conductors over 600, 1000 or 15,000 volts. Section 392.18(H) just states that if there are conductors over 600 volts, the Cable Tray shall be marked.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-52 Log #1083 NEC-P08 **Final Action: Reject**
(392.18(H))

Submitter: Michael C. Martin, American Chemistry Council
Comment on Proposal No: 8-182
Recommendation: Exception after 392.18(H) to read as follows:
Exception: Where not readily accessible ~~(as applied to equipment)~~, in industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation, cable tray system warning notices shall be located where necessary for the installation to assure safe maintenance and operation.
Substantiation: It is more appropriate to use the term "readily accessible". Using the term "accessible (as applied to equipment)" for a wiring method (tray) is confusing. I believe the term "readily accessible" matches the intent of the Panel in approving the exception.
Panel Meeting Action: Reject
Panel Statement: CMP-8 reaffirms its position to accept in principle Proposal 8-182. The panel does not accept the term "readily accessible" as it pertains to equipment because it does add clarity to the requirement.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11 Negative: 1
Explanation of Negative:
MARTIN, M.: I believe that changing the phrase "accessible (as applied to equipment)" to "readily accessible" would add clarity since this applies to a wiring method without significantly changing the meaning.

8-53 Log #837 NEC-P08 **Final Action: Accept in Principle**
(392.20(A) and (B))

Submitter: Thomas F. Mueller, The Southern Company
Comment on Proposal No: 8-187
Recommendation: Revise text to read as follows:
392.20 Cable and Conductor Installation.
(A) Multiconductor ~~Cables~~ Circuits Rated 600 Volts or Less. Multiconductor ~~cables~~ circuits rated 600 volts or less shall be permitted to be installed in the same tray.
(B) ~~Cables~~ Circuits Rated Over 600 Volts. ~~Cables~~ Circuits rated over 600 volts and those rated 600 volts or less installed in the same cable tray shall comply with either of the following:
(1) The ~~cables~~ circuits rated over 600 volts are Type MC.
(2) The ~~cables~~ circuits rated over 600 volts are separated from the ~~cables~~ circuits rated 600 volts or less by a solid fixed barrier of a material compatible with the cable tray.
Substantiation: The original proposal should have been 'accepted in principle' rather than rejected. The panel statement acknowledged that the submitter's intent and reasoning was basically sound and reasonable. Even though cable rating, rather than circuit rating is used appropriately in other places in Article 392, I found no other places where cable rating was used in this restrictive manner.
From time to time, my company will design 480 volt nominal circuits using

both 600 volt cable and 2000 volt cable. There is no reason that such 480 volt nominal cables cannot be placed side by side in the same tray, but the code currently disallows this. Additionally, 2000 volt cable may be the cable readily available at installation time when design originally called for 600 volt cable. Again, both such cables should be allowed in the same tray side by side. The intent of the rule is to separate for safety higher voltage circuits from lower voltage circuits in a tray. The re-write above makes the directive plain without being too restrictive.
Panel Meeting Action: Accept in Principle
Revise text to read as follows:
392.20 Cable and Conductor Installation.
(A) Multiconductor Cables Operating at 600 Volts or Less. Multiconductor cables operating at 600 volts or less shall be permitted to be installed in the same tray.
(B) Cables Operating at Over 600 Volts. Cables operating at over 600 volts and those operating at 600 volts or less installed in the same cable tray shall comply with either of the following:
(1) The cables operating at over 600 volts are Type MC.
(2) The cables operating at over 600 volts are separated from the cables operating at 600 volts or less by a solid fixed barrier of a material compatible with the cable tray.
Panel Statement: CMP-8 recognizes that the submitter is attempting to rationalize a mismatch between insulation rating of cables and operating voltage of circuits. The panel modified the existing text to address the concerns of the submitted comment.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-54 Log #260 NEC-P08 **Final Action: Accept**
(392.22(B)(1)(d))

Submitter: Code-Making Panel 6,
Comment on Proposal No: 8-191
Recommendation: Continue to Reject Proposal 8-191.
Substantiation: We assume that CMP-6 was included in this evaluation because the width of trays and any installation spacing requirements have to do with proper and adequate heat dissipation for the conductors. If these rules were violated, then the equivalent of bundling-induced heating would change the safe ampacity of the conductors.
There is no substantiation given for possibly changing the requirements for the width of the various trays. The submitter apparently believes that the same physics apply to under 600-volts as to over 2000-volts, but gives no technical substantiation for this belief.
The submitter's issue of having to do with how the cables are installed should be addressed in Section 392.20. If the suggested text was added to the end of 392.22(B)(1)(d) as requested, it would only apply to 1/0 through 4/0 cables.
This comment was developed by a CMP-6 Task Group and balloted through the entire panel with the following ballot results:
10 Eligible to Vote
10 Affirmative
No Comments on Vote were received
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-55 Log #261 NEC-P08 **Final Action: Accept**
(392.22(B)(1)(e) (New))

Submitter: Code-Making Panel 6,
Comment on Proposal No: 8-192
Recommendation: Continue to Reject Proposal 8-192.
Substantiation: We assume that CMP-6 was included in this evaluation because the width of trays and any installation spacing requirements have to do with proper and adequate heat dissipation for the conductors. If these rules were violated, then the equivalent of bundling-induced heating would change the safe ampacity of the conductors.
The special ampacity allowances for 392.80(A)(2)(d) do not apply to all bundled cable systems. No substantiation is given for possibly changing the requirements. There is no substantiation given for possibly changing the requirements for the width of the various trays.
There is no need for a statement regarding single layer installation for a case where the bundles must already have a maintained spacing. Any requirements having to do with installation alone should be in 392.20.
This comment was developed by a CMP-6 Task Group and balloted through the entire panel with the following ballot results:
10 Eligible to Vote
10 Affirmative
No Comments on Vote were received
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-56 Log #1461 NEC-P08 **Final Action: Reject**
(392.22(B)(1)(b) and (c))

Submitter: Robert Crain, Legrand/Cablofil
Comment on Proposal No: 8-190
Recommendation: Revise text and tables as follows:
392.22(B)(1) (b) Where all of the cables are from 250 kcmil through 900 kcmil, the sum of the cross-sectional areas of all single conductor cables shall not exceed the maximum allowable cable fill area in Column 1 of Table 392.22(B)(1) for the appropriate cable tray width.
<u>*Informational Note: See Tables in Annex C.13-C.15 for maximum number of conductors*</u>
392.22 (B)(1)(c) Where 1000 kcmil or larger single-conductor cables are installed in the same cable tray with single-conductor cables smaller than 1000 kcmil, the sum of the cross sectional areas of all cables smaller than 1000 kcmil shall not exceed the maximum allowable fill area resulting from the computation in Column 2 of Table 392.22(B)(1) for the appropriate cable tray width.
<u>*Informational Note: See Tables in Annex C.13-C.15 for maximum number of conductors*</u>
Add 3 tables to new or revised Annex C(13) through C(15) for single conductor power cables used in cable tray as follows:
(See Tables C.13, C.14 (XHHW) and C.14 (RHW) on the following pages.)
Substantiation: The rules and charts provided in Article 392 for determining the required cable tray size are complex. Cable tray manufacturers receive many technical inquiries regarding how to calculate cable tray sizes. Locating a table of industry standard single conductor cable sizes would allow for simplified determination of the maximum number of cable allowed in a tray width.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: CMP-8 identified a number of errors with original Proposal 8-190. The submitted comment also contains many of the same errors that appeared in that proposal.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

8-57 Log #1371 NEC-P08 **Final Action: Accept**
(392.60.Grounding and Bonding)

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 8-195
Recommendation: NEMA opposes the Panel Action (reject), because the original submitter has a valid point with respect to the deletion of the phrase "not smaller than a 10 AWG," which NEMA supports.
392.60 Grounding and Bonding.
(A) Metallic Cable Trays. Metallic cable trays shall be permitted to be used as equipment grounding conductors where continuous maintenance and supervision ensure that qualified persons service the installed cable tray system and the cable tray complies with provisions of this section. Metallic cable trays that support electrical conductors shall be grounded as required for conductor enclosures in accordance with 250.96 and Part IV of Article 250. Metal cable trays containing non-power conductors shall be electrically continuous through approved connections or the use of a bonding jumper ~~not smaller than a 10 AWG~~
Informational Note: Examples of non-power conductors include nonconductive optical fiber cables and Class 2 and Class 3 Remote Control Signaling and Power Limiting Circuits.
Substantiation: As substantiation for the original proponent's revision to delete the phrase "not smaller than a 10 AWG", NEMA reports that draft NEMA VE 2-2013, Cable Tray Installation Guidelines, no longer contains the provision for installing a 10 AWG bonding jumper as there is no identified substantiation for this statement. An alternative is to delete this entire sentence and Informational that was added in 2011.
Panel Meeting Action: Accept
Panel Statement: CMP-8 only accepts the deletion of "not smaller than a 10 AWG ". The panel recognizes that the submitter of the comment inadvertently omitted the term "only" before the words "non-power conductors " in the last sentence.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

[NEW] Table C.13 (1C THHN) Number of Single Conductor Cables allowed in Cable Tray

Number of Single Conductor Cables allowed in Cable Tray

(Based on fill per 392.22 , Table 392.22(B)(1), Column 1, ampacity per 392.80)

Ventilated Tray Width

Conductor Insulation Type	Conductor Size (AWG/ kcmil)	50 2"	100 4"	150 6"	200 8"	300 12"	400 16"	450 18"	500 20"	600 24"	750 30"	900 36"	Dia used
RHW													
	1/0	3	7	11	14	22	29	33	37	44	56	67	0.532
	2/0	3	6	10	13	20	27	30	34	40	51	62	0.578
	3/0	3	6	9	12	18	24	28	31	37	47	57	0.63
	4/0	2	5	8	11	17	22	25	28	34	43	52	0.688
	250	4	9	13	18	27	37	41	46	55	70	84	0.765
	300	4	8	12	16	24	32	36	40	48	61	73	0.82
	350	3	7	10	14	21	28	32	35	42	54	65	0.871
	400	3	6	9	12	19	25	28	32	38	49	58	0.918
	500	2	5	8	10	16	21	24	26	32	41	49	1.003
	600	2	4	6	8	13	17	19	21	26	33	40	1.113
	700	1	3	5	7	11	15	17	19	23	29	35	1.184
	750	1	3	5	7	10	14	16	18	21	27	33	1.218
	800	1	3	5	6	10	13	15	17	20	26	31	1.25
	900	1	3	4	6	9	12	14	15	18	23	28	1.314
	1000	1	2	4	5	8	11	12	14	17	21	26	1.372

Conductor diameter based on Chapter 9, Table 5 ~~8~~

8-56 (Log #1461)

[NEW] Table C.14 (1C RHW) Number of Single Conductor Cables allowed in Cable Tray

Number of Single Conductor Cables allowed in Cable Tray

(Based on fill per 392.22 , Table 392.22(B)(1), Column 1, ampacity per 392.80)

Ventilated Tray Width

Conductor Insulation Type	Conductor Size (AWG/ kcmil)	50 2"	100 4"	150 6"	200 8"	300 12"	400 16"	450 18"	500 20"	600 24"	750 30"	900 36"	Dia used
RHW													
	1/0	3	7	11	14	22	29	33	37	44	56	67	0.532
	2/0	3	6	10	13	20	27	30	34	40	51	62	0.578
	3/0	3	6	9	12	18	24	28	31	37	47	57	0.63
	4/0	2	5	8	11	17	22	25	28	34	43	52	0.688
	250	4	9	13	18	27	37	41	46	55	70	84	0.765
	300	4	8	12	16	24	32	36	40	48	61	73	0.82
	350	3	7	10	14	21	28	32	35	42	54	65	0.871
	400	3	6	9	12	19	25	28	32	38	49	58	0.918
	500	2	5	8	10	16	21	24	26	32	41	49	1.003
	600	2	4	6	8	13	17	19	21	26	33	40	1.113
	700	1	3	5	7	11	15	17	19	23	29	35	1.184
	750	1	3	5	7	10	14	16	18	21	27	33	1.218
	800	1	3	5	6	10	13	15	17	20	26	31	1.25
	900	1	3	4	6	9	12	14	15	18	23	28	1.314
	1000	1	2	4	5	8	11	12	14	17	21	26	1.372

Conductor diameter based on Chapter 9, Table 5 ~~8~~

8-56 (Log #1461)

[NEW] Table C.14 (1C XHHW) Number of Single Conductor Cables allowed in Cable Tray

Number of Single Conductor Cables allowed in Cable Tray

(Based on fill per 392.22 , Table 392.22(B)(1), Column 1, ampacity per 392.80)

Ventilated Tray Width

Conductor Insulation Type	**Conductor Size (AWG/ kcmil)**	**50 2"**	**100 4"**	**150 6"**	**200 8"**	**300 12"**	**400 16"**	**450 18"**	**500 20"**	**600 24"**	**750 30"**	**900 36"**	**Dia used**
XHHW													
	1/0	4	8	12	16	24	32	36	40	49	62	74	0.482
	2/0	3	7	11	14	22	29	33	37	44	56	68	0.528
	3/0	3	6	10	13	20	27	30	33	40	51	62	0.58
	4/0	3	6	9	12	18	24	27	30	37	47	56	0.638
	250	5	10	16	21	32	43	49	54	65	83	98	0.705
	300	4	9	14	18	28	37	42	47	56	71	85	0.76
	350	4	8	12	16	24	33	37	41	49	62	75	0.811
	400	3	7	11	14	22	29	33	36	44	56	67	0.858
	500	3	6	9	12	18	24	27	30	36	46	55	0.943
	600	2	4	7	9	14	19	22	24	29	37	44	1.053
	700	2	4	6	8	12	17	19	21	25	32	39	1.124
	750	2	4	6	8	12	16	18	20	24	30	37	1.158
	800	1	3	5	7	11	15	17	19	23	29	35	1.19
	900	1	3	5	6	10	13	15	17	20	26	31	1.254
	1000	1	3	4	6	9	12	13	15	18	22	27	1.312

Conductor diameter based on Chapter 9, Table 5

8-56 (Log #1461)

8-58 Log #1019 NEC-P08 **Final Action: Reject**
(392.60(A))

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 8-194
Recommendation: Revise as follows:
392.60 Grounding and Bonding. (A) Metallic Cable Trays. Metallic cable trays shall be permitted to be used as equipment grounding conductors where continuous maintenance and supervision ensure that qualified persons service the installed cable tray system and the cable tray complies with provisions of this section. Metallic cable trays that support electrical conductors shall be grounded as required for conductor enclosures in accordance with 250.96 and Part IV of Article 250. ~~Metal cable trays containing only non-power conductors shall be electrically continuous through approved connections or the use of a bonding jumper not smaller than a 10 AWG.~~
~~Informational Note: Examples of non-power conductors include nonconductive optical fiber cables and Class 2 and Class 3 Remote Control Signaling and Power Limiting Circuits.~~
Substantiation: This comment seeks to remove the language that was added to the 2011 NEC. There was no substantiation for this change, which makes sense because you couldn't possibly substantiate such a requirement. Bonding the cable tray when it is full of communications cables does what exactly? We aren't connecting the tray to earth to help mitigate induced energy from lightning. We aren't connecting it to a power supply so as to remove ground-fault voltage by opening an overcurrent device. It seems that the only thing bonding the tray is doing is ensuring that the entire tray (instead of just a small portion) gets energized in the event of a fault!
Panel Meeting Action: Reject
Panel Statement: CMP-8 reaffirms its position to reject Proposal 8-194. One of the results of effective grounding and bonding electrical systems is the reduction of electrical shock hazards. Per the submitter's statement: "It seems that the only thing bonding the tray is doing is ensuring that the entire tray (instead of just a small portion) gets energized in the event of a fault!"
If properly bonded and grounded, the cable tray voltage potential will go to ground and the cable tray will be at ground (zero) potential reducing electrical hazards.
Further, CMP-8 does not agree that any substantiation was provided for this change.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ARTICLE 393 – LOW-VOLTAGE SUSPENDED CEILING POWER DISTRIBUTION SYSTEMS

18-7 Log #954 NEC-P18 **Final Action: Accept in Principle**
(393)

Submitter: Roy Harvey, Osram Sylvania
Comment on Proposal No: 18-10a
Recommendation: I support the addition of the proposed Article 302 to specify low voltage ceiling power systems.
Substantiation: None provided
Panel Meeting Action: Accept in Principle
Panel Statement: See panel actions and statements on Comment 18-11 and 18-10a (Log #CC1800).
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

18-8 Log #1330 NEC-P18 **Final Action: Accept**
(393.10(1))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 18-10a
Recommendation: Revise text to read as follows:
393.10 Uses Permitted.
(1) For listed utilization equipment capable of operation at a maximum of 30 volts ac (42.4 volts peak) or 60 volts dc (24.8 volts peak for dc interrupted at a rate of 10 to 200 Hz) and limited to Class 2 power levels in <u>Chapter 9,</u> Table 11(A) and Table 11(B) for lighting, control, and signaling circuits.
Substantiation: Be consistent with other references to Chapter 9 tables.
Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

18-9 Log #1208 NEC-P18 **Final Action: Accept**
(393.10(5))

Submitter: Leo F. Martin, Sr., Martin Electrical Consulting
Comment on Proposal No: 18-10a
Recommendation: Delete 302.10(5).
Substantiation: Suspended ceiling grid low-voltage lighting systems are not intended for use in general patient care areas or critical care areas as defined in article 517. See UL White Book 2012 edition (IFFA) item 2, page 185.
Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

18-10 Log #1209 NEC-P18 **Final Action: Accept in Principle**
(393.12(7))

Submitter: Leo F. Martin, Sr., Martin Electrical Consulting
Comment on Proposal No: 18-10a
Recommendation: Add a new section 302.12(7).
Substantiation: Add a new section 302.12(7) to state that suspended ceiling grid low voltage lighting systems are not permitted for installation in general care or critical care areas as defined in Article 517. See UL White Book 2012 edition category IFFA, page 185.
Panel Meeting Action: Accept in Principle
Add new section as follows:
393.12(7) For lighting in general or critical patient care areas.
Panel Statement: There is no proposed language in the comment. The panel has moved the proposed text from 393.10(5) to 393.12(7).
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

18-10a Log #CC1800 NEC-P18 **Final Action: Accept**
(393.21(B))

Submitter: Code-Making Panel 18,
Comment on Proposal No: N/A
Recommendation: Revise text to read as follows:
393.21(B) Multiwire Branch Circuits. Where connected to a multiwire branch circuit, the disconnecting means shall simultaneously break all of the supply conductors including the grounded conductors.
Substantiation: To maintain consistency with 410.130(G)2 the panel concludes that all supply conductors, including the grounded conductors, should be disconnected to eliminate the shock hazard that could be attributed to unbalanced loads. The panel concludes that the reference to 210.4(B) is not needed.
Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

18-11 Log #1588 NEC-P18 **Final Action: Reject**
(393.21(B))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 18-10a
Recommendation: Revise text to read as follows:
393.21 Disconnecting Means.
(B) Multiwire Branch Circuits. Where connected to a multiwire branch circuit, the disconnecting means shall simultaneously simultaneously ~~break all the supply~~ <u>open all ungrounded</u> conductors to the power supply in accordance with 210.4(B).
Substantiation: Use the same phrase as used in 600.6.
Panel Meeting Action: Reject
Panel Statement: To maintain consistency with 410.130(G)2 the panel concludes that all supply conductors, including the grounded conductors, should be disconnected to eliminate the shock hazard that could be attributed to unbalanced loads. The panel concludes that the reference to 210.4(B) is not needed. Section 600.6 speaks to an external switch. Also 410.130(G)(2) uses the word "all" without the "ungrounded" modifier. See 18-10a (Log #CC1800).
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

18-12 Log #1589 NEC-P18 **Final Action: Reject**
(393.21(B))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 18-10a
Recommendation: Revise text as follows:
(B) Multiwire Branch Circuits. Where connected to a multiwire branch circuit, the disconnecting means shall simultaneously break all ~~the~~ <u>ungrounded</u> supply conductors to the power supply in accordance with 210.4(B).
Substantiation: Breaking the neutral is not required.
Panel Meeting Action: Reject
Panel Statement: See panel actions and statements on Comment 18-11 and 18-10a (Log #CC1800).
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

ARTICLE 396 — MESSENGER-SUPPORTED WIRING

7-16 Log #309 NEC-P07 **Final Action: Reject**
(396.10(A))

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 7-76
Recommendation: Revise the action on 7-76 as shown:
Power-limited tray cable Type PLTC ~~725.154(C) and~~ 725.179(E).

Substantiation: This is a correlating comment to our comment on proposal 3-154a to reorganize 725.154. If that comment is accepted, the current 725.154(C) will be deleted. Even if the comment on 3-154a is not accepted, referring to 725.179(E) for listing information on power-limited tray cable is sufficient information.
Panel Meeting Action: Reject
Panel Statement: CMP-7 chooses to retain reference to 725.154(C) regardless of any reorganization. The term "Type PLTC" was rejected at the ROP and therefore should not be considered in this revised comment. Any reference coordination will be reviewed by the Correlating Committee prior to final revisions.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
CYBULA, T.: Based on the action taken by CMP3 on 725.154 in comment 3-63. existing sub paragraph (C) has been deleted, and existing (I) has been renumbered as (C) Thermocouple Circuits. Therefore the reference to 725.154(C) from 396.10(A) will be incorrect. The Correlating Committee should review these comments to ensure correlation is maintained.

ARTICLE 399 — OUTDOOR, OVERHEAD CONDUCTORS, OVER 1000 VOLTS

7-17 Log #718 NEC-P07 **Final Action: Accept**
(399, Title)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 7-82
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.
The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.
The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.
Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.
Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.
If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

7-18 Log #1563 NEC-P07 **Final Action: Reject**
(399)

TCC Action: The Correlating Committee advises that article scopes, numbers, titles, and assignment of articles within Chapters are the responsibility of the Correlating Committee and the Correlating Committee accepts the panel action.
Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 7-83
Recommendation: The proposal should be accepted.
Substantiation: This is a companion comment to one submitted to include this material in Part III of Article 225. The submitter does strongly agree that this material belongs in the NEC and CMP 4 unanimously supported this relocation (Proposal 4-95) at the ROP meeting. The Correlating Committee should allow this relocation to move forward in the best interests of the NEC. Article 399 does not describe a wiring method; it describes how to engineer outdoor overhead medium voltage wiring. As such it does not belong in Chapter 3. In addition, it should not be a stand-alone article due to the nature of the coverage; it fits perfectly in Part III of Article 225. This portion of the NEC already covers overhead conductor clearances above open areas (225.60) and above buildings (225.61). This location not only fits editorially within an article entitled "Outdoor Feeders and Branch Circuits", it also assures the subject matter will be addressed by the most qualified panel to tackle the subject. The wiring employed for overhead medium voltage construction does not employ cable constructions and it would be necessary to provide additional personnel within CMP 7 to duplicate the expertise already present in CMP 4 in order to address this topic properly. Any one of these three reasons would be sufficient to justify the relocation; the three of them together make a solid case in terms of sound of code administration.
Panel Meeting Action: Reject
Panel Statement: CMP-7 reaffirms it's position on Proposal 7-83. This article covers a wiring method and therefore is appropriate for CMP-7. However, CMP-7 agrees that the removal of this article and its renumbering is beyond the scope of this panel's authority in accordance with Section 3.3.1.2 of The Regulations Governing Committee Projects.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

7-19 Log #719 NEC-P07 **Final Action: Accept**
(399.1)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 7-84
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.
The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.
The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and

the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

7-20 Log #720 NEC-P07 **Final Action: Accept**
(399.10)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 7-86
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

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Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

7-21 Log #1325 NEC-P07 **Final Action: Reject**
(399.10)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 7-86
Recommendation: Revise text to read as follows:

~~**399.10 Uses Permitted.** Outdoor overhead conductors over 1000 volts, nominal, shall be permitted only for systems rated over 1000 volts, nominal, as follows: **[ROP 7–86]**~~
~~(1) Outdoors in free air **[ROP 7–87]**~~
~~(2) For service conductors, feeders, or branch circuits~~
399.10 Uses Permitted. Conductors supported by insulators, and insulated cables, rated over 1000 volts, nominal, shall be permitted for systems rated at or below the rated insulators or insulation, when outdoors in free air.

Substantiation: 1) The original first sentence is circular.
2) The original first sentence appears to exclude high-voltage outdoor cables.
3) The original first sentence appears to exclude the use of a circuit insulated for 7.2kV to be used for a 2.4kV circuit for no apparent reason. (It is common utility practice for 22kV lines to be used for 12.47kV with no apparent hazard.)
4) (2) Appears to list "all" circuits under the *NEC*, and therefore adds nothing to Section 399.10.
5) (2) Appears to inadvertently exclude non-utility-owned transmission lines such as 22kV lines owned by mining companies in WV.

Panel Meeting Action: Reject
Panel Statement: The submitter's text does not add clarity.

Article 399 is applicable to outdoor overhead installation. It does not exclude the examples expressed in the submitter's substantiation.

Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

7-22 Log #521 NEC-P07 **Final Action: Accept**
(399.12)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 7-84
Recommendation: Revise text to read as follows:

ARTICLE 399 Outdoor Overhead Conductors over 1000 Volts.
~~**399.12 Uses Not Permitted.** Overhead conductors, over 600 volts, nominal shall not be permitted to be installed indoors.~~

Substantiation: ROP 7-84 changes 600 to 1000. 399.12 references 600volts and indoors in an article about 1000V and outdoors. It certainly does not belong here (if anywhere).

Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

7-23 Log #721 NEC-P07 **Final Action: Reject**
(399.12)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 7-88
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Reject

Panel Statement: CMP-7 deletes the provisions for uses not permitted. CMP-7 refers the submitter to Comment 7-22.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

7-24 Log #722 NEC-P07 **Final Action: Accept**

(399.30)

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 7-90

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

7-25 Log #1581 NEC-P07 **Final Action: Accept**

(399.32(B))

Submitter: James F. Williams, Fairmont, WV

Comment on Proposal No: 7-82

Recommendation: Revise text to read as follows:

399.30 Support.

(B) Structures. Structures of wood, metal, concrete, or combinations of those materials, shall be provided for support of overhead conductors over ~~600~~ 1000 volts, nominal. Documentation of the engineered design by a licensed professional engineer engaged primarily in the design of such systems and the installation of each support structure shall be available upon request of the authority having jurisdiction and shall include consideration of the following:

Substantiation: The article is now about 1000V.

Panel Meeting Action: Accept

Panel Statement: CMP-7 understands the submitter intended to refer to 399.30(B).

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

ARTICLE 400 — FLEXIBLE CORDS AND CABLES

6-67 Log #99 NEC-P06 **Final Action: Accept**

(400.4)

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 6-86

Recommendation: The Correlating Committee directs the panel to revise the panel action as it contains permissive language, i.e. the word “allowed”.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Panel Statement: CMP-6 accepts the direction of the Correlating Committee to revise the panel action. See panel action and statement on Comment 6-69.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

6-68 Log #271 NEC-P06 **Final Action: Accept**

(Table 400.4)

Submitter: Code-Making Panel 14,

Comment on Proposal No: 6-88

Recommendation: Continue to Reject proposal 6-88.

Substantiation: The correlation issues addressed by Proposal 6-88 have been resolved by CMP 14 actions on Proposals 14-37a, 14-88a, 14-105a, and 14-215a

This comment was developed by a CMP-14 Task Group and balloted through the entire panel with the following ballot results:

15 Eligible to vote

14 Affirmative

1 Ballot Not Returned (W.E. McBride)

No Comments on Vote were received

Panel Meeting Action: Accept

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

6-69 Log #1176 NEC-P06 **Final Action: Accept in Principle**

(400.4)

Submitter: Russel LeBlanc, The Peterson School of Engineering

Comment on Proposal No: 6-86

Recommendation: Accept proposal with revision as noted by the TCC.

Revise second sentence to read as follows:

Types of flexible cords and flexible cables other than those ~~(listed)~~(described) in ~~(the table)~~(Table 400.4) shall be ~~(the subject of special investigation)~~ (permitted only by special permission)

Or simply insert the sentence (Flexible cords and flexible cables shall be listed.) *and this will solve the question of whether or not cords and cables must be listed!*

Substantiation: Article 100 definition of word “Listed”. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials of periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

If the intent of Section 400.4 is to require flexible cords and flexible cables to be LISTED by a testing lab, then simply insert the sentence "Flexible cords and flexible cables shall be listed". But since there is presently no requirement as such, then the use of the word listed is not appropriate in the section. The layout of Table 400.4 is in fact a "list", but the term "LISTED" has a specific meaning in the NEC and it is not the correct term to be used here. The correct term to be used is "described" since the term "description" is being used in the first sentence.

Panel Meeting Action: Accept in Principle

Revise text to read as follows:

The use of flexible cords and flexible cables other than those in Table 400.4 shall require permission by the authority having jurisdiction.

Panel Statement: CMP-6 revises the submitter's text for clarity.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

6-70 Log #940 NEC-P06 **Final Action: Reject**

(400.7(A)(9))

Submitter: James F. Williams, Fairmont, WV

Comment on Proposal No: 6-103

Recommendation: Revise text to read as follows:

400.7 Uses Permitted.

(A) Uses. Flexible cords and cables shall be used only for the following:

(9) Connection of accessory equipment associated with mechanical equipment, alarms, or antennas using a listed non-detachable power supply cord 1.83 m (6 ft) or less; <u>or a listed power supply with an integral power plug</u>, above an accessible suspended or dropped ceiling where not prohibited by 300.22. **[ROP 6–103]**

Substantiation: The intent as I understand it is to allow equipment such as small condensate pumps, some alarm system, and WiFi points mounted above dropped ceilings to be plug and cord connected to receptacles also above dropped ceilings. Many, if not most, WiFi points use "wall warts" as power supplies. Adding the text would allow the use of Listed wall warts. Maybe there is a better description of a wall wart?

Panel Meeting Action: Reject

Panel Statement: CMP-6 recognizes that there may be situations that cords may need to be approved for use above these ceilings. These and can be addressed by the approval of the AHJ.

See panel action and statement on Comment 6-73 which rejects Proposal 6-103.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

6-71 Log #386 NEC-P06 **Final Action: Accept**

(400.7(A)(11) (New))

Submitter: Mario Xerri, UL LLC

Comment on Proposal No: 6-101

Recommendation: Add new text to read as follows:

<u>**400.7(A)(11)** Between an existing receptacle outlet and an inlet, where the inlet provides power to an additional single receptacle outlet. The wiring interconnecting the inlet to the single receptacle outlet shall be a Chapter 3 wiring method. The inlet, receptacle outlet, and Chapter 3 wiring method, including the flexible cord and fittings, shall be a listed assembly specific for this application.</u>

Substantiation: There are concerns with the use of an extension cord or a detachable power supply cord because a user can unknowingly substitute a cord set with a smaller AWG size which could result in an overheating condition of the flexible cord. The issue of users substituting a smaller AWG cord can be addressed in the listing of the assembly. The use of non-standard configuration inlets or the use of overcurrent protection at the inlet are two possible methods that could be provided in the listing of the assembly to address the hazard. Adding the specific wording to the proposed 400.7(11) helps the AHJs and installers to better understand what is allowed in this type of installation.

Note: Supporting material is available for review at NFPA Headquarters.

Panel Meeting Action: Accept

Number Eligible to Vote: 10

Ballot Results: Affirmative: 9 Negative: 1

Explanation of Negative:

STACEY, J.: The panel action should have been "Reject" There is no proof that this is a problem only concerns as stated by the submitter. As stated in ROP 6-101panel statement -The subject in this proposal and the submitter's concerns are adequately covered in section 406.7. The new language is not needed or understandable. This does not help this AHJ and could be handled by the product listing and 110.3(B). A user that installs a smaller AWG cord would not be looking at the NEC to see if it's OK nor would the AHJ be there to oversee the installation of equipment like TVs.

6-72 Log #100 NEC-P06 **Final Action: Accept**

(400.8(6))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 6-103

Recommendation: It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 3 for comment.

The Correlating Committee directs that Panel 6 clarify the reference in the panel statement to Proposal 6-102 for changes made to 400.8(5), since Proposal 6-102 was rejected.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Panel Statement: CMP-6 accepts the direction of the Correlating Committee. The panel statement for Proposal 6-103 is incorrect in that the proposed changes in Proposal 6-103 were rejected and no changes were made to 400.8(5). The A2013 ROP Draft is correct.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

6-73 Log #266 NEC-P06 **Final Action: Accept**

(400.8(6))

Submitter: Code-Making Panel 3,

Comment on Proposal No: 6-103

Recommendation: Code-Making Panel 3 does not agree with the panel action. This proposal should have been rejected.

Substantiation: The modification made to the Accept in Pprinciple added by the panel should not have been accepted. The addition of the term "alarms" is too generic and does not clearly identify the type of alarm.

This comment was developed by a CMP-3 Task Group and balloted through the entire panel with the following ballot results:

15 Eligible to vote

13 Affirmative (See affirmative comment below)

2 Ballots Not Returned (A.D. Corbin and D.T. Mills)

The following Comments on Vote were received:

AFFIRMATIVE:

S.L. STENE: The issue is not whether the short cord is a fire load or not. The reason flexible cords are not permitted above the ceiling in a drop ceiling or any other hidden application is that the cord must be installed so it is visible at all times so any deterioration or other damage can be detected and is not hidden out of sight. The proposal should still be rejected but the reasoning is related to damage and deterioration.

Panel Meeting Action: Accept

Number Eligible to Vote: 10

Ballot Results: Affirmative: 9 Negative: 1

Explanation of Negative:

CLINE, S.: In opposition to the Panel's action:

This Comment should have been rejected.

The key limits in the allowances of Proposal 6-103 were: listed and limited length. CMP-3's Comment speaks to risk. All choices about electrical construction involve some sort of risk. Not passing the allowance we crafted in the Proposal leaves higher risks in place since the replacement of equipment is most likely to be done by a non-electrician.

P6-103 did not allow the use of cords above a suspended ceiling which is used for environmental air, since they could not currently comply with 300.22(C)(1). While CMP-3 could in the future consider doing as they did with cables, by adding cord which is ""specifically listed for use within an air-handling space", it is not within CMP-3's expertise to judge the use of the cords when the space is not used for environmental air.

A "listed non-detachable power supply cord" of limited length presents very little risk of becoming a hazard due to damage and deterioration. The cords and equipment involved are easily available for inspection and replacement. Indeed, that is why they need to be cord connected in the first place. They supply power to accessory equipment which MUST work at all times, which will by default constantly be monitored for function, and which must be easily exchanged.

These exchanges of damaged accessory equipment are very likely to be done by a mechanical contractor, an alarm technician, a plumber, or an I.T technician - not an electrician. All the more reason that they be cord connected for the safety of all. We DO NOT want "adaptive" wiring methods to be used in this space.

The limitations placed upon the uses allowed by Proposal 6-103 are far the lesser of evils compared to the existing situation of people jury-rigging solutions for necessary applications.

The reality is that the types of equipment P6-103 allowed for WILL exist above suspended ceilings. We need P6-103.

6-74 Log #835 NEC-P06 **Final Action: Reject**
(400.10, Informational Note)

Submitter: Robert Huddleston, American Chemistry Council
Comment on Proposal No: 6-104
Recommendation: Change Information Note to delete "knotting the cord" from the text. Leave the rest of the Proposal as submitted.
Substantiation: This proposal should have been accepted in part by the Panel. The submitter is correct in clarifying that fittings should be identified rather than designed for the purpose. However, the Informational Note also recommends "knotting the cord" as an acceptable method of strain relief. Knotting the cord? Huh? The Panel needs to recognize that many houses have burned to the ground from damage to cords that are kinked...and just what is a knot in the cord if not an excessive kink? Realizing the fact that many lamps and other cheaply made devices use the cord knotting technique does not justify the NEC condoning such a method of strain relief.
Panel Meeting Action: Reject
Panel Statement: Knotting of some types of cords is a recognized method to provide strain relief to the cord for terminal protection.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9 Negative: 1
Explanation of Negative:
HUDDLESTON, JR., R.: Panel statement says that "knotting of some types of cords is a recognized method to provide strain relief." Recognized or not, this is not an acceptable way to provide strain relief, and there are much better ways to do so rather than tying a UL knot or some other kind of knot in a cord. Many houses burn down when cords are kinked at the outlet due to furniture being pressed against the plug and cord, and yet the Panel condones tying a knot in the cord and says it is a "recognized method". Recognizing that this is an Information Note and not mandatory text does not relinquish the Panel from its responsibilities to promote safety.

6-75 Log #101 NEC-P06 **Final Action: Accept**
(400.23)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 6-105
Recommendation: The Correlating Committee directs that the accepted text comply with Section 3.1.1 of the NEC Style Manual to use mandatory text by changing "...may be green" to "....shall be permitted to be green."
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise text to read as follows:
"...may be green" to "...shall be permitted to be green."
Panel Statement: CMP-6 accepts the direction of the Correlating Committee to review Proposal 6-105 in accordance with Section 3.1.1 of the NEC Style Manual.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

6-76 Log #102 NEC-P06 **Final Action: Accept**
(400.31(B))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 6-106a
Recommendation: The Correlating Committee directs that the panel clarify the location of the proposed text.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise text to read as follows:
(B) Equipment Grounding Conductor(s). An equipment grounding conductor(s) shall be provided in cables with three or more conductors. The total area shall not be less than that of the size of the equipment grounding conductor required in 250.122.
Panel Statement: CMP-6 accepts the direction of the Correlating Committee to clarify the panel action on Proposal 6-106a. CMP-6 notes that the A2013 Draft is correct.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

ARTICLE 404 - SWITCHES

9-40 Log #729 NEC-P09 **Final Action: Accept**
(404.1)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 9-74
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.
The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.
The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.
Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.
Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.
If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:
FERRARO, J.: It is recognized that increasing voltage from 600 volts to 1000 volts may be applicable to specific installations. However, adequate technical substantiation has not been provided to support the change in this Article.

9-41 Log #8 NEC-P09 **Final Action: Reject**
(404.2(C))

Submitter: Stephen L. Herman, Pittsburg, TX
Comment on Proposal No: 9-79
Recommendation: A grounded conductor shall be installed at any switch location that is supplied with a continuous ungrounded source of power.
Substantiation: I am writing concerning 404.2(C). I understand the concern about using grounding conductors as the return path for such electronic devices as motion detectors or occupancy sensors. I believe that the requirement concerning grounded conductors at a switch location can be solved in a much simpler way than the way that it is stated in the present code. As far as I am aware, electronic sensing devices must have a continuous power source to operate. A grounded conductor could be required at any switch location that is supplied with a continuous ungrounded source. This would require a grounded conductor at any single-pole switch and any three-way switch that contains a continuous source of power. In this way, a grounded conductor is not required in locations that cannot be connected to electronic devices because there is no continuous source of power to operate them.
Panel Meeting Action: Reject
Panel Statement: The proposal is too broad and incomplete. See panel action and statement on Comment 9-44.

Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-42 Log #244 NEC-P09 **Final Action: Reject**
(404.2(C))

Submitter: Stephen L. Herman, Pittsburg, TX
Comment on Proposal No: 9-79
Recommendation: Revise text to read as follows:
A grounded conductor shall be installed at any switch location that is supplied with a continuous ungrounded source of power.
Substantiation: At present, 404.2(C) requires a grounded conductor at any switch location. My understanding is that this requirement was made because of the practice of using grounding conductors to supply the neutral for electronic devices such as motion detectors or occupancy sensors. All of these devices require a continuous source of power to operate. If there is no continuous source of power, the electronic device cannot be installed. Therefore, the requirement for a grounded conductor to be present at any switch location could be amended to requiring a grounded conductor to be present at locations where there is a continuous source of power.
Panel Meeting Action: Reject
Panel Statement: The proposal is too broad and incomplete. See panel action and statement on Comment 9-44.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-43 Log #943 NEC-P09 **Final Action: Accept in Principle**
(404.2(C))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 9-87
Recommendation: Revise text to read as follows:
404.2 Switch Connections.
(C) Switches Controlling Lighting Loads. Where switches control lighting loads supplied by a grounded general purpose branch circuit, the grounded circuit conductor for the controlled lighting circuit shall be provided at the switch location.
Exception No. 1: The grounded circuit conductor shall ~~be permitted to be omitted from the~~ <u>shall not be required to be provided at</u> switch ~~enclosure~~ <u>locations</u> where either of the following conditions in (1) or (2) apply: ...
Exception No. 2: The grounded circuit conductor shall not be required to be provided at switch locations where snap switches with integral enclosures complying with 300.15(E) control the lighting loads. **[ROP 9–87]**
Exception No. 3: Where multiple switch locations control the same lighting load in an interior room or space, a grounded circuit conductor ~~of the lighting circuit~~ shall not be required at each such location if one has been provided at one or more switching points that is (are) visible from most areas within the room including all principal entry points. Where a switch controls a receptacle load or a lighting load that does not serve a habitable room or bathroom, or where automatic control of lighting has been provided or the switch is not within the lit area, a grounded circuit conductor shall not be required. **[ROP 9–89]**
Substantiation: 404.2(C) specifies "the grounded circuit conductor for the controlled lighting circuit" so repeating the "of the lighting circuit" is not needed in exception 3
Exceptions 1, 2, & 3 all do not require the grounded conductor, so they should say it in the same way. Using the same phrase for the same concept reduces confusion.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and statement on Comment 9-44 which meets the intent of the submitter.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-44 Log #1121 NEC-P09 **Final Action: Accept in Principle in Part**
(404.2(C))

Submitter: Phil Simmons, Simmons Electrical Services
Comment on Proposal No: 9-82
Recommendation: Revise 404.2(C) in the 2014 NEC ROP Draft as follows:
(C) Switches Controlling Lighting Loads. <u>The grounded circuit conductor for the controlled lighting circuit shall be provided at the location</u> where switches control lighting loads that are supplied by a grounded general purpose branch circuit~~, the grounded circuit conductor for the controlled lighting circuit shall be provided at the switch location.~~ <u>for other than the following:</u>
<u>1. Where conductors enter the box enclosing the switch through a raceway, provided the raceway is large enough for all contained conductors, including a grounded conductor.</u>
<u>2. Where the box enclosing the switch is accessible</u>
<u>3. Snap switches with integral enclosures complying with 310.15(B)(3)(a)</u>
<u>4, Door jamb switches</u>
<u>5. For other than a single switch that can detect occupancy in a contiguous area</u>
<u>6. Where lighting in the area is controlled by automatic means.</u>
<u>5. Statement of Problem and Substantiation for Comment:</u>
Substantiation: An attempt is made to simplify the rule and eliminate the lengthy and confusing exceptions.
The opening paragraph is changed editorially to improve the structure and be complimentary to the list of exceptions that follow it.
The exceptions are rewritten into a simplified list format. The list includes door jamb switches since the Panel in its statement on Proposal 9-83 indicates a grounded conductor should not be required for them.
It is intended that the concepts in Exceptions 1 through 3 in the 2014 NEC ROP Draft be included in the list.
Panel Meeting Action: Accept in Principle in Part
Revise text to read as follows:
(C) Switches Controlling Lighting Loads. The grounded circuit conductor for the controlled lighting circuit shall be provided at the location where switches control lighting loads that are supplied by a grounded general purpose branch circuit, for other than the following:
1. Where conductors enter the box enclosing the switch through a raceway, provided the raceway is large enough for all contained conductors, including a grounded conductor.
2. Where the box enclosing the switch is accessible <u>for the installation of an additional or replacement cable without removing finish materials.</u>
3. Snap switches with integral enclosures complying with <u>300.15(E).</u>
4. <u>Where a switch does not serve a habitable room or bathroom.</u>
5. <u>Where multiple switch locations control the same lighting load such that the entire floor area of that room or space is visible from the single or combined switch locations.</u>
6. Where lighting in the area is controlled by automatic means.
7. <u>A switch controlling a receptacle load.</u>
Panel Statement: CMP-9 accepts the submitter's change to the list format and makes the following changes to cover existing requirements in proposal 9-89 which were omitted:
1. Added #7
2. In #5, the panel reverted to the exception text accepted as part of proposal 9-89 which allows for more than one location to be required to have the grounded circuit conductor.
The panel rejects the use of the term "door jamb switches" to cover switch locations that do not serve a habitable room and reverted to the current text. CMP-9 assumes the listing of the second #5 on the comment was an editorial error and deleted the text.
3. Corrected the reference in #3.
4. CMP 9 agrees that switch locations not in the illuminated area should have a grounded connection to support some dimmers and therefore the allowance was not included in the final panel action. See Proposal 9-89.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-45 Log #147 NEC-P09 **Final Action: Accept**
(404.2(C) Exception No. 2 (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-89
Recommendation: It was the action of the Correlating Committee that the panel reconsider the new Exception No. 2 regarding the use of the words "most areas" with respect to enforceability.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel has implemented the changes requested. See panel action and statement on Comment 9-44.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-46 Log #1546 NEC-P09 **Final Action: Accept in Principle**
(404.2(C) Exception No. 2)

Submitter: Frederic P. Hartwell, Rep. Massachusetts Electrical Code Advisory Committee
Comment on Proposal No: 9-89
Recommendation: Accept the proposed CMP 9 action in principle. Revise the first sentence as accepted by CMP 9 to read as follows:
Where multiple switch locations control the same lighting load in an interior room or space, a grounded circuit conductor of the <u>controlled</u> lighting circuit shall ~~not be required~~ <u>be installed</u> at ~~each such location if one has been provided at one or more switching points that is (are) visible from most areas within the rooms including all principal entry points.~~ <u>one or more switch location(s) such that the entire floor area of that room or space is visible from the single or combined switch locations.</u>
Substantiation: This wording restates the first sentence in positive text and addresses the concerns of the Correlating Committee relative to imprecise language and enforceability. Occupancy sensor switches are readily available in three-way configurations that will provide the required coverage.

Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and statement on Comment 9-44.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-47 Log #357 NEC-P09 **Final Action: Accept**
(404.8(C))

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 9-97
Recommendation: Revise text to read as follows:
(C) Multipole Snap Switches. A multipole, general-use snap switch shall not be permitted to be fed from more than a single circuit unless it is listed and marked as a two-circuit or three-circuit switch.~~, or unless its voltage rating is not less than the nominal line-to-line voltage of the system supplying the circuits.~~
Substantiation: NEMA respectfully requests the code panel to reconsider its action.
CMP 9 has taken a position on design and certification of switches by stating that the use being cited is ".. safe or ought to be". They have also stated ".. UL will have to revisit the Guide Card information, and the problem will disappear " and "that the majority of snap switches comply with all the requirements, and the provisions are routinely being used in the field without incident."
There may have been installations in the field that "worked", but that doesn't mean they were safe or complied with all the requirements. They were likely operating well below their maximum ratings and number of use cycles. The test standard for this product includes a high current overload test and 30,000 cycles of full load endurance. As requested by the panel, UL did revisit this subject through the STP process and determined that the products have NOT been tested for this application and may not be safe. This was determined by the manufacturers of the products and UL. These are certainly "experts" on the subject.
We must not lose site of the basic requirement for safety as stated in the initial sentence of article 404.8(C) that multipole, general-use snap-switches shall NOT be fed from more than one circuit. The requirement unless ".. listed and marked as a two-circuit or three-circuit switch" is the only safe use of these products.
It is now the responsibility of the code panel to provide for a safe installation. The fact that it was in the code unchallenged for one cycle is not a good reason to promote a practice that is not safe. It was simply "missed". It was responded to late in the 2011 cycle and again in the 2014. Delaying the removal of this practice because it was missed the first time around does not make it any safer. The UL requirements for listing and marking 2 and 3 circuit switches have been in existence a long time. They were recently reviewed and clarified at the request of the code panel. The NEC requires that these products be used within their listing.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:
HARTWELL, F.: Please refer to the Explanation of Negative Vote on Comment 9-49.
Comment on Affirmative:
RUPP, B.: NEMA supports the panel action on this Comment. This change will increase the level of safety in the use of multipole snap switches by ensuring that they are installed and used in accordance with their ratings and applications for which they are designed by their manufacturers and listed. This revision by Comment 9-47 will remove explicit and implicit correlation conflicts of existing NEC® 404.8(C) with NEC® 110.3(B), 404.14, and 404.15.

9-48 Log #1164 NEC-P09 **Final Action: Accept**
(404.8(C))

Submitter: Charles S. Kurten, UL LLC
Comment on Proposal No: 9-97
Recommendation: Revise text to read as follows:
(C) Multipole Snap Switches. A multipole, general-use snap switch shall not be permitted to be fed from more than a single circuit unless it is listed and marked as a two-circuit or three-circuit switch.~~, or unless its voltage rating is not less than the nominal line to line voltage of the system supplying the circuits.~~
Substantiation: UL does not support the panel action to reject proposal 9-97.
The Standards Technical Panel (STP) for ANSIIUL20, the Standard for General Use Snap Switches, unanimously supported the "2-circuit and 3-circuit" switch requirements, which were added to the Standard on February 17,2012. These requirements, which are provided below (in legislative format), require testing with multiple supplies and loads.
Switches suitable for such applications are marked to indicate suitability for use on "2-circuit and 3-circuit" installations:
2.18 TWO- OR THREE-CIRCUIT SWITCHES - Consists of up to a three pole switch. intended to be installed on multiple or multi-phase branch circuits controlling multiple or multi-phase loads of no more than 120 V to ground and 240 V line to line, 240 V total per circuit.
5.5.3 With reference to the requirement in Clause 5.5.1, it is impracticable to describe the details of connections that must be made in order to obtain all operating conditions because of the different arrangements of terminals of switches of various manufacturers. The connections to a switch in the test circuit shall be such that the load controlled will have the same position, relative to the switch and the supply that it will have in actual service.
Two- and three-circuit switches are tested simultaneously with multiple supply and loads present to represent actual service conditions and shall be marked in accordance with Clause 7.2.4.
7.2.4 A general-use switch that is intended for the control of two or three circuits shall be marked "(2 or 3) Circuit Switch - 240V max between circuits", or equivalent. In addition, a circuit diagram showing the intended multiple connections shall be provided either on the switch, the smallest carton in which the switch is packaged, on the card in the case of a blister pack, or on a stuffer sheet packaged with each individual switch.
UL supports the original proposal to remove the provision in 404.8(C), noting that the stated use is addressed by the product Standard, and is validated by ratings which are marked on the product.
Panel Meeting Action: Accept
Panel Statement: See panel action on Comment 9-47.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:
HARTWELL, F.: Please refer to the Explanation of Negative Vote on Comment 9-49.

9-49 Log #1437 NEC-P09 **Final Action: Accept**
(404.8(C))

Submitter: David Lutz, Hubbell Inc.
Comment on Proposal No: 9-97
Recommendation: Revise text to read as follows:
Hubbell requests that Code Panel 9 reconsider its action and Accept the proposal as written to delete the text as shown below.
(C) Multipole Snap Switches. A multipole, general-use snap switch shall not be permitted to be fed from more than a single circuit unless it is listed and marked as a two-circuit or three-circuit switch. ~~, or unless its voltage rating is not less than the nominal line-to-line voltage of the system supplying the circuits.~~
Substantiation: This 2 circuit allowance has been in the code in error for 2 cycles now and the problem must be corrected. Hubbell Incorporated produces multipole switches that are UL listed for single circuit use. We also have UL listing for 2 circuit multipole switches. I can assure you that the testing for a 2 circuit rating is very different than the test for single circuit listing. The 2 circuit device must demonstrate the ability to control 2 independent circuits and loads. Each set of contacts sees maximum load make and break operations with full potential to arc between circuits. A standard 1 circuit switch only breaks 1 load thus it shares the maximum load over 2 sets of contacts.
This panel has stated that ".. the majority of snap switches comply with all the requirements, and the provisions are routinely being used in the field without incident."
This code panel cannot possibly know how Hubbell switches are designed tested. Our single circuit mutipole switches have NOT been designed or tested for use on 2 circuits. This UL standard has required special marking and testing for 2 or 3 circuit switches for decades. Hubbell has a listed 2 circuit switch, properly tested and marked.
Just because a device was installed and appears to work without incident does not mean it is safe to do so. This code is founded on the premise of using products in accordance with the manufacturer's instructions and UL listing.
The panel asked UL to review the situation last cycle and they did. The results clearly indicated that 2 circuit switches were very different than single circuit and required special testing and marking. The manufacturers and UL have clearly stated that it is not safe to use a single circuit switch on multiple circuits. This is exactly what the code has always required except for this incorrectly added alternative.
There is overwhelming expert evidence that this practice is NOT safe verses anecdotal evidence of some use in the field without incident. Because some devices have been used in a manner that violates the code, the manufacturer's instructions and the product listing, that certainly does not mean it is safe.
Is this code panel overriding the manufacturer's specifications and the UL listings? Does this code panel have the knowledge regarding the design and testing of every multipole switch manufactured and will now assume liability for this action if there is an incident?
Hubbell strongly urges this code panel to reconsider its rejection and accept the proposal to return the code to it former "safe" requirement.
Panel Meeting Action: Accept
Panel Statement: See panel action on Comment 9-47.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Coghill, P.

Explanation of Negative:

HARTWELL, F.: The comment should have been rejected. The entire point of the prior actions in the two previous code cycles was to compel a change in the product standard. Members of CMP 9 should bear in mind that a multipole switch can be used by right to control a load that includes a neutral connection. Such loads have loads on the poles of the switch that differ in degrees that cannot be known to the switch manufacturer. If the product standard does not take such unequal loading into account, then there is indeed a safety issue, one that can only be cured by making the requirements for 2- and 3-circuit listed switches, more fully described in this comment, mandatory for all multipole switches. If the comment is indeed rejected, then UL will be forced to make that change, even at the expense of a file review for the manufacturers covered by UL 20.

9-50 Log #427 NEC-P09 **Final Action: Hold**
(404.10(B))

TCC Action: The Correlating Committee directs that the Panel Action be reported as Hold because the comment introduces a new concept that has not had public review. This comment will be forwarded to Panel 1 for action during the 2017 revision cycle.
Submitter: Jerry Feagans, City of St. Louis
Comment on Proposal No: 9-89
Recommendation: Add new sentence to 110.13(A) to read:

Electrical equipment shall be secured with an approved fastening device. The use of drywall screws shall not be used to a accomplish the securing of electrical equipment.

Substantiation: The proposal was to add that drywall screws could not be used for securing switches. The information should be located in 110.13(A) for mounting and cooling of equipment. In this section it would apply to all equipment throughout the Code and would not be needed in each Article.
Panel Meeting Action: Accept in Principle
Panel Statement: The panel cannot entertain this change. It needs to come in at the proposal stage and should be directed to Panel 1. See panel action on Comment 9-52 which meets the intent of the submitter as it relates to Chapter 4.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-51 Log #1175 NEC-P09 **Final Action: Reject**
(404.10(B))

Submitter: Dean C. Hunter, Menagha, MN
Comment on Proposal No: 9-98
Recommendation: Delete text as follows:

~~Screws used for the purpose of attaching a snap switch to a box, shall be either machine screws matching the thread gage or size that is integral to the box or in accordance with the manufacturer's instructions.~~

Substantiation: The proposal should be rejected.

The NEC has language to address the mounting of switches. Section 110.3(B) addresses the manufacturers listing and labeling requirements. NEC 404.9(B)(1) covers the provision for using the yoke of the switch with metal screws to a grounded metal box.

For many cycles the NEC has made it clear that grounding and bonding can NOT be accomplished with the use of a drywall screw (NEC 250.8(A)).

Accepting this proposal we will open the door for more proposals that mention every type of screw ever manufactured when it is very obvious to the installers and the AHJ that drywall screws may not be utilized. The submitter has stated that "drywall screws are not acceptable; they may cause damage to the box and inadequate support for the device". All these issues can be enforced by the current addition of the NEC for applicable installations.

A drywall screw may be accepted in certain installations (i.e.: non-metallic boxes with stripped out threads.) Let the discretion be based on the installation and judgment of the AHJ.

Panel Meeting Action: Reject
Panel Statement: The requirement in Section 110.3(B) does not address the problem identified by the Proposal 9-98 since the manufacturers listing and labeling requirements do not address screw replacement during installation.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-52 Log #1372 NEC-P09 **Final Action: Accept**
(404.10(B))

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 9-98
Recommendation: 404.10(B) should be revised to read as follows:

<u>Screws used for the purpose of attaching a snap switch to a box, shall be of the type provided with a listed snap switch, or machine screws having 32 threads per inch, or part of listed assemblies or systems, in accordance with the manufacturer's instructions.</u>

Substantiation: NEMA supports the intent to eliminate the use of drywall screws for mounting receptacles, but the code text would eliminate other listed assemblies that do not use machine screws. Additionally, the revised text should correlate with CMP18 panel action and NEMA Comment on proposal 18-30. Therefore, NEMA would support the modified proposal above.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-53 Log #730 NEC-P09 **Final Action: Accept**
(404.13)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 9-99
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:

FERRARO, J.: It is recognized that increasing voltage from 600 volts to 1000 volts may be applicable to specific installations. However, adequate technical substantiation has not been provided to support the change in this Article.

2-120 Log #148 NEC-P02 **Final Action: Accept**
(404.14(E) Exception (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-101
Recommendation: It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 2 for action in Article 210.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
The Panel 2 rejects Proposal 9-101.
Panel Statement: The submitter's elimination of dimmer switches in this application is not substantiated. There are dimmers that can be properly applied. In addition, the submitter's addition of language requiring that the switch be listed for the use is confusing since there is no such listing that exists or is necessary.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

9-54 Log #731 NEC-P09 **Final Action: Accept**
(404.16)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 9-103
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:

FERRARO, J.: It is recognized that increasing voltage from 600 volts to 1000 volts may be applicable to specific installations. However, adequate technical substantiation has not been provided to support the change in this Article.

ARTICLE 406 — RECEPTACLES, CORD CONNECTORS, AND ATTACHMENT PLUGS (CAPS)

18-13 Log #917 NEC-P18 **Final Action: Hold**
(406.3(E))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 18-15
Recommendation: Revise text to read as follows:
406.3 Receptacle Rating and Type.
(E) Controlled Receptacle Marking. All nonlocking-type, 125-volt, 15- and 20-ampere receptacles that are controlled by an automatic control device or incorporate control features that remove power from the outlet for the purpose of energy management or building automation shall be marked with the symbol shown below placed on the controlled receptacle outlet where visible after installation <u>or have</u> <u>clearly legible marking in letters not less than 6 mm (¼ in.) high reading “Controlled”. The label shall comply with 110.21.</u>
Substantiation: Allow these receptacles to be marked with text for both retrofit work and new work when specially marked receptacles are not available and the electrician does not have stickers with the designated icon and lacks artistic skills.
Unlike the other two receptacles which are marked with icons (isolated ground and hospital grade) a controlled receptacle may be that merely by virtue of the branch circuit that feeds it, not by any mechanical property of the receptacle itself. (Yes, I know about X-10 and its like.)
Indeed currently produced “controlled” receptacles are marked “CONTROLLED”. For example see “Leviton vizia rf+” (a random example).
Panel Meeting Action: Hold
Panel Statement: This comment was held because it would introduce a concept that has not had public review by being included in a related proposal as published in the Report on Proposals.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

18-14 Log #981 NEC-P18 **Final Action: Reject**
(406.4(D))

TCC Action: The Correlating Committee directs that the panel action on this comment be reported as “Reject” to correlate with the action of Code-Making Panel 1 on Comment 1-46 which rejects Proposal 1-131.
Submitter: Charles J. Palmieri, Town of Norwell
Comment on Proposal No: 18-18
Recommendation: Revise text to read as follows:

Arc-fault circuit-interrupter and ground-fault circuit-interrupter type receptacles shall be installed in ~~a readily accessible location~~ <u>in accordance with 110.25</u>.
Substantiation: I am providing suggested text for the panel to consider on this proposal if Code Panel 1 continues to accept P 1-131 (70-A2013-ROP) and create a new section 110.25 the recommended modification to panel action on P-18-18 should be considered.
Panel Meeting Action: Accept in Principle
Panel Statement: If CMP 1 continues to accept, then CMP-18 agrees and the Correlating Committee can make the correlation.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

18-15 Log #1309 NEC-P18 **Final Action: Accept in Principle in Part**
(406.4(D)(3))

Submitter: Mike Weitzel, Bechtel
Comment on Proposal No: 18-21
Recommendation: Revise text to read as follows:

406.4(D)

(3) Ground-Fault Circuit-Interrupters. Ground-fault circuit-interrupter protected receptacles shall be provided where replacements are made at receptacle outlets that are required to be so protected elsewhere in this *Code*.

<u>*Exception: Where replacement of the receptacle type is impracticable, such as where the outlet box size will not permit the installation of the GFCI receptacle shall be permitted to be replaced with a new receptacle of the existing type, where GFCI protection is provided by a circuit breaker, and the receptacle wall plate is marked “GFCI protected”, in accordance with Section 406.4(D)(2) (a), (b), or (c).*</u>
Substantiation: The exception has been re-worded, and describes a practice that is already being done in the field every day. Receptacles are being replaced, but GFCI protection is sometimes being provided by a GFCI circuit breaker, and not by a GFCI receptacle.

Existing receptacle boxes enclosing existing old style two-wire receptacle outlets have a comparatively small cubic inch capacity by today's standards. GFCI receptacle outlets used to replace or 'update' the old, existing two-wire receptacle require approximately one and a half to two times the volume of the existing two-wire receptacle. This requires that the box be replaced, or a box extension be installed in order for the box to accept the installation of the larger GFCI receptacle.

The required GFCI protection is being provided by a GFCI circuit breaker, and not a GFCI receptacle. The old, existing – and often worn out – receptacle is being replaced with a exact same type receptacle, but a new one. This meets the objective of the *Code*, by protecting personnel from electric shock. Circuit breaker protection is an option that should be clearly permitted for this application, as both a GFCI circuit breaker and a GFCI receptacle are required to meet the standards for a Class A device per UL 943 standard.

This practice, though not specifically permitted in the *Code*, improves accessibility, in compliance with recent Section 210.8 requirements that all GFCI devices be installed in a readily accessible location. In this case, the GFCI protection will be located in a panelboard, which has clear requirements for accessibility in Section 240.24, and working space/access in Section 110.26. Accessibility for a receptacle box is only required to be accessible without removing part of the building. (Section 314.29).

As long as the receptacles are GFCI protected and marked as such, the practice of using a GFCI breaker in lieu of a GFCI receptacle should be clearly permitted in the *Code*, as it provides an equivalent level of safety.

Panel Meeting Action: Accept in Principle in Part

Revise text to read as follows:

Exception: Where replacement of the receptacle type is impracticable, such as where the outlet box size will not permit the installation of the GFCI receptacle, the receptacle shall be permitted to be replaced with a new receptacle of the existing type, where GFCI protection is provided ~~by a circuit breaker,~~ and the receptacle ~~wall plate~~ is marked "GFCI protected " and "no equipment ground ", in accordance with Section 406.4(D)(2) (a), (b), or (c).

Panel Statement: The panel made the changes to make the section technically correct and to correlate with 406.4(D)2c.

The words "wall plate" were removed as the receptacle is already required to be marked. The words "by a circuit breaker" were removed as GFCI protection is not limited to circuit breakers.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

18-16 Log #432 NEC-P18 **Final Action: Reject**
(406.4(D)(4)(1))

Submitter: Robert G. Wilkinson, IEC Texas Gulf Coast

Comment on Proposal No: 18-22

Recommendation: Accept proposal 18-22.

Substantiation: CMP 18 rejected my proposal 18-22 with the panel statement "Section 90.4 of this CODE allows the AHJ to revert to the previous Code if the device is unavailable at the time of inspection". This provision was added to 90.4 in the 1984 NEC and it was never intended to be applied to products that don't exist. This provision was added to 90.4 in the 1984 NEC and it was never intended to be applied to products that don't exist. The first electronic GFCI was developed in 1961 and the first requirement for GFCI protection in the NEC was in the 1968 edition and it was limited to protection of underwater lighting in swimming pools. Imagine what would have happened if the 1959 NEC required GFCI protection in light of the fact that the first circuit breaker type GFCI was not introduced until 1968 and the first receptacle type GFCI was not introduced until 1972. It is a disservice to the public to require a product that is not available to fulfill a requirement in the NEC. To continue to go down this path is to put the NEC in jeopardy of not being adopted. The credibility of the NEC is compromised by requiring products that do not exist. To take this matter to the ridiculous, I propose for the 2017 NEC to require a receptacle that I plan to develop that will provide AFCI, GFCI, ALCI, ELCI, IDCI, and LCDI protection. This receptacle will also be tamper resistant, weather resistant, and have the ability to change color to match the wall color. Since 90.4 permits requiring new products that may not be available at the time the Code is adopted, I'm sure my proposed magic receptacle will be accepted.

Panel Meeting Action: Reject

Panel Statement: Outlet branch circuit AFCI's exist and are available in the market.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

18-17 Log #433 NEC-P18 **Final Action: Reject**
(406.4(D)(4)(2))

Submitter: Robert G. Wilkinson, IEC Texas Gulf Coast

Comment on Proposal No: 18-23

Recommendation: Accept proposal 18-23.

Substantiation: CMP 18 rejected my proposal 18-23 with the panel statement" Section 90.4 of this CODE allows the AHJ to revert to the previous Code if the device is unavailable at the time of inspection". This provision was added to 0.4 in the 1984 NEC and it was never intended to be applied to products that don't exist. The first electronic GFCI was developed in 1961 and the first requirement for GFCI protection in the NEC was in the 1968 edition and it was limited to protection of underwater lighting in swimming pools. Imagine what would have happened if the 1959 NEC required GFCI protection in light of the fact that the first circuit breaker type GFCI was not introduced until 1968 and the first receptacle type GFCI was not introduced until 1972. It is a disservice to the public to require a product that is not available to fulfill a requirement in the NEC. To continue to go down this path is to put the NEC in jeopardy of not being adopted. The credibility of the NEC is compromised by requiring products that do not exist. To take this matter to the ridiculous, I propose for the 2017 NEC to require a receptacle that I plan to develop that will provide AFCI, GFCI, ALCI, ELCI, IDCI, and LCDI protection. This receptacle will also be tamper resistant, weather resistant, and have the ability to change color to match the wall color. Since 90.4 permits requiring new products that may not be available at the time the Code is adopted, I'm sure my proposed magic receptacle will be accepted.

Panel Meeting Action: Reject

Panel Statement: See panel action and statement on Comment 18-16.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

15-2 Log #235 NEC-P15 **Final Action: Accept**
(406.5)

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 18-29

Recommendation: It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 15 for action and to Code-Making Panel 9 for information.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Panel Statement: The panel accepts the correlating committee's direction of Comment 15-2 to review Proposal 18-29. The action on Proposal 18-29 was taken in conjunction with the panel action on Comment 15-3.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

15-3 Log #902 NEC-P15 **Final Action: Reject**
(406.5)

Submitter: Lawrence W. Forshner, Bard, Rao + Athanas Consulting Engineers LLC

Comment on Proposal No: 18-29

Recommendation: Add the following sentence at the end of 517.18(B) and 517.19(B)(2) Receptacles, required by this section, shall be supported by outlet boxes in metal stud partitions, by a bar type bracket, that supports the outlet box by engaging two or more framing members.

Substantiation: As designers of electrical systems in health care facilities, we have found that sheet metal type box supports that are bent at 90 degrees, attach to one stud and are intended to provide box and device support by being in contact with the opposite wall of the partition, to be inadequate. Head wall partitions in hospital patient rooms are often not of standard **depth**, the receptacles require more pressure to insert a plug and they get more use than office receptacles during normal hospital operations and especially during emergencies. The sheet metal brackets often do not reach the opposite wall or the sheet metal will deflect after installation requiring the wall to be opened to repair and properly fasten the box. Added language in this section to qualify and describe how to securely fasten outlet boxes used to support "hospital grade " receptacles is needed. Doctors and nurses are not very nice to these receptacles during a "code blue". Our experience has demonstrated that the brackets, clips and support schemes, that are available and designed to increase rough-in productivity, to be inadequate where used in a hospital bed location head wall.

Panel Meeting Action: Reject

Panel Statement: The National Electrical Code is not intended as a design specification. Chapters 1 through 4 provide for proscriptive installation requirements. Support of outlet boxes is covered in 300.11 and 314.23, and adequately addresses proscriptive installation requirements.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

18-18 Log #428 NEC-P18 **Final Action: Accept in Principle**
(406.5)

Submitter: Jerry Feagans, City of St. Louis

Comment on Proposal No: 18-30

Recommendation: Add new sentence to 110.13(A) to read:

Electrical equipment shall be secured with an approved fastening device. The use of drywall screws shall not be used to a accomplish the securing of electrical equipment.

Substantiation: The proposal was to add that drywall screws could not be used fro securing receptacles. The information should be located in 110.13(A) for mounting and cooling of equipment. In this section it would apply to all equipment throughout the Code and would not be needed in each Article.

Panel Meeting Action: Accept in Principle

Panel Statement: This section is not within Panel 18's jurisdiction, but see panel action on Comment 18-20 which meets the submitter's intent as applied to 406.5.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

18-19 Log #1174 NEC-P18 **Final Action: Reject**
(406.5)

Submitter: Dean C. Hunter, Menagha, MN
Comment on Proposal No: 18-30
Recommendation: Delete text as follows:
~~Screws installed for the receptacles fastened to the box, shall be machine screws matching the thread gage or size that is integral to the box.~~
Substantiation: The proposal should be rejected.
The NEC has language to address the mounting of receptacles. Section 110.3(B) addresses the manufacturer's listing and labeling requirements, and receptacles are supplied with the appropriate hardware. This section already requires receptacles shall be mounted in boxes or assemblies designed for the purpose. Accepting this proposal opens the door for frivolous proposals to include every type and size screw ever manufactured.
The submitter has stated that "drywall screws are not acceptable; they may cause damage to the box and inadequate support for the device." While this is true, any such problems can be enforced by the current requirements of the NEC for applicable installations.
Also, this change is unenforceable, as the inspector doesn't see devices at the rough-in stage, and would have to remove every cover plate at the final inspection, to assure that the correct screw was used.
The Code needs to allow discretion. Today, it's possible that an AHJ could accept a case where a screw - other than the one provided with the device - is used in a non-metallic box with stripped-out threads, if the box isn't damaged and the device is adequately secured.
Panel Meeting Action: Reject
Panel Statement: See comment 18-20 which allows alternatives. Note that if mounting threads are stripped, the box is damaged and should be replaced.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

18-20 Log #1378 NEC-P18 **Final Action: Accept**
(406.5)

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 18-30
Recommendation: The third sentence of 406.5 should be revised to read as follows:
<u>Screws used for the purpose of attaching receptacles to a box, shall be of the type provided with a listed receptacle, or machine screws having 32 threads per inch, or part of listed assemblies or systems, in accordance with the manufacturer's instructions.</u>
Substantiation: NEMA supports the intent to eliminate the use of drywall screws for mounting receptacles, but the code text would eliminate other listed assemblies that do not use machine screws. Additionally, the revised text should correlate with CMP9 panel action on proposal 9-98. Therefore, NEMA would support the modified proposal above.
Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

18-21 Log #1540 NEC-P18 **Final Action: Accept in Principle**
(406.5(E))

Submitter: Brian E. Rock, Hubbell Incorporated
Comment on Proposal No: 18-32
Recommendation: To be consistent with wording accepted for listed assemblies by CMP 18 for 406.5(F) in Proposal 18-34, Proposal 18-32 should have been Accepted In Principle and 406.5(E) should be revised to read as follows:
(E) Receptacles in Countertops and Similar Work Surfaces. Receptacles<u>, unless listed as receptacle assemblies for countertop applications,</u> shall not be installed in a face<u>-</u>up position in countertops or similar work surfaces. <u>Where receptacles assemblies for countertop applications are required to provide ground-fault circuit-interrupter protection for personnel in accordance with 210.8, such assemblies shall be permitted to be listed as GFCI receptacle assemblies for countertop applications.</u>
Substantiation: Proposal 18-32's Substantiation is correctly predicated on spillage as a hazard. Nonetheless, Standard for Safety for Attachment Plugs and Receptacles, ANSI/UL 498-2012, in Sections 143, 144 and 146, and Standard for Safety for Ground-Fault Circuit-Interrupters, ANSI/UL 943-2012, in Sections 6.28 - 6.29, specifically evaluate and list for countertop applications receptacle assemblies and GFCI receptacle assemblies, respectively. The evaluation includes, where the assembly retracts into the coutertop, 6000 cycles of mechanical endurance of the retraction mechanism, followed by dielectric-voltage withstand (also leakage current if a GFCI receptacle), and a spill test using a 1/2 gallon of saline solution tipped onto the same assembly, followed again by dielectric-voltage withstand (also leakage current if a GFCI receptacle). Further, if the assembly depends upon a self-closing cover to achieve spill resistance and the receptacle (or GFCI receptacle) has more than one outlet, a single power supply cord is engaged in only one outlet and the cord exits the cover in its released natural resting position before conducting the spill test.
Some of these receptacle assemblies, whether they employ a cover or other means to exclude spillage, may be oriented SOMEWHAT face-up. In the absence of an allowance for listed countertop receptacle assemblies and countertop GFCI receptacle assemblies, the term "face-up position" may be arbitrarily interpreted to encompass ANY position other than outright face-out. Does a receptacle face angled back 15° or 30° or 63°15' 23" in such a listed countertop assembly constitute "face-up position" despite having excluded spillage of a 1/2 gallon of saline solution? Unlike for receptacles mounted in standard outlet boxes, allowance for such listed countertop receptacle assemblies is essential to avoid arbitrary decisions as to what consitutes "face-up".
Editorial: Proposal 18-32 was Accepted with "face up" unhyphenated. The original, unmodified wording reflected those words hyphenated as an adjective "face-up" modifying a noun "position". Further, "face-up position" is a standard term in Annex B (page 29) of the 2011 National Electrical Code® Style Manual.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and statement on Comment 18-23.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

18-22 Log #1205 NEC-P18 **Final Action: Accept in Principle**
(406.5(F) (New))

Submitter: Leo F. Martin, Sr., Martin Electrical Consulting
Comment on Proposal No: 18-34
Recommendation: Continue to accept in part.
Substantiation: Acceptance of this proposal will enhance electrical safety for receptacles installed in countertops and similar locations.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and comment on Comment 18-23.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

18-23 Log #1541 NEC-P18 **Final Action: Accept**
(406.5(F) (New))

Submitter: Brian E. Rock, Hubbell Incorporated
Comment on Proposal No: 18-34
Recommendation: *Proposal 18-34 should have been Accepted In Principle In Part, and 406.5(E) and new 406.5(F) should be revised to read as follows:*
(E) Receptacles in Countertops and Similar Work Surfaces. Receptacles<u>, unless listed as receptacle assemblies for countertop applications,</u> shall not be installed in a face-up position in countertops or similar work surfaces. <u>Where receptacles assemblies for countertop applications are required to provide ground-fault circuit-interrupter protection for personnel in accordance with 210.8, such assemblies shall be permitted to be listed as GFCI receptacle assemblies for countertop applications.</u>
(F) Receptacles in Seating Areas and Other Similar Surfaces. ~~Receptacles shall not be installed in a face-up position in~~ <u>In</u> seating areas or similar surfaces<u>,</u> ~~unless they are part of an assembly listed for the application~~ <u>receptacles shall not be installed in a face-up position unless the receptacle is any of the following:</u>
<u>(1) Part of an assembly listed as a furniture power distribution unit, if cord-and-plug-connected.</u>
<u>(2) Part of an assembly listed either as household furnishings or as commercial furnishings.</u>
<u>(3) Listed either as a receptacle assembly for countertop applications or as a GFCI receptacle assembly for countertop applications.</u>
<u>(4) Installed in a listed floor box.</u>
Renumbered 406.5(G) and 406.5(H) are retained as indicated in the Panel Action.
Substantiation: New 406.5(F): Proposal 18-34's Substantiation cites benches where receptacles are installed such that they could be sat upon and correctly identifies such as a potential hazard. (Accepted Proposal 18-32's Substantiation correctly identifies spillage hazard.) However, the wording accepted is ambiguous and may result in enforcement confusion, inconsistencies and discrepancies; NOT in compliance with Clause 3.2.1 in the 2011 National Electrical Code® Style Manual. The AHJ is not provided with definitive guidance as to hazard and enforcement criteria.
• "… Unless THEY are part of an ASSEMBLY LISTED for …" is ambiguous as to whether "they" refers to "similar surfaces", "seating areas", or "receptacles". To use the product categories in the UL "White Book", are we talking about assemblies that are listed Furnishings, Household and Commercial [IYQX, listed to UL 962], OR are we talking about more specific assemblies that are listed Furniture Power Distribution Units [IYNC, listed to UL 962A], OR are we talking about specific countertop receptacle assemblies [RTRT within UL 498] and countertop GFCI receptacle assemblies [KCXS within UL 943], OR are we talking about conventional receptacles [RTRT,

listed to UL 498] mounted on the raised seating area surfaces in assemblies of scrub-water-resistant listed floor boxes and covers [QCIT, listed to UL 514A, or QCMZ, listed to UL 514C]????

• 406.5(E) definitively encompasses FIXED countertops and permanent wiring connections, whereas 406.5(F) may be interpreted less consistently. The term "seating areas" is undefined. Are we talking about the seating surface itself, or does "seating areas" include adjacent table surfaces (such as airport gate passenger seating areas, doctor's waiting room seating areas, restaurant booth seating areas, etc.)??? If we are talking about that broader definition with adjacent table surfaces, are we talking about fixed seating (assemblies incorporating receptacles that are permanently connected) or movable furnishings (portable or stationary assemblies incorporating receptacles that are cord-and-plug-connected)??? Are foot wells (treated as floors) considered to be part of seating areas???

• In this accepted wording, how is "listed for the application" any less vague or potentially unenforceable than "designed [or listed] for the purpose" that is potentially rejected by Table 3.2.1 in the 2011 National Electrical Code® Style Manual??? The presently accepted 406.5(F) wording doesn't even identify what attributes are to be used by the AHJ in making the enforcement decision. Clearly, the AHJs need more specific direction to ascertain whether the "assembly" is in fact "listed for the application" by delineating what those assemblies are that are evaluated for spillage as a hazard criterion.

The following listed assemblies are specifically evaluated for liquid spillage, and usage of such SPECIFIC assemblies can be enforced consistently and nonarbitrarily by the AHJ:

• cord-and-plug-connected furniture power distribution assemblies [IYNC] for installation in portable and stationary furnishings:

- Standard for Safety for Furniture Power Distribution Units, UL 962A, in Section 36

-- 8 ounces of saline solution tipped towards the assembly, followed by dielectric-voltage withstand

-- if a self-closing cover over more than one outlet, a single power supply cord plugged into only one outlet before spill test

• convenience outlets of household and commercial furnishings [IYQX]:

- Standard for Safety for Household and Commercial Furnishings, UL 962, in Clause 22.9 and Section 49A

-- 8 ounces of saline solution tipped towards the assembly, followed by dielectric-voltage withstand

-- if a self-closing cover over more than one outlet, a single power supply cord plugged into only one outlet before spill test

• countertop receptacle assemblies [RTRT]:

- Standard for Safety for Attachment Plugs and Receptacles, ANSI/UL 498-2012, in Sections 143, 144 and 146

• countertop GFCI receptacle assemblies [KCXS]:

- Standard for Safety for Ground-Fault Circuit-Interrupters, ANSI/UL 943-2012, in Sections 6.28 - 6.29

-- 6000 cycles of mechanical endurance of retraction mechanism, followed by dielectric-voltage withstand (also leakage current if GFCI)

-- 1/2 gallon of saline solution tipped towards the assembly, followed by dielectric-voltage withstand (also leakage current if GFCI)

-- if a self-closing cover over more than one outlet, a single power supply cord plugged into only one outlet before spill test

• conventional receptacle or GFCI receptacle [RTRT or KCXS] mounted within an assembly of a metal floor box [QCIT] and associated floor-box cover [QCIT]:

- Standard for Safety for Metallic Outlet Boxes, ANSI/UL 514A-2010, in Section 12.16

• conventional receptacle or GFCI receptacle [RTRT or KCXS] mounted within an assembly of a plastic floor box [QCMZ] and associated floor-box cover [QCMZ]:

- Standard for Safety for Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers, ANSI/UL 514C-2011, in Sections 16 - 16A

-- floor box support: 50 pounds of force applied to the floor box for 5 minutes, no more than 1/8-inch displacement of floor box 1 minute after force removal

-- scrub-water ingress-resistance (floor box+cover if for tile, vinyl or impermeable surface): 1 gallon of soap-water solution poured within 10 seconds to a depth of 1/8 inch over the unplugged, closed floor-box cover, standing for 1 minute, followed by visual examination

-- scrub-water ingress-resistance (floor box+cover if for carpeted surface): 1 quart of soap-water solution poured within 10 seconds over the unplugged, closed floor-box cover, followed by visual examination

-- floor-box cover loading: 300 pounds of force applied to the floor-box cover for 1 minute, no more than 1/8-inch displacement of floor-box cover 1 minute after force removal, no more than 1/32-inch displacement of floor-box cover 1 hour after force removal 406.5(E): See separate Comment for Proposal 18-32 for 406.5(E); also applies to wording accepted in Panel Action for Proposal 18-34.

Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

18-24 Log #1020 NEC-P18 **Final Action: Reject**
(406.9(B))

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 18-35
Recommendation: Accept the proposal in principal as follows:
(1) 15- and 20-Ampere Receptacles in a Wet Location.
15- and 20-ampere, 125- and 250-volt receptacles installed in a wet location shall have an enclosure that is weatherproof when the receptacle is covered (attachment plug cap not inserted and receptacle covers closed). ~~whether or not the attachment plug cap is inserted. For other than one- or two-family dwellings, an outlet box hood installed for this purpose shall be listed, and where installed on an enclosure supported from grade as described in 314.23(B) or as described in 314.23(F) shall be identified as "extra-duty."~~ All 15- and 20-ampere, 125- and 250-volt nonlocking-type receptacles shall be listed weather-resistant type.
Substantiation: The panel needs to come to grips with the fact the "in-use" cover was a failed experiment. The amount of broken in-use covers is nothing short of alarming. This is evidenced by the fact that we are now requiring "extra-duty" hoods (whatever they are) for some locations and are now considering expanding these enigmatic extra-duty covers. The in-use concept looks good on paper and sounds like a great idea, but it's time we cut our losses and forget we ever heard of these abominations.
If the panel needs additional substantiation, stop reading this, walk outside (wherever you may be), and look at the next ten in-use covers that you see. Odds are at least one-third of them are broken, regardless of whether or not they are supported by grade.
Panel Meeting Action: Reject
Panel Statement: In-use was not a failed experiment. Like all standards, the requirements evolve and the "extra-duty" requirements should address the submitter's concerns.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

18-25 Log #1021 NEC-P18 **Final Action: Accept**
(406.12)

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 18-41a
Recommendation: Revise the section by inserting an opening statement, such as:
406.12 Tamper Resistant Receptacles. Tamper resistant receptacles shall be installed as follows.
Substantiation: This proposal is intended only to maintain consistency in the Code. Typically an opening statement precedes a numbered or alphabetized list.
Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

18-26 Log #455 NEC-P18 **Final Action: Reject**
(406.12 Exception No. 4)

Submitter: Earl W. Roberts, REPTEC
Comment on Proposal No: 18-41a
Recommendation: Delete Exception (4) to 406.12.
Substantiation: Approximately 30% of the homes in the USA have 2-wire, 120v systems with no equipment grounding conductors. Exception (4) discourages manufacturers from producing 2-wire TR receptacles. To justify this because "none exist" helps to deprive people in 2-wire homes from receiving the safety advantages of TR receptacles.
This is similar to not requiring auto seat belts on the basis that initially, the seat belts did not exist in autos.
Producing 2-wire TR receptacles is a simple matter and they could easily be made by the wiring device manufacturers. This would offer people with 2-wire homes the same safety opportunities as the people with 3-wire homes.
Panel Meeting Action: Reject
Panel Statement: While it is true that two-wire tamper resistant receptacles could be manufactured, none are currently found in the market. The replacement use of a 3-wire device is allowed when GFCI protected and tamper resistant GFCI receptacles exist today.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

ARTICLE 408 — SWITCHBOARDS, SWITCHGEAR AND PANELBOARDS

9-55 Log #149 NEC-P09 **Final Action: Accept**
(408)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-103a
Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the panel action on Proposal 9-110.

See the Correlating Committee action on Proposal 9-110.

It was also the action of the Correlating Committee that the list in 408.3(F) be numbered consecutively, i.e., (1) through (5).

In addition, the Correlating Committee directs that the panel clarify whether the action was to delete the existing Informational Note after (E), Exception, since both proposals have not included the Informational Note from the existing Code.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

The changes to the text within Proposal 9-103a at this time, and responses to the Correlating Committee reservations, are as follows:

I. CMP 9 confirms that the exception following 408.3(E)(1) is correct, including the insertion of the word "switchgear."

II. CMP 9 agrees that the Informational Note that now follows 408.3(E) in the 2011 edition shall remain, located after 408.3(E)(1) Exception and ahead of 408.4(E)(2).

III. In 408.3(E)(2), revise the first sentence to read as follows: "DC ungrounded buses shall be permitted to be in any order."

IV. CMP 9 agrees that the numbered paragraphs in 408.3(F) should be numbered (1) through (5). CMP 9 notes that NFPA staff already corrected this error in preparing the ROP Draft.

V. In 408.3(G), revise the order of terms to read: "… provided in switchboards, switchgear, and panelboards…".

Panel Statement: CMP 9 calls attention to the concluding sentence of the panel statement on Proposal 9-103a, which reads as follows: "In the event of any editorial differences between the actions taken on this proposal and actions taken on the various public proposals submitted in Article 408, CMP 9 intends the action on this proposal to be the final result." Therefore, CMP 9 is including the text of all changes or corrections in its response to this comment. The final wording of any changes in this cycle to sections within Article 408 that are affected by the inclusion of the term "switchgear" will be found in Proposal 9-103a as modified in this comment.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 11

Ballot Not Returned: 1 Coghill, P.

9-56 Log #732 NEC-P09 **Final Action: Accept**

(408.1)

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 9-106

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 1

Ballot Not Returned: 1 Coghill, P.

Explanation of Negative:

FERRARO, J.: It is recognized that increasing voltage from 600 volts to 1000 volts may be applicable to specific installations. However, adequate technical substantiation has not been provided to support the change in this Article.

9-57 Log #584 NEC-P09 **Final Action: Accept**

(408.3)

Submitter: Trevor N. Bowmer, Telcordia Technologies / Rep. Alliance for Telecommunications Industry Solutions (ATIS)

Comment on Proposal No: 9-109

Recommendation: Continue to reject this proposal as per Panel 9 action.

Substantiation: The Panel acted correctly in rejecting the proposed action. The function of the Intersystem bonding Termination (IBT) should not be confused with a service disconnecting means.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 11

Ballot Not Returned: 1 Coghill, P.

9-58 Log #596 NEC-P09 **Final Action: Accept in Principle**

(408.3)

Submitter: James F. Williams, Fairmont, WV

Comment on Proposal No: 9-112

Recommendation: Revise text to read as follows:

408.3 Support and Arrangement of Busbars and Conductors.

(E) Bus Arrangement

(2) DC Bus Arrangement. There shall be no specific bus arrangement required of DC ungrounded buses. Arrangement of DC buses shall be field marked as to polarity, grounding system, and nominal voltage.

~~Caution sign(s) or label(s) provided in accordance with items (1) through (5) shall comply with 110.21(B).~~

(F) Switchboard, Switchgear or Panelboard Identification.

<u>Caution sign(s) or label(s) provided in accordance with items (1) through (5) shall comply with 110.21(B).</u>

(1) **High-Leg Identification.** A switchboard, switchgear, or panelboard containing a 4-wire, delta-connected system where the midpoint of one phase winding is grounded shall be legibly and permanently field marked as follows:

Substantiation: Text is misplaced.

Panel Meeting Action: Accept in Principle

Refer to Proposal 9-103a as modified by Comment 9-55 for the final text, which agrees with the submitter's comment.

Panel Statement: CMP 9 notes that the order of text in the draft is incorrect.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 11

Ballot Not Returned: 1 Coghill, P.

9-59 Log #1262 NEC-P09 **Final Action: Reject**

(408.3(A)(2))

Submitter: Donald A. Ganiere, Ottawa, IL

Comment on Proposal No: 9-108

Recommendation: This proposal should be accepted.

Substantiation: The following part of the panel comment is really the basis for this proposal: "Equipment should not be worked on while energized unless requirements of NFPA 70E are followed and appropriate precautions are taken."

There is no provision in 70E that would permit an electrician to work in the enclosure that contains the service disconnect if the line side of the service disconnect is energized and exposed. The only permitted method of working in the service enclosure without the acceptance of this proposal would be to have the utility disconnect the service conductors at a point before they enter the service equipment.

Panel Meeting Action: Reject

Panel Statement: See panel action and statement on Comment 9-61.

Number Eligible to Vote: 12
Ballot Results: Affirmative: 8 Negative: 3
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:
BELISLE, R.: Comment 9-59 should have been accepted in principle. See my negative statement on 9-60
BRINKMEYER, W.: See Comment 9-61 for my reason for Negative vote.
YOUNG, R.: This comment should have been accepted in principal with the actual wording proposed in comment 9-61.
Comment on Affirmative:
OSBORNE, R.: See my affirmative statement for Comment 9-60.

9-60 Log #1516 NEC-P09 **Final Action: Reject**
(408.3(A)(2))

Submitter: Donald R. Cook, Shelby County Department of Development Services
Comment on Proposal No: 9-108
Recommendation: Reconsider and accept in part. Accept proposed revision in title and first sentence.
Substantiation: Barrier enhances safety for both personnel and equipment by reducing the change of contact with live parts. This requirement is already in place in Canada making the equipment available.
Panel Meeting Action: Reject
Panel Statement: Canadian and US requirements are different in many ways including the US allowance for six service disconnects, which is not allowed in Canada. No substantiation of field issues has been provided. Switchboards, switchgear and panelboards have different constructions. Because of the small size of panelboards barriers would restrict cable entry and exit. Appropriate personnel protective equipment would still be required regardless of the inclusion of the barriers. Requirements in place in Canada would not allow load cables to exit the same endwall or barriered area as service cable. Equipment should not be worked on while energized unless requirements of NFPA 70E, *Standard for Electrical Safety in the Workplace*, are followed and appropriate precautions are taken. The utility can and should disconnect the service. Equipment that meets Canadian requirements may not be available for all us applications such as meter panelboards with provisions for a utility meter.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 8 Negative: 3
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:
BELISLE, R.: Comment 9-60 should have been accepted. There was a lengthy discussion among the panel members regarding the benefits of this proposal and the associated comments. The panel could not provide any negative impact of this change, with the exception of “We are not sure how the manufacturer will do it”, yet it is currently in effect in Canada and being done. One manufacturer, as a guest to the panel, spoke to the ability of the manufacturers to make it work if it were to be required, given some time. The panel then discussed a possible 3-year delayed implementation, which would have accomplished that. The panel statement relied on the fact that the U.S. has a 6 disconnect rule, which doesn’t exist in Canada, yet Mr. Dollard provided a solution to this concern in his comment 9-61 to accept the proposal with a new exception addressing this situation. The panel statement further noted that there is no documentation of field issues and voiced concerns over cable entry logistics, yet all of the members of the panel that have actually worked on an energized service voiced the obvious benefit to covering exposed live parts. The panel members appeared to get caught up in the mechanics of how the components would be constructed rather than work on code language that would direct manufacturers to do what they do best, which is provide solutions to industry problems in producing safe products. The intent of this comment was never intended to eliminate the need for safe Electrical Work Practices or PPE, but to further reduce the risk of an Arc Flash and Arc Blast by engineering means by reducing the hazard of energized parts.
BRINKMEYER, W.: See Comment 9-61 for my reason for Negative vote.
HUMPHREY, D.: Adding barriers around the ungrounded line terminals of the service disconnecting means at panelboards would provide enhanced safety at these locations. Additional research, and the substantiation derived from the additional research could serve to make the need for such barriers apparent.
Comment on Affirmative:
OSBORNE, R.: Discussion among panel members indicated an interest in providing “additional barriers” to address concerns with inadvertent contact with live parts. However, such barriers are not likely to provide “shock and arc flash protection” as originally proposed in ROP 9-108 (text that was removed as part of comment 9-60). Consideration should be given to the level of protection provided by barriers, and as noted by the panel Chair, additional research (possibly by the Fire Protection Research Foundation) could serve to qualify the need for these barriers. The appropriate level of protection, the timeframe for implementation, and the details of construction should be driven by the product Standard. The panel’s interest in this proposal should be translated to a proposal to the Standards Technical Panel with responsibility for Panelboards (STP 67). Adoption of construction requirements, including barriers within the equipment, should be decided by the STP.

9-61 Log #1539 NEC-P09 **Final Action: Reject**
(408.3(A)(2))

TCC Action: The Correlating Committee directs the Comment remain as Reject because less than 2/3 of the members eligible to vote have voted in the affirmative.
Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 9-108
Recommendation: This proposal should be Accepted in Principal. Accept the proposed revision and add the following exception:
Exception: Where more than one service disconnect within a single enclosure is used as permitted in 230.71, a barrier shall not be required.
Substantiation: A review of the panel statement to reject this proposal reveals the following reasons in italics:
There are differences between the US requirements and Canadian requirements, most notably the permissive text in 230.71 that allows up to six disconnecting means. CMP-9 is correct. This difference is easily handled with the proposed exception in this comment.
No substantiation of field issues has been provided. The submitter clearly stated the reason for the proposed requirement. When an employee works on service equipment such as a panelboard, there is no means to create an electrically safe work condition (ESWC). Even when the main OCPD is opened, there are still exposed energized parts on the line side of the main OCPD. This proposed revision will allow installer maintainers to create an ESWC. If the committee wants a body count it is readily available. Arc flash injuries and fatalities are well documented. The amount time an arcing fault occurs is directly proportional to the amount of incident energy created. Service conductors are typically not protected with fast acting OCPD’s by the serving utility. This is all about safety.
PPE is still required. CMP-9 is correct. After opening the main OCPD an employee must wear appropriate PPE for shock and arc flash hazards while he/she verifies an ESWC. Once this is completed, there would be no exposure to energized parts because the barrier as required in the proposed text would provide the same level of protection as the cabinet. An ESWC would exist.
The last sentence of the panel statement is in complete agreement with the submitters proposed revision and substantiation.
As a member of the NFPA 70E committee, I ask CMP-9 to take a seriously look at this issue and reconsider their position. The main goal of NFPA 70E is to deenergize, shut it off, and remove the hazard by creating an ESWC. In service equipment it is infeasible to have the utility deenergize. Canada has had this rule in place since before 1950. All major manufacturers have equipment to meet this proposed revision because they sell it in Canada. We need to provide installers and maintainers the ability to create an ESWC in service equipment. It is practical, feasible and will dramatically increase safety by allowing employees to create an ESWC in service equipment
Panel Meeting Action: Reject
Panel Statement: The intent of NFPA 70E, *Standard for Electrical Safety in the Workplace*, is to de-energized equipment to create a safe working condition before working on the equipment. The only alternative is to show that there is increased hazard if the equipment is not de-energized. There may be an arc flash hazard even with barriers installed. If switchboards, switchgear and panelboards are worked on while the service is energized appropriate personnel protective equipment would still be required regardless of the inclusion of the barriers as noted in the proposal as these barriers do not provide “arc protection.” Since the serving utility may not have a fast acting overcurrent protective device protecting the equipment it is even more important to have the utility disconnect the line side power. The utility should disconnect the line side power to the equipment whether there is one or more than one service disconnect to create a safe working condition. Equipment that meets Canadian requirements may not be available for all us applications such as meter panelboards with provisions for a utility meter.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 7 Negative: 4
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:
BELISLE, R.: Comment 9-61 should have been accepted in Principle, by accepting comment 9-60 and the exception cited in this comment. See my negative statement on comment 9-60
BRINKMEYER, W.: I voted to reject Proposal 9-108 in the ROP, primarily because I concurred with the panel statement differentiating between Canadian and US requirements relative to the US allowance for six service disconnects and the condition where barriers would not provide the protection the submitter was seeking in that application. Otherwise, the submitter of the proposal provided a number of good arguments to support the placement of the barriers to provide a safer environment for the protection of electrical workers. Mr. Dollard’s recommendation to add the exception for panelboards containing more than one service disconnect is a good first step toward providing greater safety for electrical workers in those applications. Since 90.1(A) states that the purpose of this code is the practical safeguarding of persons and property from hazards arising from the use of electricity, I believe Proposal 9-108 as modified by Comment 9-61 is an initial first step in providing greater safety.

HUMPHREY, D.: Adding barriers around the ungrounded line terminals of the service disconnecting means at panelboards would provide enhanced safety at these locations. Additional research, and the substantiation derived from the additional research could serve to make the need for such barriers apparent.

YOUNG, R.: This comment should have been accepted. The submitter provided a good case for making this change to require these barriers and a good case was provided in the original proposal. The barriers would go a long way towards reducing the probability of contact with energized parts which would result in less shock hazards and lower probability of getting an arc started. This equipment is available in Canada and US product standards could be changed and products made available in a reasonable amount of time (like one Code Cycle).

Comment on Affirmative:

OSBORNE, R.: See my affirmative statement on Comment 9-60.

9-62 Log #150 NEC-P09 **Final Action: Accept**
(408.3(E))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-110
Recommendation: The Correlating Committee directs that the panel clarify the panel action on this proposal by rephrasing the new (2) in accordance with 3.3.1 of the NEC Style Manual.

In addition, the Correlating Committee directs the panel to reconsider this proposal and correlate it with the action taken on Proposal 9-103a with respect to the word "switchgear" in the first sentence of (E)(1), the inclusion or exclusion of the Exception following (E)(1), and the inclusion or exclusion of the Informational Note contained in the 2011 Edition.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: Refer to the actions itemized within the response to Comment 9-55 for the actions to be taken.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-63 Log #1524 NEC-P09 **Final Action: Accept in Principle**
(408.3(E)(2) and 408.3(F))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 9-110
Recommendation: Revise text to read as follows:
408.3 Support and Arrangement of Busbars and Conductors.
(E) Bus Arrangement.
(2) DC Bus Arrangement. There shall be no specific bus arrangement required of DC ungrounded buses. Arrangement of DC buses shall be field marked as to polarity, grounding system, and nominal voltage.
~~Caution sign(s) or label(s) provided in accordance with items (1) through (5) shall comply with 110.21(B).~~
(F) Switchboard, Switchgear or Panelboard Identification.
Caution sign(s) or label(s) provided in accordance with items (1) through (5) shall comply with 110.21(B).
(1) High-Leg Identification. A switchboard, switchgear, ….
Substantiation: The second paragraph of 408.3(E)(2) should be the text for 408.3(F).
Panel Meeting Action: Accept in Principle
Refer to Proposal 9-103a, as modified by Comment 9-55 for the final text, which agrees with the submitter's comment.
Panel Statement: CMP 9 notes that the order of text in the draft is incorrect.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-64 Log #151 NEC-P09 **Final Action: Accept**
(408.3(F))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-111
Recommendation: The Correlating Committee directs that the panel clarify the panel action on this proposal as it relates to Proposal 9-103a to the order of "switchboard, switchgear, or panelboard" or "switchboard, panelboard, or switchgear."
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: Refer to the panel action on Comment 9-55 for the final text.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-65 Log #406 NEC-P09 **Final Action: Reject**
(408.18(B))

Submitter: Russel LeBlanc, The Peterson School of Engineering
Comment on Proposal No: 9-120
Recommendation: This proposal should be accepted with the following revisions:

"Clearances around switchboards (and switchgear) shall comply with the provisions of 110.26 (for 0-600 volts, and section 110.32 for over 600 volts.)"
Substantiation: With the upcoming change in scope of Article 408 and addition of the term "switchgear" (see proposals 9-103a Log #CP901 NEC-P09 and 9-104a Log #CP900 NEC-P09), this proposal is needed since the clearance requirements for equipment operating over 600 volts are different than equipment operating at lower voltages. There were no other proposals addressing this issue with the wording and changes in Article 408. This proposal will just consolidate what is already required.
Panel Meeting Action: Reject
Panel Statement: The proposal is not within the scope of Article 408 which does not cover medium voltage.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-66 Log #1523 NEC-P09 **Final Action: Reject**
(408.18(B))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 9-103a
Recommendation: Revise text to read as follows:
408.18 Clearances.
(B) Around Switchboards and Switchgear. Clearances around switchboards and switchgear shall comply with the provisions of ~~110.26~~ 110.27 or 110.34.
Substantiation: 600 volt clearance has moved from 110.26 to 110.27. Article 408 is 0 – 1000 volts, thus 11.34 needs to be referenced as well.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 9-65.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

17-2 Log #152 NEC-P17 **Final Action: Accept in Part**
(408.36(E) (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-124
Recommendation: The Correlating Committee directs that this proposal be forwarded to Code-Making Panel 17 for action in Article 680.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept in Part
Panel Statement: CMP-17 accepts the direction from the Correlating Committee to review Proposal 9-124. However, it does not accept the proposed changes. The substantiation asserts that a (swimming pool) "panelboard can be installed without regard for mounting height". However, installation height of panelboard enclosures is already specified in 680.24. There was no substantiation for why the panelboard height requirements specified in Article 550.32(F) should be applied to swimming pool installations.
Number Eligible to Vote: 9
Ballot Results: Affirmative: 9
Comment on Affirmative:

COOK, D.: I support the panel action to accept the TCC direction and the action to reject proposed revision. However, panel statement indicates installation height of panelboard enclosures is already specified in 680.24. I don't find that requirement in 680.24.

9-67 Log #733 NEC-P09 **Final Action: Accept**
(Table 408.56)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 9-132
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:

FERRARO, J.: It is recognized that increasing voltage from 600 volts to 1000 volts may be applicable to specific installations. However, adequate technical substantiation has not been provided to support the change in this Article.

9-68 Log #1269 NEC-P09 **Final Action: Reject**
(Table 408.56)

Submitter: Stanley J. Folz, Morse Electric, Inc.
Comment on Proposal No: 9-132
Recommendation: Reject the Panel action to accept Proposal 9-132.
Substantiation: The Chair of Code Making Panel 11 appointed a task group comprised of myself, Robert Fahey, James Fahey, Jeffery DesJarlais, Luis Bas and Vince Saporita to verify or amend the action taken on Proposal 11-43 where the panel amended Table 430.97 to change 600 volts nominal to 1000 volts nominal. As our research continued we asked Mark Ode to join our discussion. Table 430.97 first appeared in the 1993 NEC. That 1993 Panel rewrote Proposal 11-64 and although it was not stated it appears that the Panel used Table 384-26 (now 408.56) as a basis for Table 430.97.

Mr. Ode tracked 384-26 back to the 1959 NEC. It did not appear in either the 1956 or 1959 preprints. At this point the task group cannot determine what criteria were used to create this Table. This task group recommends that Proposal 11-43 be rejected and testing be done to verify that the current 600 volt spacing is sufficient if increased to 1000 volts. If not, then test to determine what spacing is sufficient for 1000 volts.

This comment is submitted to be consistent with the task group's action on R11-43.

Panel Meeting Action: Reject
Panel Statement: The comment provides no basis for reversal of the previous action. The HV task group evaluated each instance individually and determined that no negative impact will occur.

Product Standards for equipment rated in the 1000 volt range have existed for decades. For example, UL 508, the Standard for Industrial Control Equipment, has covered equipment rated 1500 V or less for at least 20 years. Void of other spacing requirements, use of these creepage and clearance distances are appropriate, as they have a proven record. Other considerations, such as insulating material properties, should be addressed in product Standards.

Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:

FERRARO, J.: It is recognized that increasing voltage from 600 volts to 1000 volts may be applicable to specific installations. However, adequate technical substantiation has not been provided to support the change in this Article.

9-69 Log #597 NEC-P09 **Final Action: Accept in Principle**
(408.58)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 9-134
Recommendation: Revise text to read as follows:

408.58 Panelboard Marking. Panelboards shall be durably marked by the manufacturer with the voltage and the current rating and the number of AC phases or DC ~~phases~~ <u>ungrounded conductors</u> for which they are designed and with the manufacturer's name or trademark in such a manner so as to be visible after installation, without disturbing the interior parts or wiring.

Substantiation: DC (direct current) has no "phases". I could find the term used nowhere on the internet except for "DC phases out…" where DC referred to District of Columbia.

Panel Meeting Action: Accept in Principle
Make no change in the approved ROP text of Proposal 9-134
Panel Statement: The panel notes that there is an error in the draft. The proposal uses the phrase "DC buses" which is correct. However the text was mis-transcribed in the draft as "DC phases". The panel action meets the objectives of the submitter.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

ARTICLE 409 — INDUSTRIAL CONTROL PANELS

11-5 Log #1283 NEC-P11 **Final Action: Reject**
(409, 430, 440, 460, and 470)

Submitter: Elliot Rappaport, Electro Technology Consultants
Comment on Proposal No: 11-9
Recommendation: Accept proposal.
Substantiation: The "equipment grounding conductor" is used properly by many but not by all. This is evidenced by the number of questions raised at inspectors' code sessions and at code classes.

The term "equipment grounding conductor" has a definite purpose that is not uniquely expressed in the term, i.e. "bond the equipment to a terminal at the source of voltage". As a result, there is a misconception that "grounding", without bonding to the source, will make a system safe. On the contrary, connecting equipment to ground without providing the bonding connection back to the source can make equipment less safe by increasing the time to clear the fault.

There is generally insufficient significance placed on the importance of bonding over grounding. Bonding provides sufficient ground fault current back to the source of voltage to operate an overcurrent device and clear the fault quickly. Connection to ground limits the voltage to ground on normally non-current-carrying parts during non-fault conditions. During fault conditions, the value of grounding is minimal since the primary safety concern is to remove the fault voltage as quickly as possible. A path to ground for fault current is not necessary since ground fault current must return to the source of voltage, not to ground.

Renaming this conductor as an "Equipment Bonding Conductor (EBC)" will clarify that the primary purpose of this conductor is to bond to the source in order to provide a known path for ground fault current that will facilitate rapid fault clearing.

It is recognized that the term "EGC" has been in use for a long time and that changing it to EBC will cause some concerns including changing written literature that uses the EGC term. After the initial period of understanding, users will correctly understand the purpose of this conductor and this will enhance the safety of personnel.

The fundamental purpose of this and companion proposals is to clearly state that "systems" are "grounded" and "equipment" is "bonded". The fact that the bonding conductor may be grounded also is secondary to the primary function of bonding.

Panel Meeting Action: Reject
Panel Statement: The panel continues to reject Proposal 11-9 in correlation with the action taken by CMP 5 on Proposal 5-3. Acceptance of this comment would add confusion and reduce usability.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 12 Negative: 2

Explanation of Negative:

POWELL, C.: "The term ""equipment grounding conductor"" needs to be replaced with ""equipment bonding conductor"" throughout the NEC. Yes, the term equipment grounding conductor in Article 100 would need to be changed to the term equipment bonding conductor. The use of the term ""equipment grounding conductor"" is confusing both for those new to the electrical industry and even for some experienced users. The problem is compounded when dealing with other international standards. No technical rebuttal has been provided for not making the change. This conductor always provides a bonding function but does not always provide a grounding function.

SMITH, III, A.: The panel should accept the original proposal. The Panel is incorrect in stating that this will add confusion and reduce usability. The proposed language improves the technical accuracy of the use of the terms "equipment grounding conductor" and "equipment bonding conductor". The IEEE has reviewed all the statements on this subject by various panels. The following represents the IEEE position on the issue of equipment grounding conductor or equipment bonding conductor. There is no justification for retaining an incorrect and potentially hazardous electrical installation just because this definition has been used in the NEC for many years. Not all electrical practitioners are knowledgeable in the main intent of this conductor. The intent of the proposed change is to provide a descriptive name to a construction element that has resulted in much misunderstanding with possible hazardous operating conditions in electrical installations. The use of the term "grounding" implies that grounding is its principal function. Although grounding may be desirable, providing an effective fault current path (i.e. bonding) is and should be the emphasis. There are many who assert that a connection to a water pipe meets the needs of equipment grounding, however, this connection does not perform the necessary effective fault current path back to the source. There are two conductors described in the Code performing the same function but named differently. The "bonding jumper" is a short conductor that insures the electrical integrity of enclosure to raceway. The longer conductor, intended to provide a low impedance path to the source, is presently named a "grounding" conductor instead of its real function as a "bonding" conductor. Technically, the definition in Article 100 may be adequate for Panel members and those that teach. Practically, the definition is confusing if the terminology does not fit the function performed. The equipment bonding conductor, as it should be called, provides its primary function whether or not it is grounded. For a grounded system, it is grounded because the system is grounded. For an ungrounded system, it is grounded to limit the voltage due to a lightning strike or contact with a higher voltage system. Changing the name will assist in educating users of the Code as to why they are installing a conductor that needs to be continuous all of the way back to the source.

11-6 Log #741 NEC-P11 **Final Action: Accept**
(409.1)

TCC Action: The Correlating Committee advises that article scope statements are the responsibility of the Correlating Committee and the Correlating Committee Accepts the panel action.
Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 11-10
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:

COLE, T.: Replacing 600 volts with 1000 volts will have a major impact on installers, component manufacturers, and industry standards. Increased spacing must be considered when going from 600 volts to 1000 volts. Personal safety must also be considered. It seems as though the cart is before the horse. In this situation might it be better to have standards written first before we adopt the unknown. Because the proposer has not provided enough information to the public to justify and understand all the ramifications of the proposal, the committee should reject the submitters proposal until standards are adopted.

11-7 Log #162 NEC-P11 **Final Action: Accept**
(409.1 and 409.110(4), Informational Note)

TCC Action: The Correlating Committee directs that the dates of the latest referenced standards in 409.1 and 409.110(4) Informational Note will be included in the Code.
Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 11-11
Recommendation: The Correlating Committee directs that the panel include the publication date of the referenced standards in the Informational Note in accordance with the Section 3.3.7.4 of the NFPA Regulations Governing Committee Projects.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

11-8 Log #478 NEC-P11 **Final Action: Reject**
(409.2.Industrial Control Panel and 409.4 (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 11-12
Recommendation: Revise text to read as follows:
Industrial Control Panel. An assembly of two or more components consisting of one of the following:
(1) Power circuit components only, such as motor controllers, overload relays, fused disconnect switches, and circuit breakers
(2) Control circuit components only, such as pushbuttons, pilot lights, selector switches, timers, switches, control relays
(3) A combination of power and control circuit components
~~These components, with associated wiring and terminals, are mounted on or contained within an enclosure or mounted on a subpanel. The industrial control panel does not include the controlled equipment.~~
<u>**409.4 Industrial Control Panel Components.**</u>
<u>**409.4.1** Industrial control panel components, with associated wiring and terminals, shall be mounted on or contained within an enclosure or they shall be mounted on a subpanel.</u>
<u>**409.4.2:** Industrial control panels shall not include the controlled equipment.</u>
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term in the last sentence and also contains requirements and the NEC manual of style does not permit the definition to contain the defined term. Definitions are not requirements. The proposed changes eliminate the defined term and the requirements, by placing them in an alternate location in Article 409.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain

requirements or recommendations.
Alternate approach, could be as follows (by eliminating the last two sentences):
Informational Note 1: These components, with associated wiring and terminals, are mounted on or contained within an enclosure or mounted on a subpanel.
Informational Note 2: The industrial control panel does not include the controlled equipment.
Panel Meeting Action: Reject
Panel Statement: The existing definition does not violate the intent of the NEC Style Manual. The proposed text does not add clarity nor improve readability.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

11-9 Log #565 NEC-P11 **Final Action: Reject**
(409.110(2))

Note: When the ballot result does not confirm the TC action on a Proposal by a two-thirds affirmative vote, the Report on Proposals shall be published with a specific request for public comment on that Proposal. The Proposal is now being reconsidered by the TC as a public comment.
Submitter: Richard A. Janoski, Finleyville, PA
Comment on Proposal No: 11-16
Recommendation: Revise as follows:
409.110 Marking. An industrial control panel shall be marked with the following information that is plainly visible after installation:
(2) Supply voltage of all power supplies, location of all power supply circuit disconnecting means, number of phases, frequency, and full-load current for each incoming supply circuit.
Substantiation: A new rule in Section 409.110(3) requires that the industrial control panel is to be marked with a label notifying of the presence of multiple power source disconnecting means. I am recommending an addition to the wording in the first part of the sentence of 409,110(2), that "Supply voltage of all power supplies" be listed on the label.
Also, by placing this label on the enclosure, an individual servicing an industrial control panel will be aware of the electrical hazards present. To eliminate these electrical hazards when servicing the equipment, all of the power sources need to be disconnected. Without a requirement to label to location of all of the power supply disconnects, work must be done to determine their location. It can be the case that locating numerous power supply disconnects in an unfamiliar facility can be a difficult task.
To further aid the technician in creating the safest work environment, I am recommending that the location of all power source disconnects should be labeled on the cabinet. Disconnecting all of the power sources while servicing the panel equipment is the safest work practice. With no voltage present on the interior of the cabinet, both the arc-flash and shock hazards will be eliminated.
Panel Meeting Action: Reject
Panel Statement: See the panel action and statement on Comment 11-10.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14
Comment on Affirmative:
SMITH, III, A.: IEEE supports the panel action to reject comments 11-9 and 11-10
The concept of listing the location of all power supply circuit disconnecting means on a control panel is idealistic but not practical. Control panels can have multiple sources which make marking each source infeasible due to various reasons such as availability of free space for marking. This may also lead to errors and unsafe conditions because nameplate markings may be difficult to keep up to date. A safer method employed by industry is to indicate drawing number(s) for reference and up to date information on sources supplying the panel.
Information on full load current is impractical for all incoming supply circuits to be indicated on the panel due to possible number of sources that may include power, control, communication and signaling circuits.
Power source, power supplies and incoming supply circuits are not clearly defined. Definition is needed to add clarity and prevent misinterpretation between power supply circuits and other sources of voltage.

11-10 Log #999 NEC-P11 **Final Action: Reject**
(409.110(2))

Submitter: Richard A. Janoski, Finleyville, PA
Comment on Proposal No: 11-16
Recommendation: Accept the revised text.
(2) Supply Voltage of all power supplies, location of all power supply circuit disconnecting means 50 volts or less, number, of phases, frequency, and full-load current for each incoming supply circuit.
Substantiation: I am recommending that this Proposal be accepted on the basis of personal safety of the technician servicing an industrial control panel. I understand the concerns of the CMP members regarding the voltage limitations, I have revised the text to reflect this concern. Also, the new text "of all power supplies" was not underlined in the proposal document, this would address the inclusion of; this requirement, acknowledging the presence of multiple power sources.
Panel Meeting Action: Reject
Panel Statement: CMP 11 recommends following safe work practices as outlined in NFPA 70E for establishing an electrically safe work condition. The concern is that markings added during installation are more difficult to maintain than drawings and may also be impractical to adequately describe all the sources of voltage.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14
Comment on Affirmative:
SMITH, III, A.: IEEE supports the panel action to reject comments 11-9 and 11-10
The concept of listing the location of all power supply circuit disconnecting means on a control panel is idealistic but not practical. Control panels can have multiple sources which make marking each source infeasible due to various reasons such as availability of free space for marking. This may also lead to errors and unsafe conditions because nameplate markings may be difficult to keep up to date. A safer method employed by industry is to indicate drawing number(s) for reference and up to date information on sources supplying the panel.
Information on full load current is impractical for all incoming supply circuits to be indicated on the panel due to possible number of sources that may include power, control, communication and signaling circuits.
Power source, power supplies and incoming supply circuits are not clearly defined. Definition is needed to add clarity and prevent misinterpretation between power supply circuits and other sources of voltage.

ARTICLE 410 — LUMINAIRES, LAMPHOLDERS, AND LAMPS

18-27 Log #502 NEC-P18 **Final Action: Reject**
(410.2.Closet Storage Space, 410.15 (New), and 410.16)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 18-58
Recommendation: Revise text to read as follows:
410.2 Definitions
~~**Closet Storage Space.** The volume bounded by the sides and back closet walls and planes extending from the closet floor vertically to a height of 1.8 m (6 ft) or to the highest clothes-hanging rod and parallel to the walls at a horizontal distance of 600 mm (24 in.) from the sides and back of the closet walls, respectively, and continuing vertically to the closet ceiling parallel to the walls at a horizontal distance of 300 mm (12 in.) or the width of the shelf, whichever is greater; for a closet that permits access to both sides of a hanging rod, this space includes the volume below the highest rod extending 300 mm (12 in.) on either side of the rod on a plane horizontal to the floor extending the entire length of the rod. See Figure 410.2.~~
Figure 410.2: Renumber as Figure 410.15
410.15 Closet Storage Space Closet storage space shall be the volume bounded by the sides and back closet walls and planes extending from the closet floor vertically to a height of 1.8 m (6 ft) or to the highest clothes-hanging rod and parallel to the walls at a horizontal distance of 600 mm (24 in.) from the sides and back of the closet walls, respectively, and continuing vertically to the closet ceiling parallel to the walls at a horizontal distance of 300 mm (12 in.) or the width of the shelf, whichever is greater. For a closet that permits access to both sides of a hanging rod, this space shall include the volume below the highest rod extending 300 mm (12 in.) on either side of the rod on a plane horizontal to the floor extending the entire length of the rod. See Figure 410.16.
410.16 Luminaires in Clothes Closets. (A) Luminaire Types Permitted. Only luminaires of the following types shall be permitted in a closet:
(1) Surface-mounted or recessed incandescent or LED luminaires with completely enclosed light sources
(2) Surface-mounted or recessed fluorescent luminaires
(3) Surface-mounted fluorescent or LED luminaires identified as suitable for installation within the closet storage space
(B) Luminaire Types Not Permitted. Incandescent luminaires with open or partially enclosed lamps and pendant luminaires or lampholders shall not be permitted.
(C) Location. The minimum clearance between luminaires installed in clothes closets and the nearest point of a closet storage space (in accordance with 410.15) shall be as follows:
(1) 300 mm (12 in.) for surface-mounted incandescent or LED luminaires with a completely enclosed light source installed on the wall above the door or on the ceiling.
(2) 150 mm (6 in.) for surface-mounted fluorescent luminaires installed on the wall above the door or on the ceiling.
(3) 150 mm (6 in.) for recessed incandescent or LED luminaires with a completely enclosed light source installed in the wall or the ceiling.
(4) 150 mm (6 in.) for recessed fluorescent luminaires installed in the wall or the ceiling.
(5) Surface-mounted fluorescent or LED luminaires shall be permitted to be installed within the closet storage space where identified for this use.

Substantiation: I accept the point made by the CMP that the NEC Manual of Style does not require definitions to be in single sentences. However, section 2.2.2 of the NEC Manual of Style states that "Definitions shall not contain requirements or recommendations." The comment deletes the definition altogether because it simply presents a requirement. The comment also deletes the associated Figure and inserts both into a new section of the NEC in Article 410, in a way that it can be required by the code. Thus, section 410.16, which uses the requirements associated with closet storage space, can refer to the new section 410.15. This does not change requirements but makes the section comply with the NEC Manual of Style.
Panel Meeting Action: Reject
Panel Statement: "Clothes closet" is a definition per the NEC Style Manual section 2.2.2.2 and is in the correct location.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

18-28 Log #949 NEC-P18 **Final Action: Reject**
(410.9)

Submitter: Ed Larsen, Schneider Electric USA
Comment on Proposal No: 18-62
Recommendation: Accept the revised text as follows:
410.9 FCC Compliance. Fluorescent and high intensity discharge luminaires, LED lighting power supplies and self ballasted lamps installed in dwelling units shall comply with the requirements for an FCC Part 15 Class B Digital Device or the Part 18 limits for Consumer ISM Equipment. Compliance with the FCC Part 15 requirements shall be indicated by "Class B Digital Device" marked on the luminaire, power supply or lamp ~~as required by the FCC~~. Compliance with the FCC Part 18 requirements shall be indicated by "Consumer ISM Equipment" marked on the luminaire, power supply or lamp. Luminaires, power supplies or lamps that do not comply shall be marked "Not for use in dwellings".
Substantiation: The statement that, "The use of the term 'dwelling unit' does not correlate with the FCC requirements" is incorrect. The term "dwelling unit" must be used here as it is used in 210.12 to define where AFCIs are required. Article 100 clearly defines what a dwelling unit is. FCC Parts 15 and 18 both use the term "residential environment". Can there be any disagreement that a "dwelling unit" is a "residential environment"?
The statement was made that, "There are commercial dwellings, such as extended stay hotels and assisted living facilities", but such occupancies do not require AFCIs unless they meet the Article 100 definition of a dwelling unit. If they do, then from an NEC perspective, and thus the perspective of an AHJ, they are dwelling units, not commercial dwellings.
The suggestion was made that this is not a luminaire issue but rather an AFCI compatibility issue. This suggestion is understandable, however, field experience has indicated that compatibility in the lab does not always equate to compatibility in the field, often due to the unique mix of loads and the nature of the electrical system in the dwelling. Further, the unique characteristics of a particular AFCI manufacturers design combined with the unique characteristics of a particular ballast or power supply means that adding additional tests or redefining tests in the UL 1699 standard may not totally address the problem. What is know, however, is that all AFCI manufacturers have experienced some degree of problems with non-compliant ballasts and power supplies and that these problems have often been solved by replacing the ballast with a compliant model.
This proposal does nothing more than ask that the correct type of ballast, power supply or lamp be installed in accordance with FCC requirements and that these products be appropriately marked. Using the right product for the application is already required. The marking, which is the only new requirement, will assist installers in purchasing the right product and AHJs in verifying that the right product is installed. The benefit will be a cleaner RF environment in dwellings, resulting in less AFCI unwanted tripping, less radio interference and less interference with other electronic devices in the home that may also be susceptible to RF interference.
Panel Meeting Action: Reject
Panel Statement: The Article 100 definition of "dwelling unit" may apply to commercial installations such as extended stay hotels, dormitories, nursing homes and the like. The FCC does not use the term dwelling unit, rather they use "residential environment". The FCC distinction is intended to separate commercial locations where there is professional maintenance from residential locations where maintenance may be carried out by untrained homeowners. The commenter noted that compatibly in the lab does not always equate to compatibility in the field. Since FCC ratings are based on laboratory measurements, it seems that the commenter is indicating that the FCC emissions measurements will not ensure compatibility. The commenter also stated that problems were often solved by installing FCC compliant ballasts and power supplies. The qualifier "often" infers that this action did not always resolve the problem.
The commenter noted that adding compatibility tests to UL1699 may not totally address the problem. This is counter intuitive since the commenter is proposing that an immunity test, as required for FCC rated power supplies and ballasts, will help resolve the problem. Without corresponding testing done on AFCIs, this cannot be ensured. Currently, UL1699 does not contain test criteria addressing FCC requirements. IEC 61000-4-3 and IEC 61000-4-6 are not used by the FCC. The radiated and conducted emission limits differ between the FCC & IEC test standards.
The commenter states that the benefit of his proposal will be a cleaner RF environment & less interference with electronic devices in the home. These attributes are not part of the purpose of the Code as defined in Article 90.1. The commenter also states that his proposal will result in less unwanted AFCI tripping, which implies that there will still be some unwanted AFCI tripping.
The panel recommends that AFCI immunity parameters be defined and that appropriate immunity testing should be applied to eliminate unwanted tripping. The FCC mandated testing, ratings and markings for lighting electronics are already law, there is no need to reiterate them in the Code.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

18-29 Log #1409 NEC-P18 **Final Action: Accept**
(410.9)

Submitter: Michael S. O'Boyle, Philips Lightolier
Comment on Proposal No: 18-62
Recommendation: I support the panel action to reject the proposal.
Substantiation: The simple fact is that there is no direct correlation between FCC ratings on lighting equipment and AFCI immunity. UL1699 does not contain immunity test requirements for AFCls based on FCC ratings and there is no other standard testing that proves ArCI immunity based on FCC ratings. Accordingly. there is no assurance that requiring luminaires be provided with additional FCC related labeling will be a solution to false tripping.
Panel Meeting Action: Accept
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

18-30 Log #1410 NEC-P18 **Final Action: Accept**
(410.9 (New))

Submitter: Michael S. O'Boyle, Philips Lightolier
Comment on Proposal No: 18-63
Recommendation: I support the panel action to reject the proposal.
Substantiation: The simple fact is that there is no direct correlation between FCC ratmgs on lighting equipment and AFCI immunity. ULI699 does not contain immunity test requirements for AFCls based on FCC ratings and there is no other standard testing that proves AFCI immunity based on FCC ratings. Accordingly, there is no assurance that requiring luminaires be provided with additional FCC related labeling will be a solution to false tripping.
Panel Meeting Action: Accept
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

2-121 Log #236 NEC-P02 **Final Action: Accept**
(410.9)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 18-61
Recommendation: It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 2 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
The Panel 2 action on Proposal 18-61 is Reject.
Panel Statement: The panel accepts the Correlating Committee direction to act upon Proposal 18-61. General lighting calculations are based on the VA/sq ft rules in 220.12. The exception referenced for track lighting is very specific because that calculation is based on a VA per length of track.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

18-32 Log #371 NEC-P18 **Final Action: Accept**
(410.20)

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 18-68
Recommendation: Maintain the language of 410.20 from the 2011 NEC with no change.
Substantiation: The Panel Action and original proposal should be rejected. NEMA recognizes that 314.16(B)(1) Exception already addresses the accommodation of luminaire conductors within canopies.
Panel Meeting Action: Accept
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

18-33 Log #1564 NEC-P18 **Final Action: Accept in Principle**
(410.20)

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 18-68
Recommendation: Accept the proposal in principle. Revise text to read as follows:

The internal volume of a canopy, where marked, shall be applied in accordance with 314.16(A)(3).
Substantiation: CMP 9 reviewed this proposal (18-68) and created a panel proposal (9-37a) to address it. CMP 9 concluded that Proposal 18-68 was acceptable only to a limited extent. The CMP 18 wording has now created a direct conflict with the CMP 9 action and must be modified. This is not an issue that bears on the construction of a luminaire, other than the fact of a marking. This issue addresses box fill, which is squarely within the jurisdiction of CMP 9. This comment permanently resolves the issue by returning the jurisdiction to the appropriate article and code making panel.
It should be noted that CMP 9 returned the favor. It also reviewed Proposal 18-69 on 410.25 which directly conflicts with 314.25(B). In this case, CMP 9 determined that the question was properly within the scope of CMP 18's authority and (see Panel 9 Proposal 9-55a) it amended Article 314 so as to preclude any conflict with how CMP 18 might decide to rewrite the rule regarding exposure of combustible surfaces to luminaire canopies.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action on comment 18-32. Returning the text to the 2011 NEC language will eliminate any conflict with 314.16.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

18-34 Log #1565 NEC-P18 **Final Action: Reject**
(410.62(C))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 18-74
Recommendation: Accept the proposal as written, but change the title and parent text to read as follows:
(C) Electric-Discharge and LED Luminaires. Electric discharge and LED luminaires shall comply with (1), (2), and (3) as applicable.
Substantiation: The panel statement regarding the independent applicability of the three numbered paragraphs is correct and this comment makes the required correction. The increased usability and clarity of the remainder of the proposal is self-evident. The Correlating Committee should review the current syntax and if it finds that it does not flagrantly violate Section 3.3.1 of the NEC Style Manual, then nothing in the entire NEC does and the manual should delete that provision for lack of relevance.
Panel Meeting Action: Reject
Panel Statement: Proposed 410.62(C)(1)(c) states that only listed assemblies can be cord connected via manufactured wiring system connectors. As currently written, 410.62(C) allows listed luminaires to be cord connected using listed assemblies that incorporate manufacturing wiring system connectors.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

18-31 Log #411 NEC-P18 **Final Action: Accept**
(410.130(G)(1) Exception No. 4)

Submitter: Roger Zieg, Zieg Electric
Comment on Proposal No: 18-78
Recommendation: Delete Exception No. 4 as follows:
~~Exception No. 4: A disconnecting means shall not be required in industrial establishments with restricted public access where conditions of maintenance and supervision ensure that only qualified persons service the installation by written procedures.~~
Substantiation: I believe the action of the committee should be to accept this proposal. The purpose of the Code is the practical safeguarding of persons and property from hazards arising from the use of electricity. Several on the Code Making Panel, in the Explanation of the Negative during the proposal stage, made reference to the safe working practices found in NFPA 70E. To make an exception to a safety related feature makes no sense. There are disconnecting means that have been developed in direct response to this requirement when it was added to the Code in 2005. The purpose of the exception for industrial establishments at that time seems to be the cost factor of the disconnecting means and not the protection of the worker. This exception was a development of the Code making process and was not a part of the original proposal. With the development of the "in-line" disconnecting means and other safety features provided by the manufacturers, this exception needs to be deleted. I have attached a NIOSH FACE incident in which a worker was electrocuted while working on a florescent light. The company he was working for had safety rules and regulations in place. Do not give the worker or his/her employer a choice when it comes to safety. There should be no exceptions to disconnecting means for qualified people.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Accept
Number Eligible to Vote: 11
Ballot Results: Affirmative: 9 Negative: 2
Explanation of Negative:
CARPENTER, F.: The NIOSH report referenced in the comment's substantiation does not speak about the required written procedures that should address safety methods for this electrical work. No information has been provided to show that a hazard exists "where conditions of maintenance and supervision ensure that only qualified persons service the installation by written procedure". NEMA continues to support maintenance being performed on equipment where the circuit is de-energized.
O'BOYLE, M.: The comment provided no data to demonstrate that a hazard exists where conditions of maintenance and supervision ensure that only qualified persons service the installation by written procedure. To ensure safety, the circuit must be de-energized or appropriate personal protective equipment & procedures must be used when performing electrical service work.

18-35 Log #1005 NEC-P18 **Final Action: Accept**
(410.130(G)(1) Exception No. 4)

Submitter: David Clements, International Association of Electrical Inspectors
Comment on Proposal No: 18-80
Recommendation: Reconsider this proposal and accept it.
Substantiation: The purpose of the *Code* is the practical safeguarding of persons and property from hazards arising from the use of electricity. Qualified person is defined in the *Code*, but the meaning is certainly open to interpretation. Some states and/or local jurisdictions do not require the licensing of industrial electricians and leave it to the individual establishment to define the meaning of a qualified person. It is my belief that this exception should be deleted because it does not provide practical safeguarding for those persons likely to open luminaries for maintenance purposes.
Not all authorities having jurisdiction require licensing and in industrial establishments, as in other occupancies, do not always use qualified persons to perform maintenance on lighting, especially in general office area. Therefore the same hazards exist to the worker as in other occupancies.
Panel Meeting Action: Accept
Number Eligible to Vote: 11
Ballot Results: Affirmative: 9 Negative: 2
Explanation of Negative:
CARPENTER, F.: Please see the explanation of my negative vote on Comment 18-31.
O'BOYLE, M.: The comment provided no data to demonstrate that a hazard exists where conditions of maintenance and supervision ensure that only qualified persons service the installation by written procedure. To ensure safety, the circuit must be de-energized or appropriate personal protective equipment & procedures must be used when performing electrical service work.

18-36 Log #503 NEC-P18 **Final Action: Accept**
(410.136, Informational Note)

TCC Action: The Correlating Committee directs that this Comment be reported as "Accept" to comply with the NEC Style Manual.
Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 18-81
Recommendation: Revise ASTM E84-2011b to read ASTM E84-2012b.
Substantiation: Date update of ASTM E84 standard.
Panel Meeting Action: Accept in Principle
Change reference from "ANSI/ASTM E84-2011b" to "ANSI/ASTM E84".
Panel Statement: ASTM E84 was revised four times in 2009, three times in 2010, four times in 2011 and three times, so far, in 2012. To address the problem of outdated code references the panel has removed the publication date from the reference.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

18-37 Log #1022 NEC-P18 **Final Action: Reject**
(410.151(B))

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 18-84a
Recommendation: Reject the proposal.
Substantiation: The panel is not correct. The informational note didn't contain any requirements, it simply states a fact. The panel is now moving something that is not a requirement into the mandatory portion of this section. It is better placed in the note, as it is not a requirement (the requirement is in Article 220).
Panel Meeting Action: Reject
Panel Statement: See committee action on Comment 18-38.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

18-38 Log #1064 NEC-P18 **Final Action: Accept**
(410.151(B))

Submitter: Michael J. Johnston, National Electrical Contractors Association
Comment on Proposal No: 18-84a
Recommendation: Revise 410.151(B) as follows:
(B) Connected Load. The connected load on lighting track shall not exceed the rating of the track. Lighting track shall be supplied by a branch circuit having a rating not more than that of the track. The load calculation in 220.43(B) ~~does not~~ <u>shall not be required to</u> limit the length of track on a single branch circuit, and it ~~does not~~ <u>shall not be required to</u> limit the number of luminaires on a single track.
Substantiation: The text accepted by CMP 18 t is not in mandatory language and therefore not compliant with the NEC Style Manual. The proposed change

will maintain the intent and bring the text into compliance.
Panel Meeting Action: Accept
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

ARTICLE 411 — LIGHTING SYSTEMS OPERATING AT 30 VOLTS OR LESS AND LIGHTING EQUIPMENT CONNECTED TO CLASS-2 POWER SOURCES

18-39 Log #237 NEC-P18 **Final Action: Accept**
(411 Title, 411.1, 411.2, 411.3, 411.3(B)(3), and 411.6)

TCC Action: The Correlating Committee understands that the revisions accepted in Proposal 18-85 have not been revised by the action on this comment except as follows:
411.2 and the two definitions are deleted.
A new 411.3 was added and the Correlating Committee adds first level subdivision titles in accordance with the NEC Style Manual as follows:
411.3 Low Voltage Lighting Systems
(A) General. Lighting systems operating at 30 Volts or less shall consist of an isolating power supply, low-voltage luminaires and associated equipment that are all identified for the use. The output circuits of the power supply shall be rated for 25 amperes and 30 volts (42.4 volts peak) maximum under all load conditions.
(B) Class 2. Listed Class-2 lighting equipment shall be rated in conformance with Chapter 9 Table 11(A) or 11(B).
The Correlating Committee directs the following items be renumbered:
Existing 411.3 (as modified in Proposal 18-85) moves to 411.4.
Existing 411.4 moves to 411.5.
Existing 411.5 moves to 411.6.
Existing 411.6 (as modified in Proposal 18-85) moves to 411.7.
Existing 411.7 moves to 411.8.
Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 18-85
Recommendation: The Correlating Committee advises that article scope statements and titles are the responsibility of the Correlating Committee and the Correlating Committee Accepts the panel action.
The Correlating Committee directs the panel to modify the new definition in compliance with the NEC Style Manual or remove it.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise text as follows and renumber the remaining sections.
411.2 Definitions
~~Lighting systems operating at 30 Volts or less shall consist of an isolating power supply, low-voltage luminaires and associated equipment that are all identified for the use. The output circuits of the power supply shall be rated for 25 amperes and 30 volts (42.4 volts peak) maximum under all load conditions.~~
411.3.Low Voltage Lighting Systems
(A) Lighting systems operating at 30 Volts or less shall consist of an isolating power supply, low-voltage luminaires and associated equipment that are all identified for the use. The output circuits of the power supply shall be rated for 25 amperes and 30 volts (42.4 volts peak) maximum under all load conditions.
(B) Listed Class-2 lighting equipment shall be rated in conformance with Chapter 9 Table 11(A) or 11(B).
Panel Statement: The panel made the changes in accordance with the direction of the Correlating Committee.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

18-40 Log #953 NEC-P18 **Final Action: Accept in Principle**
(411)

Submitter: Roy Harvey, Osram Sylvania
Comment on Proposal No: 18-85
Recommendation: I support the revision to Article 411 to allow LV lighting systems to be powered by Class 2 sources.
Substantiation: None provided
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and statement on Comment 18-39.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

18-41 Log #1023 NEC-P18 **Final Action: Accept in Principle**
(411.2)

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 18-85
Recommendation: Reject the proposed definition of "**Lighting Equipment Connected to Class 2 Power Sources.**"
Substantiation: This definition is so unnecessary and obvious that it is laughable. The only way that it can be defined is the way that the panel has defined it—which tells the Code user nothing! The definition violates the style manual as every single word of the defined term is included in the definition, but that's because the definition is so obvious that you could define it no other way. Article 411 is in desperate need of help, and I applaud those that are trying to fix it, but this definition doesn't help. Furthermore the definition contains a requirement (for marking), which is not permitted in a definition.
Panel Meeting Action: Accept in Principle
Panel Statement: See Panel action and statement on Comment 18-39. The Panel concludes that the text is required to describe the appropriate level of power for low voltage lighting systems.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

18-42 Log #950 NEC-P18 **Final Action: Reject**
(411.8)

Submitter: Ed Larsen, Schneider Electric USA
Comment on Proposal No: 18-88
Recommendation: Accept the revised text as follows:
411.8 FCC Compliance. Power supplies installed in dwelling units ~~shall comply with the requirements for an~~ subject to the FCC Part 15 requirements shall be marked "Class B Digital Device". Power supplies installed in dwelling units subject to the FCC ~~or the~~ Part 18 requirements ~~limits for~~ shall be marked "Consumer ISM Equipment". ~~Compliance with the FCC requirements shall be marked on the power supply as required by the FCC~~. Power supplies that do not comply shall be marked "Not for use in dwellings".
Substantiation: The statement that, "The use of the term 'dwelling unit' does not correlate with the FCC requirements" is incorrect. The term "dwelling unit" must be used here as it is used in 210.12 to define where AFCIs are required. Article 100 clearly defines what a dwelling unit is. FCC Parts 15 and 18 both use the term "residential environment". Can there be any disagreement that a "dwelling unit" is a "residential environment"?
The statement was made that, "There are commercial dwellings, such as extended stay hotels and assisted living facilities", but such occupancies do not require AFCIs unless they meet the Article 100 definition of a dwelling unit. If they do, then from an NEC perspective, and thus an AHJs perspective, they are dwelling units, not commercial dwellings.
The suggestion was made that this is not a luminaire issue but rather an AFCI compatibility issue. This suggestion is understandable, however, field experience has indicated that compatibility in the lab does not always equate to compatibility in the field, often due to the unique mix of loads and the nature of the electrical system in the dwelling. Further, the unique characteristics of a particular AFCI manufacturers design combined with the unique characteristics of a particular ballast or power supply means that adding additional tests or redefining tests in the UL 1699 standard may not totally address the problem. What is know, however, is that all AFCI manufacturers have experienced some degree of problems with non-compliant ballasts and power supplies and that these problems have often been solved by replacing the ballast with a compliant model.
This proposal does nothing more than ask that the correct type of ballast, power supply or lamp be installed in accordance with FCC requirements and that these products be appropriately marked. Using the right product for the application is already required. The marking, which is the only new requirement, will assist installers in purchasing the right product and AHJs in verifying that the right product is installed. The benefit will be a cleaner RF environment in dwellings, resulting in less AFCI unwanted tripping, less radio interference and less interference with other electronic devices in the home that may also be susceptible to RF interference.
Panel Meeting Action: Reject
Panel Statement: No study or fact finding report has been offered to support a correlation between the consumer and non-consumer FCC emissions limits and nuisance tripping of AFCI breakers. The submitter states that when nuisance tripping has occurred, changing a ballast or power supplies "often" solves the problem. This suggests that the proposed solution doesn't always work, which further suggests that a correlation between FCC limits and nuisance tripping may not exist.
The submitter states that "the marking, which is the only new requirement, will assist installers in purchasing the right product...". The panel does not agree that consumers will understand markings such as "Class B Digital Device" and "Consumer ISM Equipment" and concludes that these marking would only add confusion to the consumer.
Additionally, the proposal does not distinguish between consumer and non-consumer limits, so would require all power supplies to be marked "Class B Digital Device" even if the device did not comply with the FCC consumer limits. This practice would contradict the FCC regulations. Although the proposal suggests that some power supplies are subject to FCC Part 18, FCC Part 18 is not an applicable regulation for power supplies.
Requiring all power supplies to carry an additional marking when a definitive relationship between AFCI nuisance tripping and FCC emissions limits has not been established is not justified.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

ARTICLE 422 — APPLIANCES

17-3 Log #256 NEC-P17 **Final Action: Reject**
(422.2)

Submitter: Code-Making Panel 17,
Comment on Proposal No: 17-18a
Recommendation: Continue to Accept this proposal.
Substantiation: We are not opposed to locating this new definition in Article 100. This product is relatively new to the NEC and We are sure that a significant number of those that use the Code are not familiar with the operation of a Portable GFCI as opposed to a conventional Ground Fault Circuit Interrupter. As described in the 2010 ROP Proposal 15-127 these devices are unique and provide a level of protection that is significantly different from that of the conventional GFCI's. The submitter of that proposal makes a point that these two types of protection should not be indiscriminately substituted for each other and a conveniently located definition should promote a heightened awareness of their availability and conditions of use.
This comment was developed by a CMP-7 Task Group and balloted through the entire panel with the following ballot results:
14 Eligible to vote
12 Affirmative (See voting comment below)
1 Negative (See voting Comment below)
1 Ballot Not Returned (C.J. Fahrenhold)
The following Comments on Vote were received:
AFFIRMATIVE:
S.R. LaDART: I am not opposed to locating this new definition to Article 100. I agree with the substantiation that CMP-17 submitted.
NEGATIVE:
T.H. CYBULA: Accept Proposal 17-18a in principle. Relocate the definition to Article 100 with the following underlined text addition and with strikeouts as follows: "Ground Fault Circuit Interrupter (GFCI), Portable. ~~(as applied to ground-fault circuit interrupter protection).~~ A plug-in type of ground fault circuit interrupter (GFCI) provided with male blades or an integral power supply cord for connection to a receptacle outlet. ~~Indicating that the~~ The ground-fault circuit interrupter is intended to protect personnel from fault current to ground on equipment or circuits supplied by plug-and-cord-connections or by temporary wiring installations and additionally functions to de-energize a circuit or portion thereof when one or more of the following defects occurs:
(1) ~~the~~ The grounded conductor to the power supply is opened;
(2) ~~the~~ The grounded conductor is transposed with an ungrounded conductor to the power supply;
(3) ~~one~~ One of the ungrounded conductors to the power supply on a polyphase system or on a single-phase, 3-wire system is opened.
Explanation: The text as accepted in the proposal was not clear in describing that the portable GFCI device can either be a plug in device with blades or with a flexible cord connection. The added text in this comment was extracted from the 2011 UL White Book on page 206 describing portable GFCIs. This new suggested text makes the definition totally clear as to the type of GFCI device being used in a portable application.
Panel Meeting Action: Reject
Panel Statement: The impetus for the original CMP-17 Proposal 17-18a was a separate proposal that a "portable equipment" definition be added to Article 100 (Proposal 1-57). Proposal 1-57 was unanimously rejected by Panel 1. Since there were no subsequent comments on that proposal, there no longer is need for the original CMP-17 proposal and it is withdrawn. CMP-17 notes that the comment submitter was CMP-7, not CMP-17.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10
Ballot Not Returned: 2 Pannock, J., Sweigart, R.

17-4 Log #262 NEC-P17 **Final Action: Reject**
(422.2, 422.49, and 422.51)

TCC Action: The Correlating Committee directs that the last sentence of the panel statement on Comment 17-4 be removed based on affirmative ballot comment.
Submitter: Code-Making Panel 15,
Comment on Proposal No: 17-18a
Recommendation: If relocated to Article 100, revise the proposed definition as follows:
Portable (as applied to ground-fault circuit interrupter protection). Indicating that the ground-fault circuit interrupter is
intended to protect personnel from fault current to ground on equipment or circuits supplied by
plug-and-cord-connections or by temporary wiring installations and additionally functions to de-energize a circuit or
portion thereof when one or more of the following defects occurs:
(1) the grounded conductor to the power supply is opened;
(2) the grounded conductor is transposed with an ungrounded conductor to the power supply;
(3) one of the ungrounded conductors to the power supply on a polyphase system or on a single-phase, 3-wire system is opened.
Ground-Fault Circuit-Interrupter Protection Listed for Portable Use: A type of ground-fault circuit-interrupter intended to provide additional protection for personnel by de-energizing the downstream portion of the circuit if a supply circuit conductor opens or reverse polarity is detected.
Substantiation: This Comment is CMP-15's response to the direction of the NEC Correlating Committee regarding Proposal 17-18a; Log # CP1700.
Articles under the purview of CMP-15 do include requirements for the use of listed portable GFCI protection of personnel either explicitly [e.g., 518.3(B)] or implicitly [e.g. the proposed change to 525.23(A)] but none of the Articles presently contain a definition.
Although the concept of the portable GFCI is found in other Articles throughout the Code, there is no existing definition of "ground-fault circuit-interrupter protection listed for portable use" (or similar) elsewhere in the NEC, therefore, there is no reason to insert the definition into Article 100 in accordance with 2.2.2.1 of the 2011 National Electrical Code Style Manual.
Defining the word "portable" in Article 100, even as applied to GFCI, may create conflict and enforcement issues with existing requirements in other Articles including, but not limited to, Articles 518, 520, 525 and 530.
Nonetheless, if comments by CMP-3 or CMP-7 result in correlating action to locate a common definition in Article 100, CMP-15 submits the above revision to that definition.
The proposed changes to 422.49 and 422.51 are not addressed by this Comment.
This comment was developed by a CMP-15 Task Group and balloted through the entire panel with the following ballot results:
19 Eligible to vote
13 Affirmative
2 Negative (See comments below)
4 Ballots Not Returned (K. Jones, G.J. Krupa, S.M. Lipster and M.D. Skinner)
NEGATIVES:
K.J. Gilbert: The word "if" at the beginning of CMP-15's Comment is a problem. It creates a reliance upon other actions not required in the comment.
CMP-15's Comment should have proposed that CMP-17 "Accept in Principle" Proposal 17-18a and adopt the adjusted language shown in CMP-15's comment (after removing the sentence "If relocated to Article 100, revise the proposed definition as follows:"), then place the language into Article 100.
D.J. Talka: The definition offered by the task force of CMP 15 is incorrect. Portable GFCIs are not required to de-energize under reverse polarity conditions or open neutral conditions. They are required to continue to provide protection. The original definition more closely defines the performance of a portable GFCI. I suggest that the definition be revised as follows:
"Ground-Fault Circuit-Interrupter Protection Listed for Portable Use: A ground-fault circuit interrupter intended to protect personnel from fault current to ground on equipment or circuits supplied by plug-and-cord-connections including temporary wiring installations. Protection of personnel is maintained when one or more of the following conditions occur:
(1) the grounded conductor to the power supply is opened;
(2) the grounded conductor is transposed with an ungrounded conductor to the power supply;
(3) one of the ungrounded conductors to the power supply on a polyphase system or on a single-phase, 3-wire system is opened."
Panel Meeting Action: Reject
Panel Statement: The impetus for the original CMP-17 Proposal 17-18a was a separate proposal that a "portable equipment" definition be added to Article 100 (Proposal 1-57). Proposal 1-57 was unanimously rejected by Panel 1. Since there were no subsequent comments on that proposal, there no longer is need for the original CMP-17 proposal and it is withdrawn. CMP-17 notes that the comment submitter was CMP-7, not CMP-17.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10
Ballot Not Returned: 2 Pannock, J., Sweigart, R.
Comment on Affirmative:
COOK, D.: I support the panel action to reject. However, the last sentence of the panel statement was copied from Comment 17-3 and does not apply.

17-5 Log #267 NEC-P17 **Final Action: Reject**
(422.2, 422.49, and 422.51)

TCC Action: The Correlating Committee directs that the last sentence of the panel statement on Comment 17-5 be removed based on affirmative ballot comment.
Submitter: Code-Making Panel 3,
Comment on Proposal No: 17-18a
Recommendation: Continue to Accept Proposal 17-18a.
Substantiation: Code-Making Panel 3 agrees with the Code-Making Panel 17's action to Accept Proposal 17-18a
This comment was developed by a CMP-3 Task Group and balloted through the entire panel with the following ballot results:
15 Eligible to vote
12 Affirmative
1 Negative (See Negative comment below)
2 Ballots Not Returned (A.D. Corbin and D.T. Mills)
The following Comments on Vote were received:
NEGATIVE:
S.L. STENE: Accept Proposal 17-18a in principle. Relocate the definition to Article 100 with the following underlined text addition and with strikeouts as

follows: "Ground Fault Circuit Interrupter (GFCI), Portable. ~~(as applied to ground-fault circuit interrupter protection).~~ A plug-in type of ground fault circuit interrupter (GFCI) provided with male blades or an integral power supply cord for connection to a receptacle outlet. ~~Indicating that the~~ The ground-fault circuit interrupter is intended to protect personnel from fault current to ground on equipment or circuits supplied by plug-and-cord-connections or by temporary wiring installations and additionally functions to de-energize a circuit or portion thereof when one or more of the following defects occurs:

(1) ~~the~~ The grounded conductor to the power supply is opened;

(2) ~~the~~ The grounded conductor is transposed with an ungrounded conductor to the power supply;

(3) ~~one~~ One of the ungrounded conductors to the power supply on a polyphase system or on a single-phase, 3-wire system is opened.

Explanation: The text as accepted in the proposal was not clear in describing that the portable GFCI device can either be a plug in device with blades or with a flexible cord connection. The added text in this comment was extracted from the 2011 UL White Book on page 206 describing portable GFCIs. This new suggested text makes the definition totally clear as to the type of GFCI device being used in a portable application.

Panel Meeting Action: Reject

Panel Statement: The impetus for the original CMP-17 Proposal 17-18a was a separate proposal that a "portable equipment" definition be added to Article 100 (Proposal 1-57). Proposal 1-57 was unanimously rejected by Panel 1. Since there were no subsequent comments on that proposal, there no longer is need for the original CMP-17 proposal and it is withdrawn. CMP-17 notes that the comment submitter was CMP-7, not CMP-17.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10

Ballot Not Returned: 2 Pannock, J., Sweigart, R.

Comment on Affirmative:

COOK, D.: I support the panel action to reject. However, the last sentence of the panel statement was copied from Comment 17-3 and does not apply.

17-6 Log #1024 NEC-P17 **Final Action: Reject**

(422.2)

Submitter: Mike Holt, Mike Holt Enterprises

Comment on Proposal No: 17-18a

Recommendation: Revise the word "definition" in 422.2 by making it plural.

Substantiation: This article now contains multiple definitions, so the titles of 422.2 should now be "definitions."

Panel Meeting Action: Reject

Panel Statement: The ROP action on Proposal 17-18a has been reversed based on Comment 17-3, now leaving a single definition.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10

Ballot Not Returned: 2 Pannock, J., Sweigart, R.

17-7 Log #921 NEC-P17 **Final Action: Reject**

(422.2.Portable)

Submitter: James F. Williams, Fairmont, WV

Comment on Proposal No: 17-18a

Recommendation: Revise text to read as follows:

422.2 Definition.

~~**Portable (as applied to ground-fault circuit interrupter protection)**~~

Appliance Ground Fault Circuit Interrupter. ~~Indicating that the~~ A ground-fault circuit interrupter that is intended to protect personnel from fault current to ground on equipment or circuits supplied by plug-and-cord connections or by temporary wiring installations and additionally functions to de-energize a circuit or portion thereof when one or more of the following defects occurs:

(1) The grounded conductor to the power supply is opened;

(2) The grounded conductor is transposed with an ungrounded conductor to the power supply;

(3) One of the ungrounded conductors to the power supply on a polyphase system or on a single-phase, 3-wire system is opened.

422.49 High-Pressure Spray Washers. All single-phase cord-and-plug-connected high-pressure spray washing machines rated at 250 volts or less shall be provided with factory-installed appliance ground-fault circuit-interrupter protection for personnel. ~~The ground-fault circuit interrupter shall be identified for portable use.~~ The ground-fault circuit interrupter shall be an integral part of the attachment plug or shall be located in the supply cord within 300 mm (12 in.) of the attachment plug

422.50 Vending Machines.

(A) Cord- and Plug Connected. Cord-and-plug connected vending machines manufactured or remanufactured on or after January 1, 2005, shall include an appliance ground-fault circuit interrupter ~~identified for portable use~~ as an integral part of the attachment plug or be located within 300 mm (12 in.) of the attachment plug. Older vending machines manufactured or remanufactured prior to January 1, 2005, shall be connected to a GFCI-protected outlet.

Substantiation: I am concerned that existing "portable GFCIs" may not have the 3 properties listed in the definition. I believe these additional properties deserve a more distinctive name.

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Panel Meeting Action: Reject

Panel Statement: The comment proposes a new term "listed appliance ground-fault circuit-interrupter protection for personnel" that is not used in the product safety standard (ANSI/UL 943) nor is it marked on listed devices. In addition, the substantiation expresses concern that "existing 'portable GFCIs' may not have the 3 properties listed in the definition." However, these properties are applicable to existing listed portable ground-fault circuit-interrupters per the product safety standard.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10

Ballot Not Returned: 2 Pannock, J., Sweigart, R.

17-8 Log #947 NEC-P17 **Final Action: Reject**

(422.5)

Submitter: Ed Larsen, Schneider Electric USA

Comment on Proposal No: 17-20

Recommendation: Accept the revised text as follows:

422.5 FCC Compliance. Appliances installed in dwelling units ~~shall comply with the requirements for an~~ subject to the FCC Part 15 requirements shall be marked "Class B Digital Device". Appliances installed in dwelling units subject to ~~or~~ the FCC Part 18 requirements ~~limits for~~ shall be marked "Consumer ISM Equipment". ~~Compliance with the FCC requirements shall be marked on the appliance as required by the FCC.~~ Appliances that do not comply shall be marked "Not for use in dwellings".

Substantiation: The revised text satisfies the concern expressed in the Panel Statement on ROP 17-45 regarding the inability of AHJs to enforce the FCC requirements by placing the responsibility on the appliance manufacturer who should be well aware of the pertinent FCC requirements. All the AHJ need do is to look for the "Class B Digital Device" or "Consumer ISM Equipment" marking, or the absence of a marking on a device which is not an RF radiator. If the "Not for use in dwellings" marking is present, then the AHJ will know that the appliance is not suitable for installation in a dwelling. This text also satisfies the concern expressed regarding the marking required by the FCC and the exemption stated in 47CFR15.103d.

The size of appliances installed in a dwelling unit at the time of inspection is typically such that there should be adequate room for this marking, thus reliance on the presence of the operating manual at the time of inspection should not be a concern.

Panel Meeting Action: Reject

Panel Statement: CMP-17 rejects the original Proposal 17-20 and the revisions in Comment 17-8 for the following reasons:

(1) The substantiation provided by the submitter suggests that it is the obligation of the authority having jurisdiction to enforce the FCC regulations. This is not true; there is an entire federal agency charged with this responsibility. The authority having jurisdiction should be assured that all products covered by the requirements of FCC Part 15 are compliant. If they believe otherwise, then that concern should be addressed with the Agency.

(2) The proposal is in contradiction with the FCC Part 15 and Part 18 requirements. FCC regulations under Part 15 cover unintentional radiators that are "digital devices" only. Therefore, not all products are considered to be a source of interference nor require testing and marking. In addition, there are categories of devices that the FCC has deemed to be not likely to produce harmful interference and they have been exempted. All covered devices are required by law to comply.

(3) The Part 15 FCC regulations were designed to prevent the interference from computing devices to television and radio receivers, not prevent the unwanted functioning of other devices that share the same electromagnetic environment. Based upon the intended purpose of the regulations, the tested frequency ranges are those of broadcast frequencies and the limits are very low to ensure that nearby receivers, which are by design especially sensitive to these frequencies, are unaffected. The frequency ranges and limits of the FCC regulations are therefore wholly not suited to address the concern of interference with AFCI operation.

(4) The regulations already require information to be provided to the consumer regarding compliance. This information may be on the product or in the instruction manual in a prominent location. Adding additional or conflicting information would be inappropriate and puts the authority having jurisdiction in the position of having to determine if the marking is correct, if the product is in compliance, if the product is subject to exemptions, or if the product contains a digital device.

(5) Products that are unmarked are not non-compliant. They may either not be digital devices or not be covered. To claim that these products are sources of electromagnetic interference is inconsistent with the regulation. To claim that these products are not suitable for dwellings is completely incorrect and should not be marked as such.

(6) There is absolutely no evidence to suggest that there are Part 15 noncompliant products being installed in dwellings and that these illegal products are the source of regular misfiring of AFCI's.

(7) The frequencies and amplitudes of emissions that limited by the Part 15 FCC regulations are entirely out of the range of the frequencies and amplitudes that AFCI's are intended to respond to.

(8) AFCI's, through compliance with UL 1699, are required to demonstrate immunity to electromagnetic disturbances of a variety of types and at relatively higher severity levels. Specifically, the susceptibility of AFCI's are tested at

much higher levels of radiated and conducted EMI than that limits of Part 15. If these immunity tests are insufficient, we encourage the maker of the proposal to make proposals to the STP of UL 1699.

(9) The substantiation for this proposal states that finding adequate room for the marking because "The size of the appliances installed in a dwelling unit at the time of inspection is typically such that there should be adequate room for this marking…" would seem to indicate that the submitter is principally addressing permanently installed appliances, such as fluorescent fixtures or HVAC systems, and not, for example, cord connected appliances. If this is the intent, then the language of the proposal fails to express this limitation.

(10) If additional requirements are needed in the FCC regulations, proposals should be made to that agency.

Number Eligible to Vote: 12
Ballot Results: Affirmative: 10
Ballot Not Returned: 2 Pannock, J., Sweigart, R.
Comment on Affirmative:

COOK, D.: I support the panel action to reject. However, I don't completely agree with the panel statement. In item 1, the statement indicates all products covered by the FCC requirements are compliant. Several compliant AFCI installations in Shelby County, AL functioned until products were connected to the branch circuits by consumers. At that point, the AFCI devices tripped. Similar products from different manufacturers were installed on the same circuit and the circuit functions properly today. While I am uncertain how to resolve the unwanted tripping, it is not the consumer and AHJ's responsibility to resolve an issue of compatibility between two products when each is certified to the applicable US product standard. At this point I don't see any harmonized effort between equipment manufacturers to resolve the issues.

17-9 Log #1566 NEC-P17 **Final Action: Reject**
(422.19 (New))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 17-30
Recommendation: Accept the proposal in principle. Revise text to read as follows:

The internal volume of a canopy shall be applied in accordance with 314.16(A)(3).

Substantiation: CMP 9 reviewed a similar proposal (18-68) and created a panel proposal (9-37a) to address it. CMP 9 concluded that Proposal 18-68 was acceptable only to a limited extent, and had this proposal been reviewed similarly the conclusion would undoubtedly been the same. The CMP 17 wording has now created a direct conflict with the concept of the CMP 9 action on its proposal 9-37a and must be modified. This is not an issue that bears on the construction of a ceiling-suspended (paddle) fan, other than the fact of a marking. This issue addresses box fill, which is squarely within the jurisdiction of CMP 9. This comment permanently resolves the issue by returning the jurisdiction to the appropriate article and code making panel. A companion comment has been made to CMP 9 to directly reference paddle fans along with luminaires in the new Section 314.16(A)(3).
Panel Meeting Action: Reject
Panel Statement: The comment proposes reference to a new 314.16(A)(3) that relates to luminaires, not paddle fans, and cites "fixture wires" that are not typically employed in paddle fans. See panel action and panel statement on Comment 17-10.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10
Ballot Not Returned: 2 Pannock, J., Sweigart, R.

17-10 Log #370 NEC-P17 **Final Action: Accept in Part**
(422.19(E))

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 17-30
Recommendation: The Panel Action should be Accept in Principle in Part. Revise 422.19 (New) by qualifying the type of conductors and by deleting the last sentence, as follows:
422.19 Space for Conductors. Canopies of ceiling-suspended (paddle) fans and outlet boxes taken together shall provide sufficient space so that ~~conductors~~ <u>fixture wires</u> and their connecting devices are capable of being installed in accordance with 314.16. ~~Canopies shall be marked with their volume in order to be included in the total box volume calculation.~~
Substantiation: NEMA recognizes that 314.16(B)(1) Exception already addresses the accommodation of fixture wires that are part of the construction of a ceiling-suspended (paddle) fan, within canopies.
Panel Meeting Action: Accept in Part

Revise new 422.19 by qualifying the type of conductors and by deleting the last sentence, as follows:
422.19 Space for Conductors. Canopies of ceiling-suspended (paddle) fans and outlet boxes taken together shall provide sufficient space so that conductors and their connecting devices are capable of being installed in accordance with 314.16. ~~Canopies shall be marked with their volume in order to be included in the total box volume calculation.~~
Panel Statement: The panel agrees that the necessary space for conductors shall be determined in accordance with 314.16, but notes that "fixture wires" are but one type of conductor that may be provided by the ceiling fan manufacturer for connection to the branch circuit.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10
Ballot Not Returned: 2 Pannock, J., Sweigart, R.

17-11 Log #1586 NEC-P17 **Final Action: Reject**
(422.31(C))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 17-35
Recommendation: Revise text to read as follows:
422.31 Disconnection of Permanently Connected Appliances.
(C) Appliances Rated over 1/8 Horsepower. For permanently connected appliances rated over 1/8 hp, the branch-circuit switch or circuit breaker shall be permitted to serve as the disconnecting means where the switch or circuit breaker is within sight from the appliance. If the appliance is not within sight of the switch or circuit breaker <u>and it is not lockable in accordance with 110.25</u>, a disconnecting means shall be installed within sight of the appliance. The disconnecting means shall comply with 430.109 and 430.110. **[ROP 17–35]**
Exception: If an appliance of more than 1/8 hp is provided with a unit switch that complies with 422.34(A), (B), (C), or (D), the switch or circuit breaker serving as the other disconnecting means shall be permitted to be out of sight from the appliance.
Substantiation: I don't understand why 422.31(C) does not allow the use of a lockable disconnecting means out of sight?
Panel Meeting Action: Reject
Panel Statement: No technical substantiation has been submitted. In addition, CMP-17 has determined that the language proposed by the submitter would result in a reduction in safety. See Comment 17-12.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10
Ballot Not Returned: 2 Pannock, J., Sweigart, R.

17-12 Log #1302 NEC-P17 **Final Action: Accept**
(422.31(C))

Submitter: James M. Imlah, Hillsboro, OR
Comment on Proposal No: 17-35
Recommendation: Revise text to read as follows:

422.31 Disconnection of Permanently Connected Appliances.
(A) Unchanged
(B) Unchanged
(C) Motor-Operated Appliances Rated over 1/8 Horsepower. <u>The disconnecting means shall comply with 430.109 and 430.110.</u> For permanently connected motor-operated appliances with motors rated over 1/8 horse power, <u>the disconnecting means shall meet (1) or (2)</u>.
(1) The branch-circuit switch or circuit breaker shall be permitted to serve as the disconnecting means where the switch or circuit breaker is within sight from the appliance.
(2) The disconnecting means shall be installed within sight of the appliance. ~~The disconnecting means shall comply with~~ <u>430.109</u> ~~and~~ <u>430.110.</u>

Substantiation: Language change was editorial and reformatted for clarity to a "C1" and "C2" as they are options for the requirement of where the disconnect location shall be. The editorial change to a list type format is either 1 <u>or</u> 2 would be the location required of a disconnecting means and is very useful where citing the violation and writing the correction is mandated by state or local policy. I agree with the submitter with his proposal for appliances that do not have a unit switch or a disconnecting means within sight for the disconnecting means location. Please continue to accept in principle this proposal and comment.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10
Ballot Not Returned: 2 Pannock, J., Sweigart, R.

17-13 Log #230 NEC-P17 **Final Action: Accept**
(422.49)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 17-37
Recommendation: It was the action of the Correlating Committee that further consideration be given to the comments expressed in the voting.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-17 accepts the direction of the Correlating Committee to give further consideration to the comments expressed in the vote on Proposal 17-37. See Comment 17-14.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10
Ballot Not Returned: 2 Pannock, J., Sweigart, R.

Comment on Affirmative:

COOK, D.: I support the panel action to support the TCC direction. However, the committee action on 17-14 includes an action not addressed in the original proposal, the comments expressed in the voting, nor in Comment 17-14. The Committee action on 17-14 revised a recommendation to provide GFCI protection for personnel for three-phase high-pressure spray washing machines rated 208Y/120 volts, 60 amperes or less to a requirement that requires the proposed GFCI protection to be located in the attachment plug or the cord of the appliance. While the product standard may permit attachment plug or cord type (probably a portable type device), three-phase GFCI, it is not obvious that product exist today. While having the protection in the cord will better ensure the GFCI protection is provided at any location the appliance is used, it will obviously require a revision to the product standard for high-pressure spay washing machines and require a GFCI manufacturer to develop that specific product. Based on past actions with vending machines, a revision and implementation of the revision to another product standard could take years to complete. Meanwhile, designers, contractors, electricians, and AHJ's will be forced to revise or ignore this requirement as they wait for the product to become available. Panel action on Comment 17-14 should be accept.

17-14 Log #948 NEC-P17 **Final Action: Accept in Principle in Part**
(422.49)

Submitter: Ed Larsen, Schneider Electric USA
Comment on Proposal No: 17-37
Recommendation: Revise text to read as follows:

422.49 High-Pressure Spray Washers.

<u>**(A) Single-phase.**</u> All single-phase cord-and-plug-connected high-pressure spray washing machines rated at 250 volts or less shall be provided with factory-installed ground-fault circuit-interrupter protection for personnel. The ground-fault circuit interrupter shall be an integral part of the attachment plug or shall be located in the supply cord within 300 mm (12 in.) of the attachment plug.

<u>**(B) Three-phase.** All three-phase high-pressure spray washing machines rated at 208Y/120 volts 60 amperes or less shall be provided with groundfault circuit-interrupter protection for personnel.</u>

Substantiation: The Panel statement rejecting ROP 17-37 was correct in that there are no three-phase 240 volt listed GFCIs. Three-phase 208Y/120 volt GFCIs are recognized in UL 943 and UL 489. Listed products are on the market that meet this requirement.

Panel Meeting Action: Accept in Principle in Part

422.49 is revised as follows, with amendments to the 2011 NEC indicated by strikeout and underline:

422.49 High-Pressure Spray Washers. ~~All single-phase~~ Cord-and plug-connected high-pressure spray washing machines ~~rated at 250 volts or less~~ <u>as specified in (1) or (2)</u> shall be provided with factory-installed ground-fault circuit-interrupter protection for personnel ~~the ground-fault circuit interrupter shall be~~ <u>that is</u> an integral part of the attachment plug or ~~shall be~~ located in the supply cord within 300 mm (12 in.) of the attachment plug.
<u>(1) All single-phase equipment rated 250 volts or less</u>
<u>(2) All three-phase equipment rated 208Y/120 volts and 60 amperes or less.</u>

Panel Statement: The panel agrees that, where available, GFCI protection should be provided for 3-phase high-pressure spray washers. However, the original proposal and comment are unclear as to whether the GFCI protection is intended for all three-phase equipment or just cord-and-plug-connected equipment. Since the comment recommendation retained the cord-and-plug-connected condition for single-phase equipment, the same cord-and-plug-connected condition would logically be applicable to three-phase cord-and-plug connected equipment.

Number Eligible to Vote: 12
Ballot Results: Affirmative: 7 Negative: 3
Ballot Not Returned: 2 Pannock, J., Sweigart, R.
Explanation of Negative:

COOK, D.: I support the panel action to expand GFCI protection to three-phase spray washing machines at the voltage and current levels expressed. However, the committee action on 17-14 to Accept in Principle in Part includes an action not addressed in the original proposal, the comments expressed in the voting, nor in Comment 17-14. The Committee action on 17-14 revised a recommendation to provide GFCI protection for personnel for three-phase high-pressure spray washing machines rated 208Y/120 volts, 60 amperes or less to a requirement that requires the proposed GFCI protection to be located in the attachment plug or the cord of the appliance. While the product standard may permit attachment plug or cord type (probably a portable type device), three-phase GFCI, it is not obvious that product exist today. While having the protection in the cord will better ensure the GFCI protection is provided at any location the appliance is used, it will obviously require a revision to the product standard for high-pressure spay washing machines and require a GFCI manufacturer to develop that specific GFCI product. Based on past actions with vending machines, a revision and implementation of the revision to another product standard could take years to complete. Meanwhile, designers, contractors, electricians, and AHJ's will be forced to revise or ignore this requirement as they wait for the product to become available. Panel action on Comment 17-14 should be accept.

SCHAPP, R.: I agree with the comments of D. Cook and R. Yasenchek.

YASENCHAK, R.: We should afford the same protection to hard wired as well as cord and plug connected.

17-15 Log #923 NEC-P17 **Final Action: Reject**
(422.51)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 17-38
Recommendation: Revise text to read as follows:
422.51 Vending Machines.
(A) Cord- and Plug Connected. Cord-and-plug-connected vending machines manufactured or remanufactured on or after January 1, 2005, shall include a ground-fault circuit interrupter identified for portable use as an integral part of the attachment plug or be located within 300 mm (12 in.) of the attachment plug. Older vending machines manufactured or remanufactured prior to January 1, 2005, shall be connected to a GFCI-protected outlet. <u>The GFCI protecting a vending machine shall meet the requirements of 110.26.</u>

Substantiation: Unlike portable pressure washers vending machines are often difficult to move, so required the GFCI to be readily accessible is appropriate. Note another comment modified other text in 422.51(A), those changes are separate and not shown here.

Panel Meeting Action: Reject

Panel Statement: The GFCI protecting a vending machine" can be located in a panel, outlet, or supply cord. The only "examination, adjustment, servicing, or maintenance while energized" is actuation of the test / reset buttons of the GFCI. Requiring that the working space requirements of 110.26 be met for such actuation is unnecessary and inconsistent with the numerous other GFCI installation requirements throughout the Code.

Number Eligible to Vote: 12
Ballot Results: Affirmative: 10
Ballot Not Returned: 2 Pannock, J., Sweigart, R.
Comment on Affirmative:

COOK, D.: I agree with the Panel action to reject Comment 17-15. However the first sentence of the Panel Statement indicates the GFCI protecting the vending machine can be located in a panel, outlet, or supply cord. Based on the text in 422.51, the location of the GFCI protection is based on the date the vending machine was manufactured or remanufactured and the location of the GFCI protection is not optional, but prescriptive based on that date. The first sentence of the Panel statement should be deleted.

ARTICLE 424 — FIXED ELECTRIC SPACE-HEATING EQUIPMENT

17-16 Log #1314 NEC-P17 **Final Action: Reject**
(424)

Submitter: Mike Weitzel, Richland, WA
Comment on Proposal No: 17-46
Recommendation: Revise text to read as follows:

ARTICLE 424

Fixed Electric Space<u> and Process Heating Equipment</u>

424.1 Scope. This article covers fixed electric equipment used for space heating <u>or</u> <u>**industrial process heating**</u>. For the purpose of this article, heating equipment shall include heating cable, unit heaters, duct heaters, boilers, central systems, or other approved fixed electric space <u>**or industrial process heating**</u> equipment. This article shall not apply to electric deicing and snow melting equipment, pipelines and vessels, or room air conditioning.

<u>**Section 424.2 Definitions.**</u>

<u>**Industrial Process Heating Equipment: Equipment such as duct heaters, vessel type strip heaters, tank-type heaters, resistance-type boilers, and electrode type boilers used in industrial processes.**</u>

<u>**Section 424.3**</u> **Other Articles. Fixed electric space heating equipment incorporating a hermetic refrigerant motor compressor shall also comply with Article 440.**

<u>**Section 424.4 Branch Circuits.**</u> (Section is renumbered, but otherwise, remains the same).

(A) Branch-Circuit Requirements. (text remains the same).

(B) Branch-Circuit Ratings. (text remains the same).

<u>**New Part X. Industrial Process Heating Equipment**</u>

<u>**424.100 Installation. Industrial control panels and power disconnecting means for industrial process heating equipment shall have sufficient clearance maintained to permit replacement of controls and heating elements and for adjusting and cleaning the controls other parts requiring such attention. See 110.26.**</u>

Substantiation: The original proposal has been revised based upon CMP 12 statements in the ROP.

Article 422 - Appliances does not appear to be the correct article to cover large, heavy duty industrial process heating equipment. Section 422.11 limits overcurrent protection to 50 amperes. How many industrial boilers have overcurrent protection to limited to only 50 amperes – even for individual banks of elements? Most industrial process heating equipment require hundreds or thousands of amperes to operate. Even in Section 424.22(B), for fixed electric space heating equipment, it is realized that the overcurrent protection supplying electric power to space heating elements through a contactor, is permitted to be sized at a maximum of 60 amperes. There are often a large number of contactors within an industrial process heating equipment control panel, not just one.

In addition, Section 422.14 speaks about infrared lampholders operated in series. While some industries undoubtedly use this equipment, there are much larger installations with duct heaters, strip heaters, tank heaters, and industrial boilers that are being ignored by the NEC. Technically, as heating equipment, why is Section 110.26 specifically referenced in Section 424.66? Based upon the panel statement, mention of 110.26 in Section 424.66 should not be necessary. Instead, I believe that past members of CMP 12 saw that there truly is a need for working space in front of heating equipment panels, and hence added the language in 424.66.

Again, having installed, maintained, and inspected heating installations; I see the need for specific requirements, all for protection of the electrical worker, and the ability to safely examine the equipment, which includes Zero Energy Checks. I would hope that labor and inspector members of CMP 12 would support this proposal for these reasons alone.

Panel Meeting Action: Reject

Panel Statement: CMP-17 affirms its prior action and statement on Proposal 17-46. The comment substantiation misunderstood the intent of the panel statement citing 422.14. It was cited to illustrate that industrial equipment was covered by Article 422, not to say that the specific requirements were applicable to all industrial equipment. Similarly, the substantiation makes reference to the requirement of 422.11(C) when, instead, the equipment described would be covered by 422.11(E) or 422.11(F)(1).

With respect to the continuing need for 424.66 when 110.26 is generally applicable, CMP-17 notes that 110.26 requirements are applicable where equipment "require examination, adjustment, servicing, or maintenance while energized." The panel determined that the additional considerations of "replacement of controls and heating elements and for adjusting and cleaning of controls and other parts" were appropriate for duct heaters and therefore also sought adequate working space for these purposes not appearing in 110.26. It may be the case that similar considerations are appropriate for certain process heater installations. As previously stated, these could be addressed by adding requirements to Article 422.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10

Ballot Not Returned: 2 Pannock, J., Sweigart, R.

Comment on Affirmative:

COOK, D.: I agree with the Panel action to reject Comment 17-16. However the Panel Statement indicates process heating is within the scope of Article 422. As stated in the IAEI ballot for proposal 17-46, I don't agree that process heating equipment is an appliance.

17-17 Log #1025 NEC-P17 **Final Action: Accept**
(424.19)

Submitter: Mike Holt, Mike Holt Enterprises

Comment on Proposal No: 17-48

Recommendation: Revise the proposal (and 17-48 and 17-50) by moving the "lockable" language into the parent text of the section, as follows:

424.19 Disconnecting Means. Means shall be provided to simultaneously disconnect the heater, motor controller(s), and supplementary overcurrent protective device(s) of all fixed electric space-heating equipment from all ungrounded conductors. Where heating equipment is supplied by more than one source, feeder, or branch circuit, the disconnecting means shall be grouped and marked. The disconnecting means specified in 424.19(A) and (B) shall have an ampere rating not less than 125 percent of the total load of the motors and the heaters <u>and shall be lockable in accordance with 110.25</u>. ~~The provision for locking or adding a lock to the disconnecting means shall be installed on or at the switch or circuit breaker used as the disconnecting means and shall remain in place with or without the lock installed.~~

Remove the references to lockable disconnects in the rest of the section.

Substantiation: This section refers to a lockable disconnect multiple times, but is the accepted proposal language only addresses some of the instances (not the instance indicated above). By accepting this proposal the redundant language in the rest of the section can be removed.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10

Ballot Not Returned: 2 Pannock, J., Sweigart, R.

17-18 Log #922 NEC-P17 **Final Action: Hold**
(424.44(D))

TCC Action: The Correlating Committee directs that the panel action on Comment 17-18 be reported as "Hold " to comply with the NFPA Regulations Governing Committee Projects as this comment contains new material that has not had public review.

Submitter: James F. Williams, Fairmont, WV

Comment on Proposal No: 17-55

Recommendation: Revise text to read as follows:

424.44 Installation of Cables in Concrete or Poured Masonry Floors.

(D) Spacing Between Heating Cable and Metal Embedded in the Floor. Spacing shall be maintained between the heating cable and metal embedded in the floor, unless the cable ~~is a grounded metal-clad cable~~.<u>has a grounded metal sheath.</u>

Substantiation: It is unclear to me what is required to be grounded. If it is the sheath, then I suggest a change to the text. If something else is to be grounded, then perhaps other text is required.

Panel Meeting Action: Accept

Panel Statement: While it is arguable that this comment represents new material, CMP-17 notes that this amendment is necessary to properly describe the type of cable involved.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 9 Negative: 1

Ballot Not Returned: 2 Pannock, J., Sweigart, R.

Explanation of Negative:

YASENCHAK, R.: Metal clad and metal sheath are two different types. The original proposal was editorial in nature and this is a technical change.

17-19 Log #1312 NEC-P17 **Final Action: Accept**
(424.66 (New))

Submitter: Mike Weitzel, Richland, WA

Comment on Proposal No: 17-75

Recommendation: Add new text to read as follows:

424.66 Installation.

<u>**(A)**</u> Duct Heaters shall be installed in accordance with the manufacturer's instructions in such a manner that operation does not create a hazard to persons or property. Furthermore, duct heaters shall be located with respect to building construction and other equipment so as to permit access to the heater. Sufficient clearance shall be maintained to permit replacement of controls and heating elements and for adjusting and cleaning of controls and other parts requiring such attention. See 110.26.

<u>**Working space about electrical enclosures for resistance heating element type duct heaters which are mounted on duct systems and contain equipment that requires examination, adjustment, servicing, or maintenance while energized shall comply with Section 424.66(B).**</u>

<u>**(B) Limited Access. Where the enclosure is located in a space above a ceiling, all of the following shall apply:**</u>

<u>**(1) The enclosure shall be accessible through a lay in type ceiling or access panel(s).**</u>

<u>**(2) The width of the working space shall be the width of the enclosure or a minimum of 762 mm (30 in.), whichever is greater.**</u>

<u>**(3) All doors or hinged panels shall open to at least 90 degrees.**</u>

<u>**(4) The space in front of the enclosure shall comply with Table 110.26(A)(1) depth requirements. Horizontal Ceiling T-bar is permitted in this space.**</u>

Substantiation: Acceptance of this revised text will improve safety for electrical workers, and provide enforceable *Code* language for those who enforce *Code* requirements.

Working up a ladder in a duct heater electrical enclosure mounted on the duct system while energized can be hazardous. This equipment is often supplied by 480-volt circuits, and installed above the floor level, close to the ceiling. Many of these types of enclosures have hinged doors, which must be able to open 90 degrees in order to access all components of the equipment. Electrical workers may be working on a ladder, and required to test or examine these units while energized. Metal piping or metal structural beams/cross members are often installed or located in front of this equipment enclosure, thereby creating an unsafe condition to electrical workers due to grounded metal parts in front of the equipment being worked on while energized. A working clearance violation of this type would not be permitted for a 480-volt switchboard or panel board installed at floor level. However, there appears to be no specific *Code* rule to address this situation.

This comment and revision includes comments and concerns voiced by CMP 12 in the ROP.

"This will protect electrical workers that are required to be put in harms way to perform servicing of this equipment. Suggest relocating this to Article 424." Therefore, I did just that.

And, "The Proposal raises a significant issue related to safe workspace around utilization equipment that will likely be maintained while energized. That (heating) equipment is currently installed across North America in spaces where the prescribed workspace in 110.26 is not provided."

In addition, "...the safety of those maintaining and troubleshooting that equipment while energized is certainly an electrical concern...."

AHJ's may decide to require 110.26 working space - at least in part, in accordance with Section 90.4. However, some *Code* users would consider this a 'gray area'. The purpose of the *Code* is to protect people and property.

Acceptance of this revised text will improve safety for electrical workers, and provide enforceable *Code* language for those who enforce *Code* requirements.

Panel Meeting Action: Accept

Number Eligible to Vote: 12

Ballot Results: Affirmative: 9 Negative: 1

Ballot Not Returned: 2 Pannock, J., Sweigart, R.

Explanation of Negative:

COOK, D.: While I support expanded protection of workers and acceptance of this comment could be viewed as a step toward safer installations, the text does not provide a complete solution for the concern raised for worker safety. Existing text in 424.66 already requires sufficient clearance for adjustment, servicing or maintaining duct heaters. That existing text is vague and probably leads to inconsistent enforcement. However, the following concerns lead enforcement to vote for rejection, and support any future effort to develop a

better solution for a legitimate concern for worker safety:
1) This comment specifically addresses duct heaters and recognizes this equipment is likely to require examination, adjustment, servicing, or maintenance while energized. A variety of other utilization equipment, subject to other NEC Articles and other CMP's, is typically installed in similar locations and conditions. Accepting this text provides multiple levels of worker safety based on the type of utilization equipment.
2) For that matter, utilization equipment located in equipment rooms are seldom provided with the workspace dimensioned in NEC 110.26. While Comment 17-19 addresses this very specific duct heater installation (above ceilings), the same duct heater could be installed in an equipment room or at an elevated location that does not include a ceiling and the dimensioned workspace is not required.
3) The utilization equipment is typically installed by other trades and in many cases the location of the equipment is driven by its function. Since the prescriptive space is not correlated with space requirements in the IMC, adopted in many building departments to regulate all HVAC equipment, enforcement could be problematic for electrical inspectors.
4) I'm not completely comfortable with the technical reason for allowing metal (potentially grounded) ceiling grid in the workspace, but understand the practical difficulty of prohibiting the grid from the space.
While I don't believe the specific text is ideal, it provides a start. Comment 17-19 identifies a concern for electrical safety where utilization equipment is installed at elevated locations and requires access and working space be provided and maintained to permit ready and safe operation and maintenance of that equipment.
Since the electrical concern (shock hazards) for workers while the equipment is examined, adjusted, serviced, or maintained is clearly within the scope of the NEC and seems to be identical regardless of the function of the utilization equipment (hazard is not unique to duct heaters), TCC may wish to develop task group to address the concern and develop correlated requirements throughout the NEC. As the 2014 NEC is adopted and enforced, if Comment 17-19 is accepted, it will bring this concern for electrical safety to the forefront and immediately raise questions why dimensioned workspace in crowded ceilings is needed for the duct heater and not needed for the water heater or the air handler located in the same space. It will also raise questions why duct heaters need dimensioned workspace in crowded areas above ceiling and not needed in crowded spaces without ceilings. Enforcement supports a consensus effort to develop consistent workspace requirements for all utilization equipment installations.

Comment on Affirmative:
YASENCHAK, R.: We are voting affirmative on the panel action to Accept comment 17-19. We agree that this action is a step in the right direction. Providing adequate working space about electrical equipment that is likely to require justified energized work is essential for the safety of installer/maintainers.
We agree with the comments made by Mr. Cook.
We also suggest that the Correlating Committee develop a task group to review all electrical equipment that is, or can be installed above a ceiling or in an elevated manner. This effort will include different types of equipment, installation methods, areas above ceilings and installations that are elevated for other reasons. We support a general requirement that will address all such installations and all equipment. Such a requirement must exist in Chapter 1 of the NEC.
General requirements for working space about all equipment that is, or can be, installed above a ceiling or in an elevated manner, should be included as a new first level subdivision in 110.26."

ARTICLE 426 — FIXED OUTDOOR ELECTRIC DEICING AND SNOW-MELTING EQUIPMENT

17-20 Log #688 NEC-P17 **Final Action: Reject**
(426.28)

Submitter: Christopher M. Jensen, North Logan City
Comment on Proposal No: 17-67
Recommendation: Accept the proposal as submitted:
426.28 ~~Ground Fault Protection of Equipment.~~ <u>Equipment Ground-Fault Protection.</u> ~~Ground fault protection of equipment~~ <u>Equipment ground-fault protection</u> shall be provided for fixed outdoor electric deicing and snow-melting equipment.
Substantiation: The term "Ground Fault Protection of Equipment" is used in 215.10, 230.95 and 426.28
The term "Ground Fault Protection of Equipment" as defined in Article 100 is most often associated with the requirements in 230.95 and 215.10. The UL White Book Category (KDAX) is cross referenced as the category used to cover devices used to comply with 230.95 and 215.10. These devices have a ground fault trip level between 1 and 1200 amperes.
The ground fault protection required by 426.28 is cross referenced and covered by UL White Book Category (DIYA) "Circuit breakers with equipment ground-fault protection." The trip levels for the devices covered by (DIYA) have a trip threshold of 30 to 50 milliamperes.
Because there are 2 distinct types of ground fault protection required in section 230.95 and 426.28 there should be 2 distinct terms used to identify the different protection types.
The term "Equipment ground fault protection" is the term used by UL in the product category used to identify the protection listed to comply with the requirements in 426.28.
The change of the term "Ground fault protection of Equipment" to "Equipment Ground Fault Protection" will help the code user select the proper type of ground fault protection for fixed outdoor electric deicing and snow-melting equipment.
I have made a companion proposal to include a new definition of "Equipment Ground Fault Protection"
Panel Meeting Action: Reject
Panel Statement: Implementing this comment will not attain the desired result as it is based, in part, on some inaccurate assumptions. The substantiation references the "UL White Book" categories KDAX and DIYA, indicating that there may be confusion between them when applying 426.28. These are different devices with unique identification: "ground fault sensing and relaying equipment" and "circuit breaker with equipment ground fault protection" (or "C.B. W/EQ.GFP"), respectively. They are distinguishable on that basis. Also, the DIYA devices are not limited to a trip threshold of 30-50 mA as stated in the substantiation. The trip threshold is specified by the manufacturer and marked on the devices. There is at least one such listed device marked with a 100 mA rating. There is another "UL White Book" category (FTTE) where listed devices are identified as "equipment ground-fault protective device" (or "EGFPD") and these are limited to the range above 6 mA to 50 mA. These devices more closely resemble devices described in the proposal.
GFPE is defined in Art 100. Using the undefined "equipment ground fault protection" in lieu of GFPE could itself introduce confusion. In addition, it could preclude use of the other acceptable protection and impose a trip threshold limit (50 mA) not currently in Article 426. With respect to the threshold limit, note that the IEEE standard (IEEE 515) for industrial heat tracing and the IEEE recommended practice (IEEE 515.1) for commercial heat tracing each indicate that ground fault protection of equipment be provided at a nominal 30 mA but allows higher values ("typically set 30 mA above any inherent capacitive leakage"). Listed FTTE, KDAX and DIYA protection could all meet these criteria depending upon the specific application and the marked threshold value. Changing GFPE to equipment ground-fault protection does not eliminate confusion and introduces technical changes unsupported by the substantiation.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 10
Ballot Not Returned: 1 Sweigart, R.

17-21 Log #249 NEC-P17 **Final Action: Accept**
(426.50)

Submitter: Edward G. Kroth, Verona, WI
Comment on Proposal No: 17-69
Recommendation: Revise text to read as follows:
The disconnecting means shall be of the indicating type and be <u>capable of being locked</u> ~~provided with a positive lockout~~ in the open "~~off~~" <u>(off)</u> position.
The remainder of this section is to remain unchanged.
Substantiation: This needs to be reconsidered as a safety issue for the person working on the roof top, especially where a circuit breaker is the sole means of disconnect and is not within sight of the person working on the snow melting and/or deicing equipment. This goes to providing what 90.1 calls for in that it would help to protect person(s) from a potential electrical shock hazard. Mr. Cook is correct in that there are commercially available lockouts that meet the intent of the newly proposed 110.25 (see proposal 1-130) made by several manufacturers. If you choose to continue to reject this proposal you should at least consider an explanation of what the phrase "positive lockout" means.
I will paraphrase my words from the original proposal. This is an attempt to standardize the concept of a lockable disconnect for the safety of the person working on the apparatus. I believe Mr. Yasenchak has picked up on this concept.
Panel Meeting Action: Accept
Number Eligible to Vote: 11
Ballot Results: Affirmative: 10
Ballot Not Returned: 1 Sweigart, R.

ARTICLE 427 — FIXED ELECTRIC HEATING EQUIPMENT

17-22 Log #1440 NEC-P17 **Final Action: Accept in Principle**
(427.14 (New))

Submitter: Brian Myers, IBEW Local Union 98
Comment on Proposal No: 17-75
Recommendation: Revise text to read as follows:
424. XX Working Space and Clearance.
(A) General. Working space about electrical enclosures for resistance heating element type duct heaters which are mounted on duct systems and contain equipment that requires examination, adjustment, servicing, or maintenance while energized shall comply 110.26.

(B) Limited Access. Where the enclosure is located in a space above a ceiling, all of the following shall apply:
(1) The enclosure shall be accessible through a lay in type ceiling or access panel (s).
(2) The width of the working space shall be the width of the enclosure or a minimum of 762 mm (30. in.), whichever is greater.
(3) All doors or hinged panels shall open to at least 90 degrees.
(4) The space in front of the enclosure shall not contain ceiling supports or other material that would block access to the enclosure through the doors or hinged
panels.
Substantiation: It's obvious from the submitter's proposal this was meant for 424. This proposal is a safety issue that should be addressed and will protect the electrical workers that are required to be put in harm's way to perform servicing of this equipment. Suggest relocating this to article 424.
Panel Meeting Action: Accept in Principle
See action on Comment 17-19.
Panel Statement: The action on Comment 17-19 addresses the submitter's concerns.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 9 Negative: 1
Ballot Not Returned: 1 Sweigart, R.
Explanation of Negative:
COOK, D.: See Cook ballot statement on comment 17-19.

17-23 Log #689 NEC-P17 **Final Action: Reject**
(427.22)

Submitter: Christopher M. Jensen, North Logan City
Comment on Proposal No: 17-80
Recommendation: Accept the proposal as submitted:
427.22 **~~Ground-Fault Protection of Equipment.~~** **Equipment Ground-Fault Protection.** ~~Ground-fault protection of equipment~~ Equipment ground-fault protection shall be provided for electric heat tracing and heating panels. This requirement shall not apply in industrial establishments where there is alarm indication of ground faults and the following conditions apply:
(1) conditions of maintenance and supervision ensure that only qualified persons service the installed systems.
(2) Continued circuit operation is necessary for safe operation of equipment or processes.
Substantiation: The term "Ground Fault Protection of Equipment" is used in 215.10, 230.95 and 426.28.
The term "Ground Fault Protection of Equipment" as defined in Article 100 is most often associated with the requirements in 230.95 and 215.10. The UL White Book Category (KDAX) is cross referenced as the category used to cover devices used to comply with 230.95 and 215.10. These devices have a ground fault trip level between 1 and 1200 amperes.
The ground fault protection required by 427.22 is cross referenced and covered by UL White Book Category (DIYA) "Circuit breakers with equipment ground-fault protection." The trip levels for the devices covered by (DIYA) have a trip threshold of 30 to 50 milliamperes.
Because there are 2 distinct types of ground fault protection required in sections 230.95 and 427.22 there should be 2 distinct terms used to identify the different protection types.
~~The term "Equipment ground fault protection required in sections 230.95 and 427.22 there should be 2 distinct terms used to identify the different protection types.~~
The term "Equipment ground fault protection" is the term used by UL in the product category used to identify the protection listed to comply with the requirements in 427.22
The change of the term "Ground fault protection of Equipment" to "Equipment Ground Fault Protection" will help the code user select the proper type of ground fault protection for fixed electric heating equipment for pipelines and vessels
I have made a companion proposal to include a new definition of "Equipment Ground Fault Protection"
Panel Meeting Action: Reject
Panel Statement: See panel statement on Comment 17-20.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 10
Ballot Not Returned: 1 Sweigart, R.

17-24 Log #250 NEC-P17 **Final Action: Accept in Part**
(427.55(A))

Submitter: Edward G. Kroth, Verona, WI
Comment on Proposal No: 17-82
Recommendation: Revise text to read as follows:
The disconnecting means shall be of the indicating type and be capable of being locked ~~provided with a positive lockout~~ in the open "~~off~~" (off) position. The remainder of this section is to remain unchanged.
Substantiation: This needs to be reconsidered as a safety issue for the person working on the pipeline or vessel, especially where a circuit breaker is the sole means of disconnect and is not within sight of the person working on the pipeline and/or vessel heating equipment. This goes to providing what 90.1 calls for in that it would help to protect person(s) from a potential electrical shock hazard. Mr. Cook is correct in that there are commercially available lockouts that meet the intent of the newly proposed 110.25 (see proposal 1-130) made by several manufacturers. If you choose to continue to reject this proposal you should at least consider an explanation of what the phrase "positive lockout" means.
I will paraphrase my words from the original proposal. This is an attempt to standardize the concept of a lockable disconnect for the safety of the person working on the apparatus. I believe Mr. Yasenchak has picked up on this concept.
Panel Meeting Action: Accept in Part
Accept the revision of the sentence as indicated in the recommendation. However, the remainder of the section will not remain unchanged, but will be amended in accordance with Comment 17-25.
Panel Statement: CMP-17 agrees with the revision of the sentence beginning "The disconnecting means...". CMP-17 now recognizes that there are commercially-available lockouts that meet the submitter's intent. However, CMP-17 does not agree that the remainder of the section should remain unchanged. See action on Comment 17-25.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 10
Ballot Not Returned: 1 Sweigart, R.

17-25 Log #1441 NEC-P17 **Final Action: Accept**
(427.55(A))

Submitter: Brian Myers, IBEW Local Union 98
Comment on Proposal No: 17-82
Recommendation: This Proposal should be Accept in Principle as follows.
427.55 Disconnecting Means.
(A) Switch or Circuit Breaker. Means shall be provided to simultaneously disconnect all fixed electric pipeline or vessel heating equipment from all ungrounded conductors. The branch circuit switch or circuit breaker, where readily accessible to the user of the equipment, shall be permitted to serve as the disconnecting means. The disconnecting means shall be of the indicating type and shall be provided with a positive lockout in the off position. The disconnecting means shall be installed in accordance with 110.25
Substantiation: There is a new 110.25 that covers the intent of the submitter. See proposal 1-130 article 110.25
Panel Meeting Action: Accept
Number Eligible to Vote: 11
Ballot Results: Affirmative: 10
Ballot Not Returned: 1 Sweigart, R.

ARTICLE 430 — MOTORS, MOTOR CIRCUITS, AND CONTROLLERS

11-11 Log #742 NEC-P11 **Final Action: Accept**
(430, Parts I through X)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 11-20
Recommendation: Continue to Accept in Principle in Part.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.
The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.
The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure

that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
COLE, T.: See comment on 11-6.

11-12 Log #1310 NEC-P11 **Final Action: Reject**
(430.2 (New))

Submitter: Mike Weitzel, Bechtel
Comment on Proposal No: 11-23
Recommendation: Add new text to read as follows:

<u>**430.2 Motor Circuit Protector.** An instantaneous trip type circuit breaker designed to be used as part of a listed motor controller assembly, containing electronic or magnetic-hydraulic instantaneous trip and overload functions, no thermal trip elements, and short circuit protection.</u>

Substantiation: Thank you CMP 11 for your comments. My comments are provided in response to the panel statement. I maintain that adding a definition for Motor Circuit Protector will help the average *Code* user.

I'm trying to clarify what a Motor Circuit Protector is and how it should be used. There is misunderstanding in the field as to how these breakers are used and applied. Proper understanding of their purpose and use is important to the user.

Motor Circuit Protectors are overcurrent devices manufactured and intended for specific purposes.

Motor Circuit Protectors are intended to provide only branch-circuit, short-circuit, and ground-fault protection for individual motor branch circuits.

They may not be used to provide main, motor feeder, motor overload, and general branch-circuit or group motor protection.

NEC 430.52 requires that they shall only be used as part of a listed combination motor controller.

Motor Circuit Protectors (MCP's) are short-circuit tested only in combination with a motor controller and overload device.

Because of this, they are not labeled with an interrupting rating by themselves.

Per NEC 430.109, they may be used as a motor branch-circuit and controller disconnect, or "at the motor" disconnect only when part of a listed combination motor controller.

Another option is to add an informational Note to Section 430.52(C)(3), in a similar manner as was added to Section 430.52(C)(7) in the 2011 *Code* cycle.

Panel Meeting Action: Reject
Panel Statement: A new definition is not necessary in 430.2 as CMP 11 met the submitter's intent with the action and statement on Comment 11-17.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

11-13 Log #1327 NEC-P11 **Final Action: Hold**
(Table 430.12(C)(1))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 11-20
Recommendation: Revise text to read as follows:
Change "~~240~~ or less" to "<u>250</u> or less"
Substantiation: Voltage gap in table.
Panel Meeting Action: Hold
Panel Statement: Proposal 11-20 does not address the issue raised by the submitter. It is new material.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

11-14 Log #163 NEC-P11 **Final Action: Accept**
(430.21, 430.31, 430.40, 430.51, 430.71, 430.101, 430.102(B)2, 430.120, 430.126(A), 430.245(A), 470.18(D), 440.6(A) Exception 2, 440.31)

TCC Action: The Correlating Committee directs that the dates of the latest referenced standards in 430.102(B)(2) Exception to (1) and (2)(b) Informational Note be included in the Code.
Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 11-29b
Recommendation: The Correlating Committee directs that the panel include the publication date of the referenced standard (NFPA 70E) in the Informational Note in accordance with Section 3.3.7.4 of the NFPA Regulations Governing Committee Projects.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

11-15 Log #603 NEC-P11 **Final Action: Accept**
(430.21, Informational Note)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 11-29b
Recommendation: Revise text to read as follows:

430.21 General. Part II specifies ampacities of conductors that are capable of carrying the motor current without overheating under the conditions specified. The provisions of Part II shall not apply to motor circuits rated over 1000 volts, nominal.

Informational Note: For over ~~600~~ <u>1000</u> volts, nominal, see Part XI.

Substantiation: Simple change omitted in informational note.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

11-16 Log #1328 NEC-P11 **Final Action: Accept**
(430.21, Informational Note)

TCC Action: The Correlating Committee understands that the action on this comment is modified by the panel action on Comment 14-15.
Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 11-29b
Recommendation: Revise text to read as follows:
430.21 General.
Informational Note: For over ~~600~~ <u>1000</u> volts, nominal, see Part XI. **[ROP 11–29b]**
Substantiation: Match other references in this article.
Panel Meeting Action: Accept
Panel Statement: CMP 11 understands that this comment only deals with the informational note.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

11-17 Log #1316 NEC-P11 **Final Action: Accept in Principle**
(430.52(C)(3), Informational Note (New))

Submitter: Mike Weitzel, Richland, WA
Comment on Proposal No: 11-23
Recommendation: Add new text to read as follows:
<u>**Informational Note:** A motor circuit protector, as used in this section, is an instantaneous trip type circuit breaker designed to be used as part of a listed motor controller assembly, containing electronic or magnetic-hydraulic instantaneous trip and overload functions, no thermal trip elements, and short circuit protection.</u>
Substantiation: Thank you CMP 11 for your comments. My comments are provided in response to the panel statement. I maintain that adding a definition for Motor Circuit Protector will help the average *Code* user.

Please consider the option of adding an Informational Note to Section 430.52(C)(3), in a similar manner as an Informational Note was added to Section 430.52(C)(7) in the 2011 *Code* cycle.

I'm trying to clarify what a Motor Circuit Protector is and how it should be used. There is misunderstanding in the field as to how these breakers are used and applied. Proper understanding of their purpose and use is important to the user.

Motor Circuit Protectors are overcurrent devices manufactured and intended for specific purposes.

Motor Circuit Protectors are intended to provide only branch-circuit, short-circuit, and ground-fault protection for individual motor branch circuits.

They may not be used to provide main, motor feeder, motor overload, and general branch-circuit or group motor protection...

NEC 430.52 requires that they shall only be used as part of a listed combination motor controller.

Motor Circuit Protectors (MCP's) are short-circuit tested only in combination with a motor controller and overload device.

Because of this, they are not labeled with an interrupting rating by themselves.

Per NEC 430.109, they may be used as a motor branch-circuit and controller disconnect, or "at the motor" disconnect only when part of a listed combination motor controller.

Panel Meeting Action: Accept in Principle

Add a new informational note and renumber the existing informational note:

Informational Note No. 1: Instantaneous trip circuit breakers are also known as motor circuit protectors (MCPs).

Informational Note No. 2: For the purpose of this article, instantaneous trip circuit breakers may include a damping means to accommodate a transient motor inrush current without nuisance tripping of the circuit breaker.

Panel Statement: The panel understands that the ROP reference on this comment is incorrect; it should be 11-34, not 11-23. The intent of the submitter has been met by adding a new Informational Note No. 1 and renumber the existing informational note as Informational Note No. 2.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

11-18 Log #1315 NEC-P11 **Final Action: Reject**

(430.62(A)(1))

Submitter: Mike Weitzel, Richland, WA

Comment on Proposal No: 11-37

Recommendation: Section 430.62 Rating or Setting - Motor Load. … no change...

Add the acronym "MCP" after Instantaneous Trip Circuit Breaker where found in Section 430.62 Exception No. 1.

Exception No. 1: Where one or more instantaneous trip circuit breakers ***(MCP's)*** *or motor short-circuit protectors are used for motor branch-circuit short-circuit and ground-fault protection as permitted in 430.52(C), the procedure provided above for determining the maximum rating of the feeder protective device shall apply with the following provision: For the purpose of the calculation, each instantaneous trip circuit breaker* ***(MCP's)*** *or motor short-circuit protector shall be assumed to have a rating not exceeding the maximum percentage of motor full-load current permitted by Table430.52 for the type of feeder protective device employed.*

Substantiation: Please see my comments on Sections 430.2 and 430.52.

Panel Meeting Action: Reject

Panel Statement: The panel rejects the addition of "(MCP's)" as it is not necessary.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

11-19 Log #1270 NEC-P11 **Final Action: Reject**

(Table 430.97)

Submitter: Stanley J. Folz, Morse Electric, Inc.

Comment on Proposal No: 11-43

Recommendation: Reject the Panel action to accept Proposal 11-43.

Substantiation: The Chair of Code Making Panel 11 appointed a task group comprised of myself, Robert Fahey, James Fahey, Jeffery DesJarlais, Luis Bas and Vince Saporita to verify or amend the action taken on Proposal 11-43 where the panel amended Table 430.97 to change 600 volts nominal to 1000 volts nominal. As our research continued we asked Mark Ode to join our discussion. Table 430.97 first appeared in the 1993 NEC. That 1993 Panel rewrote Proposal 11-64 and although it was not stated it appears that the Panel used Table 384-26 (now 408.56) as a basis for Table 430.97.

Mr. Ode tracked 384-26 back to the 1959 NEC. It did not appear in either the 1956 or 1959 preprints. At this point the task group cannot determine what criteria were used to create this Table. This task group recommends that Proposal 11-43 be rejected and testing be done to verify that the current 600 volt spacing is sufficient if increased to 1000 volts. If not, then test to determine what spacing is sufficient for 1000 volts.

Panel Meeting Action: Reject

Panel Statement: The submitter's recommendation to reject Proposal 11-43 was already accomplished in the proposal stage.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

Comment on Affirmative:

THOMPSON, J.: Products and applications demand guidance for applications above 600 volts, but believe that these are best provided in the end-product standards. If electrical spacing tables are to remain in the Code, then the proper spacings for field installed bus bars etc must be defined. The NFPA Research Foundation, in concert with third party safety certifiers should establish a research project to determine the appropriate spacing distances (through air and over surface) for 1000V applications. It should be noted that existing UL standards contain electrical spacing requirements for products used in applications in excess of 600V.

11-20 Log #601 NEC-P11 **Final Action: Hold**

(430.111(B)(3))

Submitter: James F. Williams, Fairmont, WV

Comment on Proposal No: 11-20

Recommendation: Revise text to read as follows:

430.111 Switch or Circuit Breaker as Both Controller and Disconnecting Means

(B) Type.

(3) Oil Switch. An oil switch used on a circuit whose rating does not exceed 1000 volts or 100 amperes, or by special permission on a circuit exceeding this capacity where under ~~expert~~ engineering supervision. The oil switch shall be permitted to be both power and manually operable.

-or-

430.111 Switch or Circuit Breaker as Both Controller and Disconnecting Means

(B) Type.

(3) Oil Switch. An oil switch used on a circuit whose rating does not exceed 1000 volts or 100 amperes, or by special permission on a circuit exceeding this capacity ~~where under expert supervision~~. in industrial installations where conditions of maintenance and supervision ensure that only qualified persons service the equipment. The oil switch shall be permitted to be both power and manually operable.

Substantiation: This is the only instance in the *NEC* that the term *expert* is used.

Panel Meeting Action: Hold

Panel Statement: The comment and proposed change is not related to the original proposal. It is new material.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

11-21 Log #164 NEC-P11 **Final Action: Accept**

(430.130 and 430.131)

TCC Action: The Correlating Committee directs that the last sentence of 430.131 read as follows: For the purposes of 430.53 and 430.131, power conversion equipment shall be considered a motor controller.

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 11-60a

Recommendation: The Correlating Committee directs that the panel correct the use of the term "may" in the Informational Note in 430.130, as it makes the Informational Note permissive.

The Correlating Committee directs that the action on this proposal be rewritten to either remove the requirement in the Informational Note for 430.131 or incorporate the text into the section.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Revise to read as follows:

430.130 Branch Circuit Short-Circuit and Ground-Fault Protection for single motor circuits containing power conversion equipment.

(A) Circuits containing power conversion equipment shall be protected by a branch circuit short-circuit and ground-fault protective device in accordance with the following:

(1) The rating and type of protection shall be determined by 430.52 (C) (1), (3), (5) or (6) using the full load current rating of the motor load as determined by 430.6.

(2) Where maximum branch-circuit short-circuit and ground-fault protective ratings are stipulated for specific device types in the manufacturers instructions with the power conversion equipment or are otherwise marked on the equipment, they shall not be exceeded even if higher values are permitted in 430.130 (A) (1).

(3) A self-protected combination controller shall only be permitted where specifically identified in the manufacturer's instructions with the power conversion equipment or otherwise marked on the equipment.

Informational note: The type of protective device, its rating and setting ~~may be~~ is often **marked on or provided with the power conversion equipment.**

(B) **Bypass Circuit/Device.** Branch circuit short-circuit and ground-fault protection shall also be provided for bypass circuit/device(s). Where a single branch-circuit short-circuit and ground-fault protective device is provided for circuits containing both power conversion equipment and a bypass circuit, the branch circuit protective device type and its rating or setting shall be in accordance with that determined for the power conversion equipment and for the bypass circuit/device(s) equipment.

430.131 Several motors or loads on one Branch Circuit including Power Conversion Equipment

For installations meeting all the requirements of 430.53 that include one or more power converters, the branch circuit short-circuit and ground-fault protective fuses or inverse time circuit breakers shall be of a type and rating or setting permitted for use with the power conversion equipment using the full load current rating of the connected motor load in accordance with 430.53. For the purposes of 430.53 and 430.131, power conversion equipment is considered a motor controller.

Panel Statement: CMP 11 accepts the direction of the Correlating Committee and modified the informational note to 430.130 and incorporated the informational note 430.131 into the text of 430.131.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

11-22 Log #1583 NEC-P11 **Final Action: Reject**
(430.130(B))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 11-60a
Recommendation: Revise text to read as follows:
430.130 Branch Circuit Short-Circuit and Ground-Fault Protection for Single Motor Circuits Containing Power Conversion Equipment.
(B) Bypass Circuit/Device. Branch circuit short-circuit and ground-fault protection shall also be provided for bypass circuit/device(s). Where a single branch-circuit short-circuit and ground-fault protective device is provided for circuits containing both power conversion equipment and a bypass circuit, the branch circuit protective device type and its rating or setting shall be in accordance with that <u>maximum</u> determined for the power conversion equipment and for the bypass circuit/device(s) equipment. **[ROP 11–60a]**
Substantiation: Can a single setting and amperage rating serve for both the power conversion equipment and the bypass? If not what settings are to be used?
Panel Meeting Action: Reject
Panel Statement: "In accordance with that determined for the power conversion equipment and for the bypass circuit/device(s) equipment" clearly states that the sizes or settings must meet the most restrictive requirement and must provide protection for both pieces of equipment. If one device cannot protect both pieces of equipment then separate protective devices must be used. The word "maximum" is not necessary.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

11-23 Log #743 NEC-P11 **Final Action: Accept**
(430, Part XI)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 11-61
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.
The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.
The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.
Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.
Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.
If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
COLE, T.: See comment on 11-6.

11-24 Log #1256 NEC-P11 **Final Action: Reject**
(430, Part XI)

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 11-61
Recommendation: I ask the panel to reject this proposal. The proposal would change 600 volts to 1000 volts.
Substantiation: Replacing 600 volts with 1000 volts will have a major impact on installers, component manufacturers, and industry standards. Increased spacing must be considered when going from 600 volts to 1000 volts. Personal safety must also be considered.
Because the proposer has not provided enough information to the public to justify and understand all the ramifications of the proposal, the committee should reject the submitters proposal.
Panel Meeting Action: Reject
Panel Statement: The change for Part XI of 430 does not create a major impact on the Industry, the change only allows higher voltages to be utilized if available and/or chosen to be used by the installer, there is no requirement higher voltages must be utilized.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
COLE, T.: Action should have been to accept. See comment on 11-6.

11-25 Log #1421 NEC-P11 **Final Action: Reject**
(430.233)

Submitter: Keith Fager, Bayer CropScience
Comment on Proposal No: 11-68
Recommendation: Panel action should have been Reject.
Substantiation: Paragraph 430.233 is used in conjunction with paragraph 430.232, which requires exposed live parts of motors and controllers operating at 50 volts or more to be guarded by enclosure or location. Paragraph 430.233 requires further protection if the parts are operating at 150 volts or more and the guarding required by 430.232 is by location.
Panel Meeting Action: Reject
Panel Statement: The panel agrees that voltages over 50 V are hazardous and that the requirements of 430.233 should apply. Two separate situations are addressed. Section 430.232 addresses accidental contact. Section 430.233 addresses worker's safety while adjusting energized equipment.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

11-26 Log #602 NEC-P11 **Final Action: Reject**
(Table 430.250)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 11-20
Recommendation: Revise text to read as follows:
Table 430.250 Full-Load Current, Three-Phase Alternating-Current Motors
The following values of full-load currents are typical for motors running at speeds usual for belted motors and motors with normal torque characteristics. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120, 220 to 240, 440 to 480, ~~and~~ 550 to ~~1000~~ <u>600, and 690</u> volts.
Substantiation: Restore the previous value of 600 volts. The same current for motors that differ in voltage by about a factor of two is unlikely.
Adding a column may be appropriate for higher voltage motors (e.g.: 690).
It appears to be a case of search and replace run amuck.
Panel Meeting Action: Reject
Panel Statement: Proposal 11-20 covered Parts I through X. Proposal 11-61 covered Part XI. There were no proposals changing 600 volts to 1000 volts in Part XIV which includes Table 430.250. The voltages in the heading of Table 430.250 did not change. The draft was changed in error and will be corrected. It is anticipated that errata will be issued.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

ARTICLE 440 — AIR CONDITIONING AND REFRIGERATING EQUIPMENT

11-27 Log #479 NEC-P11 **Final Action: Reject**
(440.2.Branch-Circuit Selection Current and 440.4 (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 11-76
Recommendation: Revise text to read as follows:
Branch-Circuit Selection Current. The value in amperes to be used instead of the rated-load current in determining the ratings of motor branch-circuit conductors, disconnecting means, controllers, and branch-circuit short-circuit and ground-fault protective devices wherever the running overload protective device permits a sustained current greater than the specified percentage of the rated-load current. ~~The value of branch-circuit selection current will always be equal to or greater than the marked rated-load current.~~
440.4 Branch-circuit selection and rated load currents. The value of the branch-circuit selection current shall be equal to or greater than the marked rated-load current.
Renumber sections as needed from 440.4 through 440.9.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term in the last sentence and also contains requirements and the NEC manual of style does not permit the definition to contain the defined term. Definitions are not requirements. The proposed changes eliminate the defined term and the requirements, by placing them in an alternate location in Article 440.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Alternate approach, could be as follows (by eliminating the last sentence):
Informational Note: The value of branch-circuit selection current will always be equal to or greater than the marked rated-load current.
Panel Meeting Action: Reject
Panel Statement: The existing definition does not violate the intent of the NEC Style Manual. The proposed text does not add clarity nor improve readability.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

11-28 Log #557 NEC-P11 **Final Action: Reject**
(440.9 (New))

Submitter: Richard E. Loyd, Sun Lakes, AZ
Comment on Proposal No: 11-83
Recommendation: Reject Proposal 11-83 which will delete new Section 440.9 in its entirety.
Substantiation: I recognize that a seven member task group developed this proposal based on one of the task member's proposal and comment to the 2011 NEC. The proponent sighted concerns related to an electrocution incident which occurred August 2, 2007. However, their action to proceed with a new proposal leads me to believe they did not carefully study the supporting documentation provided.
I looked at this information and conveyed this in my negative comment to ROP 8-90 as follows;
1. The case cited occurred **August 2, 2007**, and although it lists a fatality related to an air conditioner in a residence and a metal fence, it does not state the details of why the shock occurred, however, the homeowner stated the air conditioner seemed to be working properly. A forensic investigation report has not been supplied. It does not identify or implicate any specific wiring method nor that it was defective or damaged and caused the accident.
2. The two pictures that were included were dated **October 31, 2008** almost 15 months after the accident occurred. These two pictures show that both the supply and load are installed in a flexible type raceway, however, it does not identify the type of flexible raceway or if the raceway was implicated. It does however prove that EMT was not used as the wiring method to supply the disconnection switch or the air-conditioner. EMT was not even involved.
3. Nothing in the records or the substantiation provided indicate that there was no ground fault path between the Air conditioner the overcurrent t protective device. Nothing in the report indicates this was a contributing factor to the accident.
4. The CPSC report provided is for electrocutions from 1992 through 2002 associated with consumer products more than 5 years before the accident occurred. Nothing in this report indicated EMT was not a reliable equipment grounding path per 250-118
5. Since the evidence presented was taken on three different dates, there is no indication that any corrective action was taken or necessary following the accident.

I believe in absence of a forensic report and investigation we must assume the installation and the materials used to connect the air-conditioner was not the cause of the accident.
In addition to this, the negative voting and comments by committee members from various segments of the industry indicate this is not a good addition to the 2014 Edition of the NEC. It is not based on sound substantiation. Testing laboratories have retested fittings and the manufactures have improved them in recent years. Nothing has been submitted for public review that supports this proposed change.
Panel Meeting Action: Reject
Panel Statement: See the panel action and statement on Comment 11-31.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 10 Negative: 4
Explanation of Negative:
MISSILDINE, JR., J.: See negative ballot statement for Comment 11-31.
POWELL, C.: The submitter adequately explained that insufficient evidence was presented by proposal 11-83 to justify the addition of the new requirements of 440.9 created by the proposal.
THOMPSON, J.: I support the position provided by the submitter.
WRIGHT, J.: It is not reasonable to simply require a grounding conductor on a product that has an excellent record of performance. Manufacturers of this product have not had issues or complaints about problems with either the armor opening or with grounding. The Code already addresses applications where the EMT or liquidtight may be subject to damage, in Sections 358.12 and 350.12. EMT is not permitted where subject to severe physical damage, and liquidtight is not permitted where subject to physical damage.

11-29 Log #1257 NEC-P11 **Final Action: Accept in Principle in Part**
(440.9)

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 11-83
Recommendation: I ask the panel to continue to Accept in Principal this proposal. Article 440.9 including panel statements change is shown below.
440.9 Grounding and Bonding. Where equipment is installed outdoors with either Liquidtight Flexible Metal Conduit or Electrical Metallic Tubing, an equipment grounding conductor shall be provided as required per 350.60(B) and 358.60(B).
Substantiation: In a recent survey conducted by IEC over 50% of the respondents said they had observed or heard of non- threaded conduit, to HVAC and refrigerator equipment, that came apart after being installed on rooftops. Also, over 7% indicated they knew of or received a serious electrical shock as a result of the separation of the conduit.
Panel Meeting Action: Accept in Principle in Part
Panel Statement: See the action and statement on Comment 11-32. The references to 350.62(B) and 350.68(B) are not required.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 10 Negative: 4
Explanation of Negative:
MISSILDINE, JR., J.: See negative ballot statement for Comment 11-32.
POWELL, C.: Without additional details regarding the survey used in the substantiation, it cannot be know whether the respondents were a representative sample.
THOMPSON, J.: See comment in 11-30.
WRIGHT, J.: See my negative comment on Comment 11-28.

11-30 Log #1313 NEC-P11 **Final Action: Accept in Principle in Part**
(440.9)

Submitter: Mike Weitzel, Richland, WA
Comment on Proposal No: 11-83
Recommendation: Add new text to read as follows:
440.9 Grounding and Bonding. Where equipment is installed outdoors with either Liquidtight Flexible Metal Conduit of Electrical Metallic Tubing, an equipment grounding conductor shall be provided as required per 350.60(B) and 358.60(B).
Substantiation: First of all, steel conduit and tubing raceways such as EMT are excellent wiring methods. No one disputes that fact.
With that being understood, and despite what our friends representing the steel conduit industry may say, there is still a problem with loose or damaged conduit connections on some installations in the field. Outdoor installations of these types of wiring methods are commonly used to supply electrically-powered air-conditioning equipment. Though not exclusively, AC units are most often installed at grade level, or on rooftops of buildings.
When installed in these locations outdoors, there can be a problem with physical damage. This is not a reflection on the steel conduit. The steel conduit itself is not the problem. And Liguidtight Flexible Metal Conduit is an excellent wiring method in its own right. However, there are issues in the field.
Sometimes, the problem is with the installation. AHJ's or their field inspector will typically provide a 'visual inspection' of the installation, and will not attempt to check the tightness of the fitting(s). (After all, this is the installer's or contractor's responsibility). The installer is responsible to perform the installation in a workmanlike manner, and in accordance with the manufacturer's instructions. [NEC 110.12, and 110.3(B)]. Obvious loose connections should be discovered at the time of installation or installation, if checked both visually, and in the manner described.
Other problems with the conduit installation may occur after installation. Because physical damage can occur, such as when a building rooftop is re-roofed, or when snow is removed, conduit or tubing buried under snow may be struck with a snow blower, and fittings may loosen and separate. when this

occurs, the equipment grounding capability of the conduit or tubing wiring method is lost. Roofing contractors hire laborers who don't show proper care for the installed electrical tubing on the roof, and merely 'pull things out of the way'. In order to remove the old roof and install the new one.

The NEC addresses physical damage in many sections. Consider why Schedule 80 PVC conduit is required in locations subject to physical damage. Is the conduit defective? No, of course not. However, the heavier, tougher grade of conduit is required where installed in a traffic area such as a driveway located on the side of a building, because we know that there is a possibility that physical damage may occur if people in vehicles aren't careful.

Also, in the case of Type NM Cable, nail plates are required where the NM Cable could possibly be damaged after wall covering is installed. Is this a problem with the NM Cable being defective? No, of course not. And, the cable industry does not take that the Code Panel is concerned about the quality of their product. Not at all. The concern is to protect good and properly installed cable from penetration from a screw or nail, after the cable is installed. We could go on to discuss buried conduits and cable requiring physical protection, but you get the point.

In the case of Health Care Facility Patient Care Areas, per Section 517.13(B), an insulated wire type equipment grounding conductor is required to be installed in the wiring method along with the branch-circuit conductors. Does this mean that the EMT tubing or the MC cable wiring method is not suitable for supplying power to electrical loads where a person is laying in a hospital bed? No, of course not. However, the issue is safety, and this rule that requires the additional or 'redundant' equipment grounding conductor has been in the *Code* for a long time.

Therefore, again, the steel conduit as a product is not being criticized. Nor is the PVC conduit, the NM Cable, nor the MC cable either.

What it does come down to is a matter of safety for personnel and property, which is the stated purpose of the *Code*. What has been proposed here is to simply assure that a wire type equipment grounding conductor be installed in the tubing or flex conduit to an air-conditioning unit installed outdoors, sized in accordance with Section 250.122, to provide a back-up plan, in the event that the equipment-grounding capability of the primary wiring method is not able to function as designed. That's all.

This wire type EGC is relatively inexpensive, and will greatly increase safety in installations, which is what the NEC is all about. I know that there are those who may offer opposing views, but I urge you to continue to accept and support this proposal.

Panel Meeting Action: Accept in Principle in Part

Panel Statement: See the action and statement on Comment 11-29.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 10 Negative: 4

Explanation of Negative:

MISSILDINE, JR., J.: See negative ballot statement for Comment 11-32.

POWELL, C.: See reason on 11-28.

THOMPSON, J.: I fully support the safe installation and maintenance of all connected equipment. The conduit currently allowed by the Code is evaluated for its ability to serve as the equipment grounding conductor in addition to the requirements for mechanical strength. Conduit has a long and firmly established safety record. Based on the comments of this submitter, the suitability of EMT and other conduit methods to act as a suitable ground path is not in dispute. Rather, the proposal is attempting to address installation and maintenance concerns. As a result, the proposal does not address what the submitter considers to be the root cause of the concern (e.g., maintenance or installation). The NFPA Research Foundation should consider a research project to determine if maintenance and installation practices need to be addressed.

WRIGHT, J.: See my negative comment on Comment 11-28.

11-31 Log #1374 NEC-P11 **Final Action: Reject**
(440.9)

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)

Comment on Proposal No: 11-83

Recommendation: Reject proposal 11-83 and delete the text of the entire proposed new section 440.9.

~~440.9 Grounding and Bonding. Where equipment is installed outdoors with either Liquidtight Flexible Metal Conduit or Electrical Metallic Tubing, an equipment grounding conductor shall be provided as required per 350.60(B) and 358.60(B).~~

Substantiation: This proposal should be rejected. Nothing in the substantiation, in the CPSC report or in the report of the Chicago incident indicates the wiring method was the cause of the electrocution. The CPSC report is dated 2002 and only shows the number of consumer product-related electrocutions by specific products involved, not the specific cause. The report shows a greater number of electrocutions were related to other components of the installed household wiring than to the wiring method. In the case of damaged or exposed wiring, the "exact nature of the wiring was unspecified".

The substantiation submitted with the proposal provides a single incident and does not provide any information on the construction of the raceway, whether or not it was listed, or if listed fittings were used or properly installed.

The use of a supplemental equipment grounding conductor should be a design decision based on the wiring method to be used and the unique installation environment in which the equipment is being installed. Both EMT and FMC have excellent performance records. Manufacturers have not had issues or complaints about problems with either the armor opening (FMC) or with grounding for either product.

A Georgia Tech research study on grounding which is referenced in the Soares Book on Grounding validates that EMT is a proven equipment grounding conductor when installed in accordance with the NEC and with either set-screw or compression type fittings. The Georgia Tech report states that steel EMT, IMC and RIGID conduit, not exceeding the maximum allowable length, meets the requirements of Article 250 of the NEC. In fact, the performance of steel conduit sized in accordance with Chapter 9, Table 1 of the NEC, compared to the minimum size equipment grounding conductors in Article 250 allows the flow of higher fault current. This is due to the lower impedance of the steel conduit.

The construction of LFMC requires that it be provided with a bonding strip wound into the conduit convolutions throughout its entire length. It is required to withstand a 300 pound tension, and up to a 750 Amp fault current. The raceway is required to be terminated in listed fittings and required to be protected by overcurrent devices rated a maximum 20 or 60 amps, depending on the size of the raceway. In addition the use of the raceway as a ground fault path is limited to six feet.

The Panel 11 Technical Committee should require more substantive substantiation. There are many non-listed, off-shore sourced Liquid tight products in the marketplace. Was the product in this incident listed? Were the fittings used also listed for the application? Were all of the metal components properly bonded? Was the installation compliant with the NEC®?

In light of the construction, listing, and installation requirements in place for these wiring methods and the excellent record of performance when installed in accordance with the requirements of the NEC®, the requirement for an equipment grounding conductor in this application should not be required.

Panel Meeting Action: Reject

Panel Statement: See the panel action and statement on Comment 11-33. Previously submitted evidence, along with the substantiation provided in Comments 11-3 and 11-29, is sufficient to require the extra degree of safety that is intended by Proposal 11-83.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 10 Negative: 4

Explanation of Negative:

MISSILDINE, JR., J.: The panel's action should have been to accept this comment. I agree with the substantiation given in this comment and the substantiation given for comment 11-28 as reason for rejecting the requirement for a wire type ground conductor.

Requiring a wire type conductor for equipment ground rather than use of conduit or other means as described in 250.118 is not a substitute for proper conduit application, installation or maintenance.

This change would only correct the stated problem for air conditioning and refrigeration equipment. If this change is necessary, Article 440 is not the appropriate place since it should be for all outdoor equipment fed from EMT and/or LFMC. Even other HVAC equipment, such as air handling equipment is not covered by this change.

The justification for this change is the regular occurrence of damaged EMT and LFMC conduit on rooftops, possibly from snow removal or outdoor adjacent to buildings. Section 358.12(1), states that the use of EMT is not permitted where subject to "severe physical damage". The stated regular occurrence of damaged EMT should qualify as "severe physical damage".

Installation of a wire type equipment ground conductor in the outdoor portion of the EMT run would ground the load and provide a fault return path, but does not ground an intermediate section of EMT if two breaks are present in the run. The IEC survey in the Substantiation of Comment 11-29 states that over 50% of IEC respondents had seen separated EMT connections on rooftops and over 7% had received a serious shock by the conduit. This problem will not be corrected by the addition of a wire type equipment grounding conductor to bypass the outdoor conduit run if the short occurs in an isolated section of conduit.

Correcting a problem with the ground path does not correct the mis-application of material as specified in the Code. Whether or not a wire type equipment ground conductor is installed, the complete solution to the problem must include proper selection of raceways and maintenance.

POWELL, C.: See reason on 11-28.

THOMPSON, J.: I support the position provided by the submitter.

WRIGHT, J.: See my negative comment on Comment 11-28.

11-32 Log #1530 NEC-P11 **Final Action: Accept in Principle**
(440.9)

Submitter: Michael J. Johnston, National Electrical Contractors Association

Comment on Proposal No: 11-83

Recommendation: Revise proposed text as follows:

440.9 Grounding and Bonding. Where equipment is installed outdoors with either Liquidtight Flexible Metal Conduit or Electrical Metallic Tubing, ~~an~~ <u>wire-type</u> equipment grounding conductor shall be provided <u>in the outdoor portion of the raceway</u> as required per 350.60(B) and 358.60(B).

Substantiation: The proposed requirement is unclear as to where a required wire-tye equipment grounding conductor starts and stops. By inserting the words "wire-type" it is clear that only the type specified in 250.118(1) is what is required. As currently worded, the proposed text will be problematic not only for contractors but for inspectors. By adding the words "in the outdoor portion of the raceway" clearly establishes where the requirement applies and does not apply. Without the additional wording, the requirement applies to all portions of the raceway system, whether inside or outside. The proposed text only addresses outdoor installed equipment, and is not specific about the outdoor portion of the raceway upon which the substantiation appears to have been based.

Panel Meeting Action: Accept in Principle

Revise the proposed text to read as follows:

440.9 Grounding and Bonding. Where air-conditioning and refrigeration equipment is installed outdoors with wiring methods consisting of Liquidtight Flexible Metal Conduit or Electrical Metallic Tubing, a wire type equipment grounding conductor as specified in 250.118 (1) shall be provided in the outdoor portion of the raceway.

Panel Statement: The panel inserted text which adds clarity to the requirement and meets the submitter's intent. The Committee also inserted text to clarify the use of a wire type equipment grounding conductor. See the substantiation on Comment 11-29 for this revision.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 10 Negative: 4

Explanation of Negative:

MISSILDINE, JR., J.: This comment should have been rejected.
Requiring a wire type conductor for equipment ground rather than use of conduit or other means as described in 250.118 is not a substitute for proper conduit application, installation or maintenance.

This change would only correct the stated problem for air conditioning and refrigeration equipment. If this change is necessary, Article 440 is not the appropriate place since it should be for all outdoor equipment fed from EMT and/or LFMC. Even other HVAC equipment, such as air handling equipment is not covered by this change.

The justification for this change is the regular occurrence of damaged EMT and LFMC conduit on rooftops, possibly from snow removal or outdoor adjacent to buildings. Section 358.12(1), states that the use of EMT is not permitted where subject to "severe physical damage". The stated regular occurrence of damaged EMT should qualify as "severe physical damage".

Installation of a wire type equipment ground conductor in the outdoor portion of the EMT run would ground the load and provide a fault return path, but does not ground an intermediate section of EMT if two breaks are present in the run. The IEC survey in the Substantiation of Comment 11-29 states that over 50% of IEC respondents had seen separated EMT connections on rooftops and over 7% had received a serious shock by the conduit. This problem will not be corrected by the addition of a wire type equipment grounding conductor to bypass the outdoor conduit run if the short occurs in an isolated section of conduit.

Correcting a problem with the ground path does not correct the mis-application of material as specified in the Code. Whether or not a wire type equipment ground conductor is installed, the complete solution to the problem must include proper selection of raceways and maintenance.

POWELL, C.: See reason on 11-28.

THOMPSON, J.: See comment in 11-30.

WRIGHT, J.: See my negative comment on Comment 11-28.

11-33 Log #585 NEC-P11 **Final Action: Reject**
(440.9 Exception (New))

Submitter: Charles L. Powell, American Chemistry Council

Comment on Proposal No: 11-83

Recommendation: Add the following new text:

<u>Exception: Where Air Conditioning or Refrigerating Equipment is part of an industrial, commercial, or institutional installation operating under conditions of maintenance and supervision that ensure that only qualified persons monitor and supervise the system, LFMC or EMT shall be permitted to be used as an equipment grounding conductor when installed in accordance with 250.118(6).</u>

Substantiation: The supporting documentation of the original proposal identified that a problem exists with these residential and commercial installations but there was no evidence presented that the existing practices in industrial installations should be modified by this new code section. Typical industrial refrigeration units involve large motors whose installation does not require a local disconnect switch, (440.14 Exception No. 1), and therefore the substantiation in the original proposal does not apply.

Panel Meeting Action: Reject

Panel Statement: The panel recognizes the shock potential due to loss of ground continuity regardless of occupancy type. Requiring the equipment grounding conductor within conduits at all occupancies provides an additional level of safety.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 11 Negative: 3

Explanation of Negative:

MISSILDINE, JR., J.: The panel's action to should have been to accept this comment based on the panel's action on Comment 11-32. The conditions specified in the justification for a wire type ground conductor in outdoor EMT and LFMC does not apply to areas as stated in the exception proposed in this comment.

POWELL, C.: The original substantiation does not reference any problems in industrial locations. The panel statement does not say otherwise, it simply states "if" ground continuity is lost it is a hazard regardless of occupancy. Also, see reason on 11-28.

THOMPSON, J.: See comment in 11-30. If ROP 11-83 is to be accepted, the panel should accept the position of the submitter of ROC 11-33 to exempt Industrial, commercial or institutional installations that operate under maintenance and supervision.

Comment on Affirmative:

WRIGHT, J.: While NEMA votes affirmative on this Panel Action, NEMA does not agree that the requirement belongs in Article 440. The requirement should not be contained in either Section 358.60 or Article 440. It is not reasonable to simply require a grounding conductor on a product that has an excellent record of performance. Manufacturers of this product have not had issues or complaints about problems with either the armor opening or with grounding. The Code already addresses applications where the EMT or liquidtight may be subject to damage, in Sections 358.12 and 350.12. EMT is not permitted where subject to severe physical damage, and liquidtight is not permitted where subject to physical damage.

11-34 Log #621 NEC-P11 **Final Action: Reject**
(440.9 Exception (New))

Submitter: Travis K. Foster, American Chemistry Council

Comment on Proposal No: 11-83

Recommendation: Add the following:

Exception: Where Air Conditioning or Refrigerating Equipment is part of an industrial, commercial, or institutional installation operating under conditions of mantenance and supervision that ensure that only qualified persons monitor and supervise the system, LFMC or EMT shall be permitted to be used as an equipment grounding conductor when installed in accordance with 250.118(6).

Substantiation: The supporting documentation of the original proposal identified that a problem exists with these residential and commercial installations but there was no evidence presented that the existing practices in industrial installations should be modified by this new code section. Typical industrial refrigeration units involve large motors whose installation does not require a local disconnect switch, (440.14 Exception No. 1), and therefore the substantiation in the original proposal does not apply.

Panel Meeting Action: Reject

Panel Statement: See the panel action and statement on Comment 11-33.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 11 Negative: 3

Explanation of Negative:

MISSILDINE, JR., J.: See negative ballot statement for Comment 11-33.

POWELL, C.: The original substantiation does not reference any problems in industrial locations. The panel statement does not say otherwise, it simply states "if" ground continuity is lost it is a hazard regardless of occupancy. Also, see reason on 11-28.

THOMPSON, J.: See comment in 11-33.

Comment on Affirmative:

WRIGHT, J.: See my Affirmative comment on Comment 11-33.

ARTICLE 445 — GENERATORS

13-2 Log #177 NEC-P13 **Final Action: Accept**
(445.11)

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 13-11

Recommendation: It was the action of the Correlating Committee that the panel clarify the panel action on this proposal with respect to the redundant appearance of the phrase "time rating" in the accepted text.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Revise the panel action as follows:

445.11 Marking. Each generator shall be provided with a nameplate giving the manufacturer's name, the rated frequency, ~~power factor,~~ number of phases if of alternating current~~, the subtransient and transient impedances,~~ the rating in kilowatts or kilovolt amperes, the normal volts and amperes corresponding to the rating, rated revolutions per minute, ~~insulation system class~~ and rated ambient temperature or rated temperature rise~~, and time rating~~.
<u>Nameplates for all stationary generators and portable generators rated more than 15 kW, shall also give the power factor, the subtransient and transient impedances, insulation system class, and time rating.</u>

Panel Statement: CMP-13 accepts the direction of the Correlating Committee to clarify the panel action on proposal 13-11 with respect to the redundant appearance of the term "time rating." CMP-13 has revised the panel action.

Number Eligible to Vote: 21

Ballot Results: Affirmative: 21

13-3 Log #1512 NEC-P13 **Final Action: Reject**
(445.11)

Submitter: Donald R. Cook, Shelby County Department of Development Services
Comment on Proposal No: 13-10
Recommendation: Reconsider and accept proposed text for marking that indicates the location of system bonding location.
Substantiation: Since the NEC permits and includes provisions to modify the system bonding arrangement of a generator. based all selection of a transfer switch, it is critical that installers and AHJ's be able 10 find the system bonding location. That local ion is not universal from one generator manufacture!' or even consistent on variousgenerators from the same manufacturer. To properly make or break that bonding connection, persons working in the field must know where the connection is located.
Panel Meeting Action: Reject
Panel Statement: The text of the paragraph immediately preceding the additional sentences added by Proposal 13-10 indicates a generator nameplate is required where the marking will be provided. Some generators may not be designed so the system bonding jumper is accessible and, other generators may not have enough area on a nameplate to indicate the exact location within the generator of the system bonding jumper. The exact marking on the generator should remain a manufacturer's responsibility.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-4 Log #1272 NEC-P13 **Final Action: Accept**
(445.12)

Submitter: James L. Brown, Detroit Edison, DTE Energy
Comment on Proposal No: 13-12
Recommendation: Delete text to read as follows:
445.12 Overcurrent ~~and Overload~~ Protection. (A) Constant-Voltage Generators. Constant-voltage generators, except ac generator exciters, shall be protected from overload by inherent design, circuit breakers, fuses, protective relays, or other identified overcurrent protective means suitable for the conditions of use.
Substantiation: The panel's action does not meet the Proposal-submitter's intent and this proposal should have been rejected at the Proposal stage. The inclusion of "overload" in the section title does not address his concerns for short-circuit protection. The term "Overload" does not need to be included in the title since the present title "Overcurrent Protection" already encompasses overload protection. The body of the text 445.12(A) does specifically state that the protection by inherent design is for overload only. The intent of this comment is for the current code in 445.12 to remain as it is.
Panel Meeting Action: Accept
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-5 Log #1097 NEC-P13 **Final Action: Accept in Principle in Part**
(445.18)

Submitter: Linda J. Little, St. Louis, MO
Comment on Proposal No: 13-16
Recommendation: Continue to Accept in Principle revised as follows:
445.18 Disconnecting Means Required for Generators. Generators shall be equipped with disconnect(s), lockable in the open position, by means of which the generator and all protective devices and control apparatus are able to be disconnected entirely from the circuits supplied by the generator except where all of the following conditions apply:
<u>(1) The generator is listed.</u>
<u>(2)</u> The driving means for the generator can be readily shut down<u>, rendered incapable of restarting and is lockable in the OFF position in accordance with 110.25.</u>
<u>(3)</u> The generator is not arranged to operate in parallel with another generator or other source of voltage.
<u>Informational Note: See UL 2200 Standard for Safety of Stationary Engine Generator Assemblies.</u>
Substantiation: The action to accept in principle proposal 13-111 will permit the installation of a standby generator without a disconnecting means installed at any point from the generator terminals to the equipment supplied. A means to simply shut down the driving means for the generator, such as a diesel engine, is all that will be required. The panel action to accept proposal 13-111 is based partially on UL 2200 which mandates a means to stop the driving means, prevent restarting and requires this means to be lockable in the OFF position. The informational note points users to this reference. Not all generators are listed. The above modifications are needed for the safety of all installer/maintainers. It should be noted that OSHA does not permit an emergency stop button to be used to lockout electrical equipment. See CFR 29 1910.333(b)(2)(ii)(B). If a Nationally Recognized Testing Laboratory (NRTL) has listed such a device for lockout/tag-out, it may be considered by OSHA as an acceptable means of lockout/tag-out. The reference to 110.25 was accepted by panel action to correlate with the action on proposal 1-130.
This proposed revision does not constitute "new material." This proposed revision had public review in the ROP. See the affirmative comment on proposal l3-16 which included the suggested revision for public review.
Panel Meeting Action: Accept in Principle in Part
Panel Statement: See panel action on Comment 13-18a.
CMP 13 rejects proposed 445.18(1) because the action on Comment 13-18a addresses the concerns of the submitter without a listing requirement.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21
Comment on Affirmative:
LITTLE, L.: We are voting affirmative on the panel action to "Accept in Principle in Part" comment 13-5. The panel statement points to comment 13-18a, which should have been numbered 13-5a since it addresses comments 13-5, 13-6 & 13-7.

13-6 Log #1292 NEC-P13 **Final Action: Accept in Principle**
(445.18)

Submitter: Joseph Harding, Portable Generator Manufacturers Association
Comment on Proposal No: 13-16
Recommendation: Revise text to read as follows:
445.18 Disconnecting Means Required for Generators. Generators shall be equipped with disconnects(s), lockable in the open position in accordance with 110.25, by means of which the generator and all protective devices and control apparatus are able to be disconnected entirely from the circuits supplied by the generator except <u>for portable generators where electrical supply cords can be readily disconnected and removed or</u> where both of the following conditions apply:
(1) The driving means for the generator can be readily shut down.
(2) The generator is not arranged to operate in parallel with another generator or other source of voltage.
Substantiation: This proposed addition seeks to clarify that this requirement does not apply to portable generators, because by their design they can be readily disconnected by removal of the supply cord from the portable generator's outlet.
PGMA members represent a significant majority of the portable generator industry. Our member companies include:
- American Honda Motor Co.
- Briggs & Stratton Home Power Products
- Champion Power Equipment
- Generac Power Systems
- Pramac America
- Subaru Industrial Power
- Techtronic Industries North America
- Wacker Neuson Production Americas LLC
- Yamaha Motor Corp USA

Panel Meeting Action: Accept in Principle
Panel Statement: See panel action on Comment 13-18a.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21
Comment on Affirmative:
LITTLE, L.: We are voting affirmative on the panel action to "Accept in Principle" comment 13-6. See our affirmative statement on comment 13-5.

13-7 Log #1388 NEC-P13 **Final Action: Accept in Principle**
(445.18)

Submitter: Greg Marchand, Briggs & Stratton
Comment on Proposal No: 13-16
Recommendation: Revise text to read as follows:
445.18 Disconnecting Means Required for Generators. Generators shall be equipped with disconnect(s), lockable in the open position in accordance with 110.25, by means of which the generator and all protective devices and control apparatus are able to be disconnected entirely from the circuits supplied by the generator except <u>for portable generators supplying cord-connected equipment or</u> where both of the following conditions apply:
(1) The driving means for the generator can be readily shut down.
(2) The generator is not arranged to operate in parallel with another generator or other source of voltage.
Substantiation: This proposed addition seeks to clarify that this requirement does not apply to portable generators used in "stand alone" mode, because by their design they can be readily disconnected by removal of the cord from the portable generator's outlet.
We are in full support of the Portable Generator Manufacturers Association.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action on Comment 13-18a.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21
Comment on Affirmative:
LITTLE, L.: We are voting affirmative on the panel action to "Accept in Principle" comment 13-7. See our affirmative statement on comment 13-5.

13-18a Log #CC1300 NEC-P13 **Final Action: Accept**
(445.18)

Submitter: Code-Making Panel 13,
Comment on Proposal No: 13-16
Recommendation: Revise the text to read as follows:
445.18 Disconnecting Means Required for Generators. Generators shall be equipped with disconnect(s), lockable in the open position, by means of which the generator and all protective devices and control apparatus are able to be disconnected entirely from the circuits supplied by the generator except for:
(1) Portable generators that are cord and plug connected or
(2) Where both of the following conditions apply:
(a) The driving means for the generator can be readily shut down, rendered incapable of restarting and is lockable in the OFF position in accordance with 110.25.
(b) The generator is not arranged to operate in parallel with another generator or other source of voltage.
Informational Note: See UL 2200 Standard for Safety of Stationary Engine Generator Assemblies.
Substantiation: This Committee Comment combines for clarity the actions taken on Comments 13-5, 13-6, and 13-7.
Panel Meeting Action: Accept
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21
Comment on Affirmative:
LITTLE, L.: We are voting affirmative on the panel action to "Accept" comment 13-18a. The subject line for this comment incorrectly references 455.5. This comment revises 445.18 and should have been numbered as 13-5a for clarity.

13-8 Log #178 NEC-P13 **Final Action: Accept**
(445.19)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 13-17
Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 13-16a.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-13 accepts the direction of the Correlating Committee to reconsider Proposal 13-17 and to correlate with the action on Proposal 13-16a.
CMP-13 rejects Proposal 13-17 and continues to support the action to Accept Proposal 13-16a, which deletes 445.19.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-9 Log #153 NEC-P13 **Final Action: Accept**
(445.19(1))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-134a
Recommendation: The Correlating Committee understands that the panel action on this proposal incorporates the modified definition of "Metal Enclosed Power Switchgear" to "Switchgear" in Proposal 9-7 by Code-Making Panel 9.
The Correlating Committee directs that this proposal will be forwarded to Code-Making Panel 13 for action in Article 445, recognizing that 445.19(1) has been deleted in the ROP.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-13 accepts the direction of the Correlating Committee to take action on Proposal 9-134a.
CMP-13 rejects Proposal 9-134a and continues to support the action to Accept Proposal 13-16a, which deletes 445.19.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-10 Log #412 NEC-P13 **Final Action: Reject**
(445.20)

Submitter: Daniel J. Caron, Bard, Rao + Athanas Consulting Engineers, LLC
Comment on Proposal No: 13-18
Recommendation: Reconsider Proposal 13-18.
Substantiation: The Panel statement on Proposal 13-18 does not address the submitters substantiation. Generators arranged to operate in parallel to serve loads in hospitals, data centers, etc. are very common. The conductors, controls and equipment required to parallel the generator, including electrically operated circuit breakers and the common bus in the paralleling switchgear should be defined as a system. Rules for applying ground fault protection (700.6(D)) and selective coordination (700.27) are often misapplied, or as the submitter has indicated cannot be applied.
Panel Meeting Action: Reject
Panel Statement: The comment is dealing with installation requirements that are not within the scope of Article 445. The submitter is encouraged to submit a proposal on Articles 700, 701, or 702 as appropriate.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 20 Negative: 1
Explanation of Negative:
CARON, D.: My Comment may be dealing with installation requirements that are not within the scope of Article 445, however the original Proposal is within the scope of 445 and this Panel should address the original Submitters substantiation.

13-11 Log #967 NEC-P13 **Final Action: Reject**
(445.20 (New))

Submitter: Kenneth L. Box, Cummins Power Generation
Comment on Proposal No: 13-19
Recommendation: None given.
Substantiation: 445.20 is not necessary. The same verbiage already exists in article 590.6. Consequently, duplicating the article in another section of the code is not consistent with the NFPA style guide. Furthermore, the existing article 590.6 & the proposed new article are not consistent with existing standards for generators. Specifically, 445.20 & 590.6 are in conflict with the ISO 8528-6 standard with respect to requiring a bonded neutral to the frame of the generator set. 445.20 assumes an installation with a transfer switch, when in fact, most portables are used for recreational purposed not as emergency standby generators. In recreational use, the generator is used as a prime power machine and a nonemergency power source. For example, ice fisherman use portable generators to power home appliance type items in their fishing huts on a frozen lake or pond. In order for the GFCI interrupter to properly function, the genset neutral bonding strap must be connected to the generator frame and the generator must be grounded to earth. How does one drive a 6 ft. ground rod in a frozen lake or pond? The GFCI interrupter is non-functional and does nothing to increase safety. The potential for misapplication remains great. Safety should always be the paramount concern. However, adding this duplicated article does nothing to address unqualified personal, such as the average homeowner, from back feeding a dryer receptacle with an extension cord connected to the generator. By doing so, this potential creates a safety hazard for utility lineman. In addition, the average homeowner is ignorant of the NEC and does not use the services of a qualified person (licensed electrician) to properly install the portable generator. Consequently, the GFCI device nuisance trips because the genset has parallel paths to ground. A local utility in Georgia employs temporary staffs of "generator listeners" who ride around in residential neighborhoods during severe ice storms. Their sole purpose is to listen for generators running so they can investigate the potentially lethal hazard previously explained. The proper place for addressing the bonded neutral strap to the frame of the generator is in the portable generator owner's manual and UL2201 and not the NEC.
Panel Meeting Action: Reject
Panel Statement: This comment does not contain a recommendation as required by 4.4.5(c) in the NFPA Regulations Governing Committee Projects.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 20 Negative: 1
Explanation of Negative:
BOX, K.: The committee cites "safety concerns as the reason for rejecting the proposal. Yet, no historical evidence of safety concern or fire hazard was presented to the committee. In fact, evidence to the contrary was presented to the committee by the Portable Generator Manufacturer's Association. This issues should be addressed by UL2201 for small portable generators and not the NEC.

13-12 Log #1098 NEC-P13 **Final Action: Reject**
(445.20 (New))

Submitter: Richard E. Loyd, Sun Lakes, AZ
Comment on Proposal No: 13-19
Recommendation: Reject proposal 13-19.
Substantiation: Adding this requirement may decrease the level of safety provided presently.
I agree with the negative voting comments of Degnan and Czarnecki There has been no substantiation of a safety problem and the submitter did not cite any safety issues that were not appropriately addressed in the 2008 edition proposal and comment meetings. 90.1(A) states the purpose of this code is the safeguarding of persons for the use of electricity. If this change is accepted it does not always assure this safety will be achieved. I believe the extensive discussions held in this committee and all documented literature has confirmed that both the floating neutral and bonded neutral types of generators perform safely when installed to the manufacturer's instructions that are provided with the generator when purchased and available from each manufacturer..
Based on the ECOA/IBEW study both types can be safe or not so safe based on the conditions of use.
In 1997 the construction safety association of Ontario (ECAO) in conjunction with the IBEW, with the assistance of Kubota Canada completed a in-depth

study on the use of GFCIs on portable generators. They tested both types the following are the analysis and conclusions of that study:

Analysis: It is clear that when generators of the floating-neutral or bonded-neutral type sit on dry surfaces in dry environments, they behave similarly In both cases, the GFCIs failed to trip In addition, the reading of little or no current on the multimeter indicated that there was not enough electricity leaking to ground to constitute a hazard In both cases, the GFCI did not trip when there was only one ground fault in the system. When effective grounding was established, GFCIs performed as expected Testing also proved that wet surfaces can create grounding for bonded-neutral generators When a bonded-neutral generator was placed on wet ground, the GFCI tripped under the prescribed current leakage

However, testing also showed that grounding can vary from one place to another, even when both are relatively close In one test, a variation in ground elevation yielded different results When the screwdriver was inserted in wet ground, the GFCI tripped When the screwdriver was moved 100 feet to a slope that had better drainage, the GFCI did not trip

The second series of tests showed that the placement of the GFCI in the circuit is critical to a floating-neutral system.

When the GFCI was plugged directly to the generator, the GFCI failed to detect any imbalance in the current As a result, it did not trip even when the current leak reached a higher than acceptable level When the GFCI was placed at the tool, however, it tripped at the prescribed level

Conclusions: Since the GFCI test button functioned regardless of the generator's grounding property, GFCI test buttons cannot and should not be used to test the effectiveness of GFCIs as personnel protection or the grounding of portable generators The test button should only be used to test GFCIs after grounding has been established.

Portable generators with established ground must be treated the same way as any grounded utility system Workers must be protected by GFCIs to prevent electrocution by ground fault Ground should be established and verified only by competent workers trained to do so and using specialized instruments. Generators with established ground allow a GFCI mounted at the generator outlet to work effectively when there is a current leak, the current goes to ground to complete the circuit. This creates an imbalance, causing the GFCI to trip When generators with established ground are being used, GFCIs should be located closest to the generator, protecting all workers from ground faults, not just the generator user. Construction people complain that GFCIs trip unnecessarily, especially with extension cords As a result, personnel often consider GFCIs a nuisance and don't use them But GFCIs trip for a reason. These trips should be treated as a warning that there is a ground fault in the system When a GFCI trips, tools, cords, and plugs should be inspected for defects and, where necessary, replaced before work continues. When the electrical system does not have reference to ground, GFCIs mounted on the generator do not work With one fault, not enough current leaks to ground to be considered a hazard Thus, in a floating-neutral circuit, workers are not endangered by electrocution from current going to ground as long as there is only ONE fault in the system However, with two faults in the system, one on the neutral and one on the hot side, it is possible that the floating-neutral system can become grounded In that case, workers without properly located GFCIs can be electrocuted Two faults can be produced by a defective generator, poorly insulated or defective extension cord, defective tool, or defective plug, to name just a few causes Other conditions such as wet ground, rain, or high humidity can increase the risk that the electrical system will become grounded.

Testing showed that in a two-fault system, the placement of the GFCI is critical The GFCI must be placed between the two faults in order to function Since the likely locations for faults are tool cord, tool plug, and extension cord, the GFCI should be placed closest to the tool.

Last but not least, the hazards of electrocution can be minimized by using only double-insulated tools in good working order and well-insulated cords.

Panel Meeting Action: Reject

Panel Statement: CMP 13 has taken this action to address safety concerns but recognizes that alternate solutions to the product standard, UL 2201, should be developed to address these issues.

Number Eligible to Vote: 21

Ballot Results: Affirmative: 17 Negative: 4

Explanation of Negative:

BOX, K.: See my explanation of negative vote on Comment 13-11.

BROWN, J.: This comment should have been accepted since the acceptance of Proposal 13-19 can introduce an additional electrical shock hazard that currently does not exist with floating neutral generators.

CZARNECKI, N.: The original proposal seeks to add GFCI protection to all 125v generator outlets without any substantiation that an issue exists at all levels. In order to establish a functional GFCI configuration on the generator, the generator is forced to be of the bonded neutral variety. Therefore, the original proposal would have the effect of eliminating floating neutral generators used to power structures, non-separately derived standby systems, and transfer switches for non-separately derived systems. Eliminating such equipment will not enhance safety, but obsolete safe infrastructure already in place. Enhanced safety has not been accomplished and potentially compromised with users defeating the system by removing grounding connections to find a means to get power on in their home.

DEGNAN, J.: See my response to Comment 13-13.

13-13 Log #1295 NEC-P13 **Final Action: Reject**
(445.20 (New))

Submitter: Joseph Harding, Portable Generator Manufacturers Association
Comment on Proposal No: 13-19
Recommendation: This proposed new section should not be published in NEC 2014.
Substantiation: Proposal 13-19 should have been rejected since it indirectly introduces an electrical shock hazard that currently does not exist (disallowing isolated output portable
generators), and will lead to nuisance tripping of the proposed GPCI on bonded neutral portable generators and electric shock in the event of failure of the GPCI.

In the Report on Proposals, members of Code-Making Panel 13 agree that acceptance of the proposal will require all portable generators to be of the bonded neutral
type. This is because a GPCI will not function properly on an isolated output (non-bonded neutral) portable generator.

According to a recent PGMA survey, approximately 50% of all portable generators sold in the U.S. are the isolated output type, with no connection of the neutral conductor to the generator frame. Portable generators that are used in "stand alone" mode are not normally connected to a grounding electrode (as allowed in 250J4(A»). In this configuration, isolated output generators pose no risk of a shock hazard (please refer to the presentation and videos associated with this comment).

It is also the experience of the portable generator industry that there have been no reported incidents of electrical shock associated with these generators over at least the last five years for which data is readily available. Requiring the neutral conductor to be connected to the portable generator frame only serves to increase the risk of electrical shock (again please refer to the presentation and videos associated with this comment). This proposal was rejected during the 2008 and 2011 Codemaking cycles and is now being re-introduced with no additional information or evidence that it will improve the safety of portable generators without introducing unintended consequences.

Additionally, if isolated output generators are 110 longer allowed, then all generators used for backup power during power outages would need to be connected as separately derived systems. This is required because not doing so would result in the system having two points where the neutral is bonded to the grounding electrode (the main bonding jumper and the generator). The dual bonding points allow neutral current to flow on equipment bonding conductors under normal conditions, resulting in nuisance tripping of GPCIs, etc. Connecting a generator as a separately derived system requires the use of an extra pole in the transfer switch in order to switch the neutral conductor. According to industry sources, 99% or more of portable generators used for home backup power are connected as non-separately derived systems by using single or dual pole transfer switches. If this proposal is accepted, it will then force those owners who subsequently replace their portable generator to also replace their current transfer switch at considerable expense and without any real-world safety benefit. If the owner chooses to operate a new portable generator with the existing transfer switch, the system will not be in compliance with the NEC. Considering the significant expense of replacing a transfer switch, it is the belief of PGMA members that some owners would then attempt to modiJY their new generator or their existing transfer switch and this would then pose significant safety risks where one would not otherwise exist. It is finally noted that the Code currently has a provision for connecting generators as non-separately derived systems (250.30 Informational Note 1).

In the case of bonded neutral generators, the requirement for integral OPCI on the portable generator will lead to nuisance tripping and unintended consequences. It has already been the experience of the portable generator industry that users attempt to bypass the GPCl with the associated risk of also bypassing other systems such as overcurrent protection devices, etc.

PGMA members represent a significant majority of the portable generator industry. OUf member companies include:

- American Honda Motor Co.
- Briggs &. Stratton Home Power Products
- Champion Power Equipment
- Generac Power Systems
- Pramac America
- Subaru Industrial Power
- Techtronic Industries North America
- Wacker NeusonProduction
- Yamaha Motor Corp USA

Panel Meeting Action: Reject

Panel Statement: CMP 13 has taken this action to address safety concerns but recognizes that alternate solutions to the product standard, UL 2201, should be developed to address these issues.

Number Eligible to Vote: 21

Ballot Results: Affirmative: 17 Negative: 4

Explanation of Negative:

BOX, K.: See my explanation of negative vote on Comment 13-11.

BROWN, J.: This comment should have been accepted since the acceptance of Proposal 13-19 can introduce an additional electrical shock hazard that currently does not exist with floating neutral generators.

CZARNECKI, N.: The original proposal seeks to add GFCI protection to all 125v generator outlets without any substantiation that an issue exists at all levels. In order to establish a functional GFCI configuration on the generator, the generator is forced to be of the bonded neutral variety. Therefore, the original proposal would have the effect of eliminating floating neutral generators used to power structures, non-separately derived standby systems, and transfer switches for non-separately derived systems. Eliminating such equipment will not enhance safety, but obsolete safe infrastructure already in place. Enhanced safety has not been accomplished and potentially compromised with users defeating the system by removing grounding connections to find a means to get power on in their home.

DEGNAN, J.: The submitter's substantiation for adding GFCI's to portable generators does not contain any statistical data to verify that the identified safety issues have actually resulted in injury or death. In opposition, PGMA identifies that mandating bonded neutral generators and GC
I receptacles is likely to create other safety issues that could result in injury or death. The general public is likely to recognize if a portable generator does or does not have GFCIs and understand the consequences. The general public is much less likely to understand the requirements for correctly connecting portable generators to a grounding electrode and the hazards of sharing neutral currents between the interconnection of two bonded systems. This requirement appears to solve a problem that doesn't exist and is likely to create an unwanted hazard.
Panel members that support the addition of this code requirements should address each item of the submitter's concerns in their comments.

13-14 Log #1301 NEC-P13 **Final Action: Reject**
(445.20)

Submitter: James Jongkind, American Honda Motor Co., Inc.
Comment on Proposal No: 13-19
Recommendation: Please reject the proposal.
Substantiation: This proposal is as unnecessary today as it was in the 2011 code cycle where it was rejected due to lack of consensus. Being that no new information or data to support such a requirement has been provided, I encourage you to vote to reject the proposal. I Most of the portable generators that Honda has sold for the past 40 years are of the floating neutral design (without GFCl) and are used safely everyday by millions of consumers. To require that all newly produced portable generators be equipped with GFCI is unjustified by the lack of incident data and would result in added complexity with potentially increased risk should the GFCI fail. The output on these floating neutral generators is isolated so there is no path back to the source through which users can be shocked. This is a well established and proven safety strategy for this type of product and should not be arbitrarily replaced with a much less ideal system that introduces a shock hazard (bonding) and the installation of a device (GFCI) that can fail to protect against it.
Panel Meeting Action: Reject
Panel Statement: CMP 13 has taken this action to address safety concerns but recognizes that alternate solutions to the product standard, UL 2201, should be developed to address these issues.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 17 Negative: 4
Explanation of Negative:

BOX, K.: See my explanation of negative vote on Comment 13-11.

BROWN, J.: This comment should have been accepted since the acceptance of Proposal 13-19 can introduce an additional electrical shock hazard that currently does not exist with floating neutral generators.

CZARNECKI, N.: The original proposal seeks to add GFCI protection to all 125v generator outlets without any substantiation that an issue exists at all levels. In order to establish a functional GFCI configuration on the generator, the generator is forced to be of the bonded neutral variety. Therefore, the original proposal would have the effect of eliminating floating neutral generators used to power structures, non-separately derived standby systems, and transfer switches for non-separately derived systems. Eliminating such equipment will not enhance safety, but obsolete safe infrastructure already in place. Enhanced safety has not been accomplished and potentially compromised with users defeating the system by removing grounding connections to find a means to get power on in their home.

DEGNAN, J.: See my response to Comment 13-13.

13-15 Log #1386 NEC-P13 **Final Action: Reject**
(445.20 (New))

Submitter: Greg Marchand, Briggs & Stratton
Comment on Proposal No: 13-19
Recommendation: This proposed new section should not be published in the NEC 2014.
Substantiation: As far back as our records are available there are no reported injuries that a GFCI would have prevented, this appears to be a solution looking for a problem.

We are in full support of the more complete substantiation presented by the Portable Generator Manufacturers Association authored by Joseph Harding and John Loud of Exponent, Inc.
Panel Meeting Action: Reject
Panel Statement: CMP 13 has taken this action to address safety concerns but recognizes that alternate solutions to the product standard, UL 2201, should be developed to address these issues.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 17 Negative: 4
Explanation of Negative:

BOX, K.: See my explanation of negative vote on Comment 13-11.

BROWN, J.: This comment should have been accepted since the acceptance of Proposal 13-19 can introduce an additional electrical shock hazard that currently does not exist with floating neutral generators.

CZARNECKI, N.: The original proposal seeks to add GFCI protection to all 125v generator outlets without any substantiation that an issue exists at all levels. In order to establish a functional GFCI configuration on the generator, the generator is forced to be of the bonded neutral variety. Therefore, the original proposal would have the effect of eliminating floating neutral generators used to power structures, non-separately derived standby systems, and transfer switches for non-separately derived systems. Eliminating such equipment will not enhance safety, but obsolete safe infrastructure already in place. Enhanced safety has not been accomplished and potentially compromised with users defeating the system by removing grounding connections to find a means to get power on in their home.

DEGNAN, J.: See my response to Comment 13-13.

13-16 Log #1465 NEC-P13 **Final Action: Accept in Principle**
(445.20)

TCC Action: The Correlating Committee directs that the Panel Action on Comment 13-16 be reported as "Accept in Principle" and the text revised as follows to comply with the NEC Style Manual and for editorial revisions to the punctuation:
"445.20 Ground-Fault Circuit Interrupter Protection for Receptacles on 15 kW or Smaller, Portable Generators.
All 125-volt, single-phase, 15-and 20 ampere receptacle outlets, that are a part of a 15 kW or smaller, portable generator, either shall have ground-fault circuit interrupter protection for personnel integral to the generator or receptacle, or shall not be available for use when the 125/250 volt locking-type receptacle is in use. If the generator does not have a 125/250 volt locking-type receptacle, this requirement shall not apply"
Submitter: Michael O. Flegel, Reliance Controls Corporation
Comment on Proposal No: 13-1
Recommendation: Revise text to read as follows:

445.20 (New) Ground-Fault Circuit Interrupter Protection for Receptacles on 15 kW or Smaller, Portable Generators. All 125-volt, single-phase, 15-and 20~~-, and 30~~-ampere receptacle outlets, that are a part of a 15 kW or smaller, portable generator, either shall have ground-fault circuit interrupter protection for personnel integral to the generator or receptacle or shall not be allowed to be available for use when the 125/250 volt locking receptacle is in use. If the generator does not have a 125/250 volt locking receptacle, then this requirement does not apply.
Substantiation: GFCI protection is not necessary on systems that are not grounded for the reasons given in my comment to reject this proposal. However, when the generator is connected to a premises wiring system, whether it is has a floating or bonded neutral, it becomes part of a bonded and grounded system. This has not been a safety problem because nobody uses the duplex receptacles when powering their house because they want as much power to the house as possible through the locking 125/250 volt receptacle which is the one they use to power their house. If the panel is still concerned, then protecting the duplex receptacles with a GFCI is one way to improve the situation but is not the only way. The generator could be built with a simple system to make the duplex receptacles unavailable when the 125/250 volt locking receptacle is being used. This would be more effective and economical than GFCI protection. If the panel is going to force a change in the design of a portable generator, the panel should allow the manufacturers the freedom to create better solutions. They are the ones that are familiar with the applications and will ultimately be responsible for product liability, not the code making panel.

I have eliminated the GFCI protection on the 30A-125V receptacles because there are 125 volt generators up to 3000 watts that use a 30A locking receptacle. These are used primarily for camping and are floating neutral generators. They already have protection from ground faults. Since all premises wiring is 125/250 volts, these generators are not generally used for home standby power and never become part of a bonded and grounded system.
Panel Meeting Action: Accept
Panel Statement: CMP 13 does not agree with all of the submitter's substantiation.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21
Comment on Affirmative:

DEGNAN, J.: The revised text alleviates some fo the concerns identified in comment 13-13.

ODE, M.: This Comment should have been an accept in principle by adding a comma after "receptacle" and before "or shall not" and delete the text "allowed to be" as redundant, and replace the word "does" with the word "shall in the final sentence to comply with the NEC Style Manual:
445.20 (New) Ground-Fault Circuit Interrupter Protection for Receptacles on 15 kW or Smaller, Portable Generators.

All 125-volt, single-phase, 15-and 20-ampere receptacle outlets, that are a part of a 15 kW or smaller, portable generator, either shall have ground-fault circuit interrupter protection for personnel integral to the generator or receptacle, or shall not be ~~allowed to be~~ available for use when the 125/250 volt locking receptacle is in use. If the generator does not have a 125/250 volt locking receptacle, then this requirement ~~does~~ shall not apply.

13-17 Log #1466 NEC-P13 **Final Action: Reject**
(445.20)

Submitter: Michael O. Flegel, Reliance Controls Corporation
Comment on Proposal No: 13-19
Recommendation: Reject the proposal.
Substantiation: Statement of Problems

1. It is impossible to have a ground fault back to the generator if it is not bonded and grounded so GFCI protection on the generator doesn't make sense since no requirement exists for bonding and grounding. In complex systems and in harsh environments, neutrals can be pulled to ground beyond the generator. GFCI protection on generators that are not bonded and grounded does not protect people against these ground faults but they will believe it does. This will encourage bad safety practices and/or discourage people from taking further steps to protect themselves against ground faults.

2. The bonding and grounding needed in Comment 1 will create ground fault hazards. Why intentionally create a hazard and then have to add a device to protect against it? Especially when the added device is an electronic device on a piece of hot, vibrating equipment which adds to the likelihood of its failure. It makes more sense to float the system. A floating neutral portable generator without GFCI protection is safer than a bonded neutral portable generator with GFCI protection in stand alone applications even if the latter is properly grounded. There is no need to have GFCI protection built into a floating neutral generator.

3. Article 90.2 of the National Electrical Code states that the Code only covers the installation of electrical conductors, equipment, and raceways, etc. It does not cover the design of equipment such as having GFCI protection built into a portable generator. The Code can and does address the following installation aspects of a portable generator:

a. Adding downstream GFCI protection - Article 590 (2008)

b. Bonded or not bonded – There are several sections addressing Separately and Non-separately derived systems

c. Receptacles connected to the frame – Article 250.34

In each case the Code does not dictate that the generator has these design features but rather it instructs on how to install it when a generator has these features. The NEC does not develop product standards for the equipment that is installed. The NEC can specify how to install a bonded neutral generator with GFCI protection, or a floating neutral generator without GFCI protection but it shouldn't require that the generator have the protection built in.

4. The proposal has not substantiated a safety problem; it just incorrectly states there is one. GFCI protection on the generator would ensure that people would use it but is only effective if people properly bond and ground the generator and is not as effective as other alternatives as stated above in Comments 1 and 2. If you don't electrify the ground by tying the neutral of the generator to it, you have no ground path for a ground fault to occur. People are safer in all the conditions stated in the substantiation of the proposal with a floating neutral generator without GFCI protection.

Does the panel have information that the current safety record isn't due to the fact that very few portable generators are grounded and many of them 5kW and less are floating neutral generators? Are you sure adding GFCI protection will make things better and not worse? Isolation is a powerful safety device and should not be ignored. Has somebody provided data to show that what is being done now is not safe?

Bonding and Grounding – Utility vs. Portable Generators

OSHA requires bonded neutral generators in their regulations for construction sites. In reading these regulations, they appear to be identical to the NEC requirements except for this bonding requirement. The interpretation in Appendix A explains their position. To completely understand OSHA's response, please read the request letter by Mr. Iwasa. It appears OSHA incorrectly interprets the NEC. OSHA says a generator in stand-alone use is a separately derived system (see Article 100) and as such needs to be bonded. However, the NEC definition of a separately derived system says it is a premises wiring system. A generator in stand-alone use is not a premises wiring system so it is not separately derived. Please note the interpretation does not have any safety arguments other than misinterpreting the NEC which leaves it with no technical merit. As such it has no relevance in this discussion.

Generators used in simple stand-alone applications, operate in a much different environment than a premises wiring system being feed from the utility. There is no huge generator capable of outputting high fault current, no transformers and switchgear, and no large, elevated distribution system subject to lightning strikes all of which can create surges in the system. Such surges must be addressed through bonding and grounding rather than having them go through appliances and endanger safety. The reason for bonding and grounding is substantially reduced when utility power is removed. As a matter of fact, Article 250 agrees and does not require a ground connection to earth for a generator in stand-alone applications. This allows a floating system using either floating neutral generators or bonded-neutral generators that are not grounded.

Bonding and grounding have some pitfalls that are tolerated in order to get the desired protection described above from utility systems. A bonded and grounded system creates numerous pathways for current to flow back to the power source. These include the ground, and any metal object connected to the ground such as plumbing fixtures and pipes and heating ducts. If someone comes in contact with a hot wire from the power source and one of these objects, the circuit is completed with disastrous results to the individual. In fact, people did realize that these pitfalls created very dangerous situations for premises wiring systems. Products and systems were developed to mitigate the safety risks. Grounding wires were added to appliance plugs and grounding terminals were added to receptacles so that a hot wire faulting to the case of an appliance would cause a short, tripping the circuit breaker. This protected the user in case he touched the case and one of the extensive return paths to the power source created by bonding and grounding the system. The GFCI was invented to interrupt the current flow when the current out of a receptacle isn't the same amount as the returning current. If it isn't returning through the receptacle, then it probably is returning through a person that is touching one of those many objects that have a path back to the power source, again, as a result of bonding and grounding the system.

Why create a more dangerous situation by connecting multiple objects to a return path back to the source if there are no advantages in doing so? Stand-alone portable generator applications provide excellent opportunity to do just that. Some people would argue that the devices used to protect people in bonded and grounded systems no longer would work in a floating situation. **This is true but they fail to understand they are not necessary.** The circuit breaker tripping in the fault-to-case example above and the GFCI protection are two of the safety devices in bonded and grounded systems mentioned earlier. In a floating system, the fault to the case represents only a connection of the person to one wire from the source. Because there is no path back to the source, the individual holding the tool is not injured. Similarly, a GFCI would never trip because there is never a ground path available back to the generator i.e. a ground fault can never occur back to the source. **This truly is a paradigm shift in the way we think about electrical systems and it is important for people to understand they have to look at portable generator applications differently.**

Stand Alone Installations

For the casual user such as a camper or home owner working in the back yard, the floating neutral generator is the safest and most cost effective application that does not require additional ground fault protection using GFCIs. Multipoint failures are extremely unlikely to occur but what if they do? **The floating system without GFCI protection still seems to be the safer of the two alternatives as shown in Appendix B.** GFCI protection is needed on a bonded neutral generator that is properly grounded but grounding the generator is unlikely since the NEC does not require it. If not grounded, the protection is unnecessary on the generator because you have a system that does not intentionally create any paths back to the source. However, it is more likely that the neutral in a bonded neutral generator is pulled to ground at the source since the frame is already bonded to the neutral. The solution to that is not to connect the neutral to the frame which results in the floating neutral generator. Look at the electrical safety record for portable generators. If the record is good, then please understand the elements that contribute to that record BEFORE you make changes that you think will improve safety but, in fact, will decrease safety. The fact that the presence of a GCFI on the generator will give people the impression they are safe when they may not be is a bad idea.

Premises Wiring Installations

When the generator is connected to a premises wiring system, whether it is has a floating or bonded neutral, it becomes part of a bonded and grounded system. This has not been a safety problem because nobody uses the duplex receptacles when powering their house because they want as much power to the house as possible through the locking 125/250 volt receptacle. That is why they use it to power their house. There is no data to support this is an unsafe condition.

Portable generators are unique because they can be used in different applications. They are portable and are cord connected the same as any appliance but they supply power instead of use power. They are delivered as a finished product and have the same product liability to the manufacturers as appliances yet the code making panel feels the need to dictate what features are built into a portable generator rather than telling people how to install them. I believe this is outside the scope of the NEC and that the generator should be covered by a product standard that involves the generator manufacturers and other interested parties. Such a group already exists, STP2201, and they continually raise the red flag that this proposal doesn't make sense for all applications. UL has a mission to get what they want from the STP (they are upset they only get one vote on the STP) and is attempting to use the code making process to suit them.

Panel Meeting Action: Reject

Panel Statement: CMP 13 has taken this action to address safety concerns but recognizes that alternate solutions to the product standard, UL 2201, should be developed to address these issues.

Number Eligible to Vote: 21

Ballot Results: Affirmative: 17 Negative: 4

Explanation of Negative:

BOX, K.: See my explanation of negative vote on Comment 13-11.

BROWN, J.: This comment should have been accepted since the acceptance of Proposal 13-19 can introduce an additional electrical shock hazard that currently does not exist with floating neutral generators.

CZARNECKI, N.: The original proposal seeks to add GFCI protection to all 125v generator outlets without any substantiation that an issue exists at all levels. In order to establish a functional GFCI configuration on the generator, the generator is forced to be of the bonded neutral variety. Therefore, the original proposal would have the effect of eliminating floating neutral generators used to power structures, non-separately derived standby systems, and transfer switches for non-separately derived systems. Eliminating such equipment will not enhance safety, but obsolete safe infrastructure already in place. Enhanced safety has not been accomplished and potentially compromised with users defeating the system by removing grounding connections to find a means to get power on in their home.

DEGNAN, J.: See my response to Comment 13-13. Panel members that support the addition of this code requirements should address each item of the submitter's concerns in their comments.

13-18 Log #1483 NEC-P13 **Final Action: Reject**
(445.20)

Submitter: Richard Torine, BR Forbes
Comment on Proposal No: 13-19
Recommendation: Delete text to read as follows:

~~Ground-fault circuit interrupter protection for receptacles on 15 kW or smaller, portable generators. All 125-volt, single-phase, 15-20, and 30 ampere receptacle outlets, that are part of a 15 kW or smaller portable generator, shall have ground-fault circuit interrupter protections for personnel integral to the generator or receptacle.~~

Substantiation: The substantiation for this proposal points out that the TCC rejected a similar proposal in the 2011 code cycle due to a lack of consensus. This new proposal is virtually the same and does nothing to address the real problems associated with placing GFCls on portable generators, including:

1. A GFCI will not operate at all on a floating neutral generator. It is impossible for a ground fault to occur when the neutral is not bonded to the generator ground.

2. Even when the neutral is bonded to the generator ground, a GFCI will not operate properly unless the generator is solidly connected to earth ground. The NEC does not require grounding of a generator frame and this is seldom done in practice, especially on camping trips and during natural disasters as described in the substantiation.

Nothing has changed in the last three years. Portable generators continue to be available with and without GFCI protection, and the user can choose which is right for his or her application. It should remain this way.

There is no data that shows that the current practice is in any way unsafe.

Panel Meeting Action: Reject
Panel Statement: CMP 13 has taken this action to address safety concerns but recognizes that alternate solutions to the product standard, UL 2201, should be developed to address these issues.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 17 Negative: 4
Explanation of Negative:

BOX, K.: See my explanation of negative vote on Comment 13-11.

BROWN, J.: This comment should have been accepted since the acceptance of Proposal 13-19 can introduce an additional electrical shock hazard that currently does not exist with floating neutral generators.

CZARNECKI, N.: The original proposal seeks to add GFCI protection to all 125v generator outlets without any substantiation that an issue exists at all levels. In order to establish a functional GFCI configuration on the generator, the generator is forced to be of the bonded neutral variety. Therefore, the original proposal would have the effect of eliminating floating neutral generators used to power structures, non-separately derived standby systems, and transfer switches for non-separately derived systems. Eliminating such equipment will not enhance safety, but obsolete safe infrastructure already in place. Enhanced safety has not been accomplished and potentially compromised with users defeating the system by removing grounding connections to find a means to get power on in their home.

DEGNAN, J.: See my response to Comment 13-13.

ARTICLE 450 — TRANSFORMERS AND TRANSFORMER VAULTS (INCLUDING SECONDARY TIES)

9-70 Log #734 NEC-P09 **Final Action: Accept**
(450)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 9-135
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:

FERRARO, J.: It is recognized that increasing voltage from 600 volts to 1000 volts may be applicable to specific installations. However, adequate technical substantiation has not been provided to support the change in this Article.

9-71 Log #1258 NEC-P09 **Final Action: Reject**
(450)

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 9-135
Recommendation: I ask the panel to reject this proposal. The proposal would change 600 volts to 1000 volts.
Substantiation: Replacing 600 volts with 1000 volts will have a major impact on installers, component manufacturers, and industry standards. Increased spacing must be considered when going from 600 volts to 1000 volts. Personal safety must also be considered.
Because the proposer has not provided enough information to the public to justify and understand all the ramifications of the proposal, the committee should reject the submitter's proposal.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 9-68.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:

FERRARO, J.: It is recognized that increasing voltage from 600 volts to 1000 volts may be applicable to specific installations. However, adequate technical substantiation has not been provided to support the change in this Article.

9-71a Log #839 NEC-P09 **Final Action: Reject**
(450.3 (New))

Submitter: Gaylan Bishop, The University of North Carolina - Chapter Hill
Comment on Proposal No: 9-136
Recommendation: It may come as a surprise to users of the NEC that the NEC does not contain any straightforward guidance on specifying the kVA-rating of transformers even though the kVA rating of a transformer determines the ampere-rating of everything downstream from it. Thus, we would like to modify our original approach in Proposal 9-136 by taking the recommendation of the only vote in support of our original proposal (cast by B. Breitkreutz) and submit for the committee's consideration the following language:
<u>**(NEW) 450.15. Capacity**. Transformer load, ampacity, rated KVA, and capacity shall be permitted to be determined by a licensed professional engineer considering load demand factor appropriate for the application and ambient temperature.</u>
Substantiation: The University of North Carolina supports the effort by the education facilities industry, represented by APPA.ORG's Standards Council, to bring the 2014 NEC in step with rapidly evolving energy codes by reducing the amount of energy brought into building. Most transformers in the United States are underloaded (as shown by the significant quantity of data presented to NEC committees by our industry during the proposal stage) and this over-sizing is a significant safety hazard, and it wastes material and energy.
The committee's own statement: <u>Load and transformer size may not directly correlate</u>" confirms the crux of the safety problem and its statement in related proposal 9-155 acknowledges correlation problems between Chapter 2 and Chapter 4. We believe the language we propose, allowing a professional engineer to make case-by-case judgments to the same degree that Authorities Having Jurisdiction are permitted to use their professional judgment, is an acceptable, near-term resolution to the safety and waste problems originating in Article 220 prescriptive requirements.
Panel Meeting Action: Reject
Panel Statement: The panel reaffirms its original statement in rejection of pProposal 9-136.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:
BREITKREUTZ, B.: Panel action should be to accept. The code should be amended to add permissive language for transformer sizing. Now, the code has no information at all about transformer sizing and some users are wrongly assuming that transformers must be sized per the same rules as for conductors. Transformers have a kVA rating based on 24 hour average temperature and should be sized based on 24 hour average load.

9-72 Log #1298 NEC-P09 **Final Action: Accept in Principle**
(450.5)

Submitter: Tony Hoevenaars, Mirus International Inc.
Comment on Proposal No: 9-142
Recommendation: I submitted an earlier proposal for this Section and received initial comment that it has been rejected for the following reason. *CMP 9 requires additional information to evaluate the technical merits of the proposal. If the submitter provides data as part of a public comment, CMP 9 will create a task group to further review available information prior to the meeting all public comments. The Panel is concerned that this requirement may create an opportunity for a proprietary product and the panel is concerned this may violate the NFPA Patent Policy. The submitter should provide information to NFPA that indicates that the NFPA Patent Policy is not violated.* For my response to this, please see Item 5 below.
Substantiation: I provided quite a bit of background information with my original submission and have expanded on it for resubmission. I hope that this provides the information required to complete the technical assessment on the merits of the proposal. In addition, I am prepared to present at the next ROC Meeting in San Diego if that is possible. As for the issue with the NFPA Patent Policy, I have reviewed the policy and I do not believe that it would be violated. I understand why the NEC cannot mandate the use of a patented product but I do not see why it should exclude the use of a patented product if it is only one possible way of meeting the code requirement. My proposal does not restrict the use of any methods for complying. It simply allows the use of another approach that is equally as safe and would allow savings in energy among other benefits. Surely that is not a violation of the Patent Policy.
Note: Supporting Material is available for review at NFPA headquarters.
Panel Meeting Action: Accept in Principle
Accept the original Proposal 9-142 reworded as follows:
Exception: An auto transformer with a wye configuration on its line side and a zigzag configuration on its load side that does not permit neutral or ground-fault current to return over the line connection shall be permitted on the load side of a system grounding connection. This exception shall not apply to a connection made from a high resistance grounded system applied in accordance with 250.36.
Panel Statement: CMP 9 agrees that the concept has merit, but is unwilling to apply it to high resistance grounded systems without further investigation relative to whether it would impair the functionality of such systems. CMP 9 does not want to place specific impedance percentages in the NEC, nor use the word "special" because it could unreasonable restrict free application of the concept. This wording meets the objectives of the submitter. CMP 9 notes that the comment was not in correct form, but has decided to continue to act on the technical merit of the concept.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.
Comment on Affirmative:
BREITKREUTZ, B.: I agree with the panel action to add the exception as stated but am not convinced that the transformers presented by Mr. Hoevenaars will actually meet that exception.
HARTWELL, F.: CMP 9 understood the comment as requesting that the underlying proposal be accepted, and acted on the technical merits accordingly. The proposal submitter was in the room and made a technical presentation on the topic, so there was no doubt as to the intent. Note that the underlying proposal was a companion proposal to one offered in 210.9 by the same submitter. Although the submitter is highly qualified in terms of electrical design, the overall approach should have included a better understanding of the NEC. For example, it became clear in a conversation with this voter that the usual application involved to supply of a panelboard in a data center. As such, the usual companion application was to a feeder, necessitating an amendment to 215.11, and the proposal to 210.9 is largely irrelevant. Unfortunately this cannot be entertained at this point, other than through the TIA process.

9-73 Log #1206 NEC-P09 **Final Action: Accept**
(450.11)

Submitter: Leo F. Martin, Sr., Martin Electrical Consulting
Comment on Proposal No: 9-145
Recommendation: Continue to accept in principle.
Substantiation: Source marking. Requiring the manufacturer to provide installation requirements will enhance electrical safety.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-74 Log #474 NEC-P09 **Final Action: Accept in Principle**
(450.21, Informational Note)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 9-150
Recommendation: Revise ASTM E119-2011a to read ASTM E119-2012.
Substantiation: Date update of ASTM E119 standard.
Panel Meeting Action: Accept in Principle
Revise ASTM E119-2011a to read ASTM E119-12a.
Panel Statement: The panel modified the comment to reflect the correct designation.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-75 Log #598 NEC-P09 **Final Action: Accept**
(450.21(A))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 9-135
Recommendation: Revise text to read as follows:
450.21 Dry-Type Transformers Installed Indoors.(A) Not over 112-½ kVA.
Exception: This rule shall not apply to transformers rated for 1000 volts, nominal, or less that are completely enclosed~~, with or without~~ <u>except for</u> ventilating openings.
Substantiation: The new text does not parallel the text in:
450.21 Dry-Type Transformers Installed Indoors.
(B) Over 112-½kVA.
Exception No. 2: Transformers with Class 155 or higher insulation systems and completely enclosed except for ventilating openings.
And in:
450.22 Dry-Type Transformers Installed Outdoors.
Dry-type transformers installed outdoors shall have a weatherproof enclosure. Transformers exceeding 112-½kVA shall not be located within 300 mm (12 in.) of combustible materials of buildings unless the transformer has Class 155 insulation systems or higher and is completely enclosed except for ventilating openings.
Using the same text for the same meaning reduces confusion.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-76 Log #475 NEC-P09 **Final Action: Accept in Principle**
(450.42, Informational Note)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 9-152
Recommendation: Revise ASTM E119-2011a to read ASTM E119-2012.
Substantiation: Date update of ASTM E119 standard.
Panel Meeting Action: Accept in Principle
Revise ASTM E119-2011a to read ASTM E119-12a.
Panel Statement: The panel modified the comment to reflect the correct designation.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

ARTICLE 455 — PHASE CONVERTERS

13-19 Log #1452 NEC-P13 **Final Action: Reject**
(455.5)

Submitter: Arnoldo L. Rodriguez, American Chemistry Council
Comment on Proposal No: 13-20
Recommendation: Replace the phrase "equipment grounding conductor" with the phrase "Equipment bonding conductor" in the Article 455.5.
Substantiation: Proposal 13-20 should have been approved. Grounding electrode conductors are the connection to the earth and accomplish grounding. In the present NEC, Equipment Grounding Conductors and bonding jumpers provide a "path back" to the source. Both are always performing a bonding function. If the Grounding Electrode connection is removed or broken, the bonding function remains intact.
Section 250.4 does not permit the earth (ground) to be used as an effective ground fault current path but the term equipment grounding conductor inherently incorrectly contains the word "ground".
Visualize equipment supplied by a portable generator. The generator frame is not required to be connected to the earth.
The "green" wire in the flexible cord is not performing a grounding function but is performing a bonding function.
Visualize building one supplied by a service, having the grounded conductor connected to the grounding electrode system by a grounding electrode conductor. A feeder supplies a second building and a grounding electrode conductor is required for grounding any equipment in the second building. An equipment grounding conductor is required to be installed from building 1 to building 2. Not for grounding, but for bonding, providing an effective fault current path.
Making this change has the added benefit of being more harmonized with other international standards and usage of terminology.
Experienced NEC users have to ignore other concepts in other definitions and requirements to use the existing term.
This does not help the future NEC user or provide clarity in the existing NEC. Changing the term is the right thing to do and should be supported.
Panel Meeting Action: Reject
Panel Statement: This issue was addressed in great detail in the 2005 NEC revision cycle. These terms are well understood. There is no confusion.
The Correlating Committee (CC) should carefully review actions on this issue across all committees. Any action to change these long standing, well understood terms would create confusion.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 19 Negative: 2
Explanation of Negative:
RODRIGUEZ, A.: It is understood that this item was discussed in past NEC cycles. This comment should have been approved by the committee because it is our (ACC) belief that the term "equipment grounding conductor" is confusing to new and experienced users.
SPINA, M.: The panel should accept the original proposal. The Panel is incorrect in stating that this change will add confusion. The proposed language improves the technical accuracy of the use of the terms "equipment grounding conductor" and "equipment bonding conductor" and will reduce the confusion. The IEEE has reviewed all the statements on this subject by various panels. The following represents the IEEE position on the issue of equipment grounding conductor or equipment bonding conductor. There is no justification for retaining an incorrect and potentially hazardous electrical installation just because this definition has been used in the NEC for many years. Not all electrical practitioners are knowledgeable in the main intent of this conductor. The intent of the proposed change is to provide a descriptive name to a construction element that has resulted in much misunderstanding with possible hazardous operating conditions in electrical installations. The use of the term "grounding" implies that grounding is its principal function. Although grounding may be desirable, providing an effective fault current path (i.e. bonding) is and should be the emphasis. There are many who assert that a connection to a water pipe meets the needs of equipment grounding, however, this connection does not perform the necessary effective fault current path back to the source. There are two conductors described in the Code performing the same function but named differently. The "bonding jumper" is a short conductor that insures the electrical integrity of enclosure to raceway. The longer conductor, intended to provide a low impedance path to the source, is presently named a "grounding" conductor instead of its real function as a "bonding" conductor. Technically, the definition in Article 100 may be adequate for Panel members and those that teach. Practically, the definition is confusing if the terminology does not fit the function performed. The equipment bonding conductor, as it should be called, provides its primary function whether or not it is grounded. For a grounded system, it is grounded because the system is grounded. For an ungrounded system, it is grounded to limit the voltage due to a lightning strike or contact with a higher voltage system. Changing the name will assist in educating users of the Code as to why they are installing a conductor that needs to be continuous all of the way back to the source.

ARTICLE 460 — CAPACITORS

11-35 Log #744 NEC-P11 **Final Action: Accept**
(460, Part I)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 11-93
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.
The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.
The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.
Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.
Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.
If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
COLE, T.: See comment on 11-6.

11-36 Log #745 NEC-P11 **Final Action: Accept**
(460, Part II)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 11-94
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
COLE, T.: See comment on 11-6.

ARTICLE 470 — RESISTORS AND REACTORS

11-37 Log #746 NEC-P11 **Final Action: Accept**
(470, Part I)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 11-96
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
COLE, T.: See comment on 11-6.

11-38 Log #747 NEC-P11 **Final Action: Accept**
(470, Part II)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 11-98
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

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Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
COLE, T.: See comment on 11-6.

ARTICLE 480 — STORAGE BATTERIES

13-20 Log #536 NEC-P13 **Final Action: Hold**
(480.2)

TCC Action: The Correlating Committee directs that the panel action be reported as "Hold" because this comment contains new material that has not received public review.
Submitter: James E. Brunssen, Telecordia Technologies Inc. / Rep. Alliance for Telecommunications Industry Solutions (ATIS)
Comment on Proposal No: 13-33
Recommendation: Add the following definition to 480.2: "**Prime Mover.** A machine that transforms potential energy, such as electrical or thermal, to mechanical energy, typically an engine, turbine or electric motor."
Substantiation: The term "prime mover" is used in 480.5 as well as numerous other Articles in the NEC without definition. The term should be defined per the NEC Style Manual, Section 2.2.2.1.
Panel Meeting Action: Reject
Panel Statement: The definition of prime mover is technically incorrect. This comment contains new material that has not received public review.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-21 Log #857 NEC-P13 **Final Action: Accept in Principle**
(480.5)

Submitter: Stephen McCluer, Schneider Electric / Rep. IEEE Stationary Battery Committee
Comment on Proposal No: 13-33
Recommendation: Add text to read as follows:
480.5 DC Disconnect Methods
(A) Disconnecting Means. A disconnecting means shall be provided for all ungrounded conductors derived from a stationary battery system with a nominal voltage over 50 volts. A disconnecting means shall be readily accessible and located within sight of the battery system.
(B) Remote Actuation. Where controls to activate the disconnecting means of a battery are not located within sight of a stationary battery system, the disconnecting means shall be capable of being locked in the open position and the location of the controls shall be field marked on the disconnecting means.
(C) Busway. Where a DC busway system is installed, the disconnecting means shall be permitted to be incorporated into the busway.
(D) Notification. A label shall be installed on or adjacent to the disconnect containing the maximum available short circuit current. The label shall be placed in a conspicuous location near the battery if a disconnect is not provided.
Informational Note: Battery equipment suppliers can provide information about short circuit current on any particular battery model.
Substantiation: We support the comment on the affirmative by Linda Little. Further modifications to this section is necessary. The above text revisions had been submitted in a proposal not acknowledged or published by NFPA staff. The text had been developed through a joint effort by the NEC Task Force of the Technical Correlating Committee and the IEEE Stationary Battery Committee.

645.10(A) requires remote activation for disconnects serving ITE rooms. The disconnect serving the ITE room must be capable of being locked open to prevent the remote actuation from occurring when it will jeopardize safety of personnel.

DC busway is common in large UPS installations in which there are multiple strings of batteries. Each cell in a string is connected in series to create the necessary dc voltage and each string has a disconnecting means &/or overcurrent protective device. The strings are connected in parallel to a common dc bus which may also have a disconnecting means. The individual string disconnects allow manual disconnecting so that maintenance can be performed on a redundant battery string while the remaining battery strings support the load. It also functions as an OCPD to prevent the energy from other strings from feeding into a faulted cell in one string. The disconnect on a DC busway system can allow for a single point of shutdown for the entire dc supply.

The stored energy in a battery system is a potential hazard to personnel maintaining the system. The labeling requirement attests this hazard and aids in determining the arc-flash protection boundary and required PPE.
Panel Meeting Action: Accept in Principle
Revise text to read as follows:
480.5 DC Disconnect Methods
(A) Disconnecting Means. A disconnecting means shall be provided for all ungrounded conductors derived from a stationary battery system with a nominal voltage over 50 volts. A disconnecting means shall be readily accessible and located within sight of the battery system.
(B) Remote Actuation. Where controls to activate the disconnecting means of a battery are not located within sight of a stationary battery system, the disconnecting means shall be capable of being locked in the open position, in accordance with 110.25, and the location of the controls shall be field marked on the disconnecting means.
(C) Busway. Where a DC busway system is installed, the disconnecting means shall be permitted to be incorporated into the busway.
(D) Notification. A label, containing the maximum available short circuit current, shall be installed on or adjacent to the disconnecting means. ~~containing the maximum available short circuit current.~~ The label shall be placed in a conspicuous location near the battery if a disconnecting means is not provided.
Informational Note: Battery equipment suppliers can provide information about short circuit current on any particular battery model.
(D) Notification. A label, containing the maximum available short circuit current, shall be installed on or adjacent to the disconnecting means. ~~containing the maximum available short circuit current.~~ The label shall be placed in a conspicuous location near the battery if a disconnecting means is not provided.
Panel Statement: This text in this comment was provided by the affirmative vote of Linda Little to Proposal 3-33 so the text has had public review. Added "ing" to "disconnect" and "means" after "disconnect" in two places in the text to make it more technically correct. The remainder of the changes in text in (D) was strictly editorial. In 480.5(B) a reference to 110.25 was added for correlation and clarity.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21
Comment on Affirmative:
LITTLE, L.: We are voting affirmative on the panel action to "Accept in Principle" comment 13-21. Comment 13-21 incorrectly lists first level subdivision (D) twice. Additionally, it is important to note for the Correlating Committee and the public that this action is modified by the panel action on comment 13-22.

13-22 Log #856 NEC-P13 **Final Action: Hold**
(480.5(A) and (B))

TCC Action: The Correlating Committee directs that the items identified in the panel action be reported as "Hold" per the panel action.
Submitter: Stephen McCluer, Schneider Electric / Rep. IEEE Stationary Battery Committee
Comment on Proposal No: 13-36
Recommendation: Accept the proposed text in principle with the following revisions:
480.5 Disconnecting Means. A disconnecting means shall be provided for all ungrounded conductors derived from a stationary battery system over nominal 50 volts.
(A) Accessibility ~~A~~ The disconnecting means shall be readily accessible to qualified personnel for inspection and maintenance and shall be located as close as practicable and within sight of the battery ~~system~~ terminals.
(B) Remote Operation Where controls to activate the disconnecting means of a battery are located in a remote location, the disconnecting means shall be lockable in the open position and the location of the controls shall be field marked on the disconnecting means.
~~(B)~~(C) Field Marking.
The disconnecting means shall be legibly marked in the field in accordance with 110.24. ~~the nominal battery system voltage and maximum available fault~~

~~current derived from the stationary battery system.~~, The field marking(s) shall:
(1) include the nominal battery voltage and the maximum available short circuit current derived from the stationary battery;
INFORMATIONAL NOTE: NFPA 70E-2012 states in Annex D-8 that the value to be used for calculating maximum direct current incident energy is the bolted fault current in amperes, which is the same as the battery short circuit current. "Short circuit current" is the term generally used within the battery industry. The short circuit current values for individual cells or units can be obtained from the battery manufacturer.
(2) be calculated at the terminals of the battery where the arc flash potential is highest;
(3) be determined by the owner or owner's agent responsible for the battery installation;
(4) include the date the ~~fault current~~ calculation was performed; and
(5) be of sufficient durability to withstand the environment involved.
(D) Modifications. When modifications to the electrical installation occur that affect the maximum available fault current, the maximum available fault current shall be verified or recalculated as necessary to ensure the necessary updates are made to reflect new available fault current at the terminals of the battery.

Substantiation: The panel rejected the original proposal because it lacked "technical substantiation to require a calculation for dc fault current. The text is revised and additional bullets are provided to match the manual of style. The revised text correlates with other sections of the Code.

480.5: The word "nominal" is added to be consistent with 480.2 and to clarify that battery voltages are charged within a range that can exceed 50 volts.

480.5(A): We support the explanations of negative ballots by Little and Spina. For safety purposes, the disconnecting means must be as close as reasonably possible to the terminals of the battery (where the voltage and short circuit current is at its highest). "Within sight" could allow a disconnect to be as far as 50 feet away from the battery terminals, thereby creating an unnecessary hazard. Conversely, while it may be theoretically possible to put the disconnect only inches away from the terminal, such practice is seldom reasonable and prudent. The term "as close as practicable" satisfies both issues. The term "as close as practicable" is used elsewhere in the NEC and is added to the requirement for the disconnecting means to be within sight of the battery. This proposed revision correlates with the present requirement in 240.21(H), which requires overcurrent protection to be installed as "close as practicable" to the battery terminals.

The intent of 480.5(A) is to identify the hazard potential precisely at the point of maximum arc flash potential at the battery terminals and the adjacent battery disconnect. Because the value will change depending upon where the measurement is taken, the Code needs to specify where the calculation is to be determined.

Regarding the deletion of the word "system" we note that, by Article 480's own definition, a "battery system" encompasses "Interconnected battery subsystems consisting of one or more storage batteries and battery chargers, and can include inverters, converters, and associated electrical equipment." The word "system" is too vague, so it is replaced with the word "terminals" to harmonize with 240.21(H) and to precisely identify where the disconnecting means should be located.

480.5(B): Article 645 requires remote activation for battery disconnects serving ITE rooms. The disconnect serving an ITE room must be capable of being locked open to prevent the remote actuation from occurring when it will jeopardize safety of personnel. The text is similar to that used elsewhere in the Code, such as in 450.14.

480.5(C): The text is modified to correlate with section 110.24. An editorial change puts the requirements in bullet form per the manual of style. The purpose of posting the battery short circuit current in bullet (1) is to allow maintenance personnel to determine the required PPE by using the guidance provided in NFPA 70E. Annex D.8 in NFPA 70E provides guidance for the user to calculate the arcing current from the system bolted fault current. NFPA 70E Table 130.7(c)(15)(b) provides the recommend PPE provided that the user can determine the arcing current. If the system bolted fault current is not provided, it is unlikely that a worker will have the ability to determine the arcing current, thereby making Table 130.7(c)(15)(b) useless to the people who really need it. The present requirement for labeling of ac equipment already allows field technicians to determine PPE from the ac tables (see Table 130.7(c)(15)(a)). This text for dc-output batteries is consistent with the requirements for ac equipment. We note that proposals have been submitted to NPFA 70E that will likely change Table 130.7(c)(15)(b) to be based on system bolted fault current only, thereby making the text in 480.4(C) even more useful.

Short circuit on individual cells or units can be obtained from the battery manufacturer. However, the short-circuit current of an entire battery must factor in such things as the number of cells, line impedance within intercell and intertier connectors and other conductors, cable length, parallel battery strings, etc. Bullet (3) stipulates that such calculations are to be performed by the owner or owner's agent who is ultimately responsible for the system/installation design. This is consistent with equipment marking requirements in NFPA 70E.

An informational note is added to 480.5(C)(1) to clarify possible confusion over terms. In this context, the battery's bolted fault current and battery short circuit current are synonymous. "Short circuit current" is the term used and the value that will be provided by battery manufacturers.

480.5(D): Text is necessary to explain what needs to be done when equipment is modified. The text correlates with 110.24, but it clarifies that the value is to be calculated for the potential at the battery terminals and no place else.

Panel Meeting Action: Accept in Principle in Part
CMP-13 accepts in principle:
The concept of "nominal" voltage in the first sentence of 480.5;
The concepts of "readily accessible" and "within sight" in 480.5(A);
And 480.5(B)
CMP-13 Holds the following new material:
The phrase "to qualified personnel for inspection and maintenance" in 480.5(A);
480.5(C)(1), Informational Note
480.5(C)(2);
480.5(C)(3);
And 480.5(D)
CMP-13 Rejects the reference to 110.24 in 480.5(C)
CMP-13 Accepts in Principle language providing requirements for field marking of the disconnecting means including: Voltage, Fault current, date of the calculation, and durability to withstand the environment.
For clarity and to correlate with action on Comment 13-21 revise 480.5(D) as follows:
(D) Notification. The disconnecting means shall be legibly marked in the field. A label with the marking shall be placed in a conspicuous location near the battery if a disconnecting means is not provided. The marking shall be of sufficient durability to withstand the environment involved and shall include:
(1) the nominal battery voltage
(2) the maximum available short circuit current derived from the stationary battery system, and
(3) the date the calculation was performed.
Informational Note: Battery equipment suppliers can provide information about short circuit current on any particular battery model.

Panel Statement: The concepts of remote operation, "nominal" volts, "readily accessible" and "within sight" are accepted in principle in the panel action on comment 13-21. CMP-13 accepts in principle the requirements for field marking but modifies the language to incorporate the changes into text accepted by Comment 13-21.

CMP-13 holds new material that has not had the opportunity for public review. CMP-13 rejects the reference to 110.24 in 480.5(C) since 110.24 gives field marking requirements for service equipment.

Number Eligible to Vote: 21
Ballot Results: Affirmative: 21
Comment on Affirmative:
LITTLE, L.: We are voting affirmative on the panel action to "Accept in Principle in Part" comment 13-22. It is important to note for the Correlating Committee and the public that this action clarifies the final text for 480.5(D). See our affirmative statement on comment 13-21.

13-23 Log #858 NEC-P13 **Final Action: Accept in Principle**
(480.9(A))

Submitter: Stephen McCluer, Schneider Electric / Rep. IEEE Stationary Battery Committee
Comment on Proposal No: 13-39
Recommendation: Revise existing NEC-2011 text to read as follows per the proposal carried over from the 2010 annual meeting:
480.9 Battery Locations. Battery locations shall conform to 480.9(A),(B), and (C).
(A) Ventilation. Provisions appropriate to the battery technology shall be made for sufficient diffusion and ventilation of ~~the~~ gases from the battery, if present, to prevent the accumulation of an explosive mixture.
Revise the proposed text that would add a new Informational Note to read as follows:
Informational Note: See ~~IEEE/ASHRAE Std. 1635, Guide for the Ventilation and Thermal Management of Stationary Battery Installations.~~ NFPA 1 Chapter 52 for ventilation considerations for specific battery chemistries.

Substantiation: The proposal originally appeared as a comment in the 2010 Annual Meeting NEC ROP and was held for further study during the process of the 2014 NEC cycle.

480.9(A): Delete the word "the" and add the phrases "appropriate to the battery technology" and "if present", The statement, "ventilation of the gases from the battery" is too strong because it suggests that there are always gases, which is simply not a true statement. The revised text recognizes that some batteries emit gas and others do not. In other words, special ventilation is not required for all battery types.

Informational Note: The note is revised. The appropriate source for guidance regarding proper ventilation would be the Fire Code (NFPA 1). NFPA 1 identifies ventilation requirements for several types of batteries in Chapter 52. We note that ventilation requirements are normally beyond the scope of the National Electrical Code.

We also wish to note that the publication date for IEEE 1635/ASHRAE 22, *Guide for the Ventilation and Thermal Management of Stationary Battery Installations*, is October 2012. This document, jointly developed and published by ASHRAE and IEEE, provides detailed information about how to design ventilation of most battery systems.

Panel Meeting Action: Accept in Principle
Revise existing NEC-2011 text to 480.9(A) read as follows:
(A) Ventilation. Provisions <u>appropriate to the battery technology</u> shall be made for sufficient diffusion and ventilation of ~~the~~ gases from the battery, <u>if present,</u> to prevent the accumulation of an explosive mixture.
Revise the proposed text that would add a new Informational Notes to read as follows:
Informational Note <u>1</u>: See ~~IEEE/ASHRAE Std. 1635, Guide for the Ventilation and Thermal Management of Stationary Battery Installations.~~ <u>NFPA 1 Chapter 52 for ventilation considerations for specific battery chemistries.</u>
<u>**Informational Note 2:** Some battery technologies do not require ventilation.</u>
Note no other changes were made to the remainder of this section in this action.
Panel Statement: Informational Note 2 was added for clarity. The committee does not agree with all of the submitter's substantiation.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-24 Log #1527 NEC-P13 **Final Action: Reject**
(480.9(C))

TCC Action: The Correlating Committee directs that the Action on this comment be reported as "Reject" because, per the Action on Comment 1-81, 110.26 was not changed to 110.27.
Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 13-42
Recommendation: Revise text to read as follows:
480.9 Battery Locations.
(C) Spaces About Battery Systems. Spaces about battery systems shall comply with ~~110.26~~ <u>110.27</u>. Working space shall be measured from the edge of the battery cabinet, racks, or trays.
Substantiation: 600 volt clearance has moved from 110.26 to 110.27.
Panel Meeting Action: Accept
Panel Statement: The only change to proposed (C) is to revise 110.26 to 110.27 based on a change in the 2014 ROP.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-25 Log #859 NEC-P13 **Final Action: Accept in Principle**
(480.9(C), Informational Note (New))

TCC Action: The Correlating Committee directs that "110.26" not be changed to "110.27" because of the Action taken on comment 1-81. The Correlating Committee further directs that "may be" be replaced with "is often." This is an editorial correction.
Submitter: Stephen McCluer, Schneider Electric / Rep. IEEE Stationary Battery Committee
Comment on Proposal No: 13-41
Recommendation: Proposal was to add a new informational note:
480.9(C) Working Space. Working space about the battery systems shall comply with 110.26. Working clearance shall be measured from the edge of the battery rack, <u>tray, or cabinet.</u>
<u>**Informational Note:** Additional space may be needed to accommodate battery hoisting equipment, tray removal, or spill containment.</u>
Substantiation: The panel rejected the proposal on the basis that "this information does not provide for the practical safeguarding of persons and property from hazards arising from the use of electricity." We disagree and we concur with the explanations of negative by Degnan and Little.
The informational note is not for the electrician doing the work; it's for the engineer who designs the room to comply with existing code without factoring in *additional* space for service equipment. The Code provides minimum requirements. The proposed informational note is designed to inform the code user that additional space may be required. Where adequate space is not provided to permit the hoisting, removal or replacement of batteries, serious safety concerns exist. The intent is to create a safer working environment.
Batteries can never de-energized. Mishandling because space was not allowed for battery handling can result it electrical shorts, dropped and broken battery units (e.g., acidic or alkaline hazardous material spill), etc.
The section should also note that the physical point of measurement should begin from the furthest point of protrusion into the working space. Many batteries are installed in cabinets, not in racks. There might also be spill containment barriers which extend around the battery rack and thereby reduce the working space.
Panel Meeting Action: Accept in Principle
CMP-13 accepts addition of the Informational Note but retains the original text for 480.9(C) as presented in the ROP Draft and modified by Comment 13-24 as follows:
(C) Spaces About Battery Systems. Spaces about battery systems shall comply with 110.27. Working space shall be measured from the edge of the battery cabinet, racks, or trays.
<u>**Informational Note:** Additional space may be needed to accommodate battery hoisting equipment, tray removal, or spill containment.</u>
Panel Statement: The panel notes that the existing text of 480.9(C) was not duplicated in this comment. The panel retains the text that was accepted in Proposal 13-41. The reference to 110.26 was changed to 110.27 by Comment 13-24 based on an action in the ROP.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-26 Log #860 NEC-P13 **Final Action: Accept in Principle in Part**
(480.9(D) (New))

Submitter: Stephen McCluer, Schneider Electric / Rep. IEEE Stationary Battery Committee
Comment on Proposal No: 13-43
Recommendation: Revise text to read as follows:
480.9(D) <u>Marking for</u> Personnel access to energized batteries. Each battery space shall be marked ~~"Battery room restricted to authorized personnel" or "Area restricted to authorized personnel~~ <u>in accordance with 110.27(C)</u>
<u>Informational Note: NFPA 70E includes guidance in 320.3(A)(4) for warning signs to be posted in battery rooms.</u>
Substantiation: 110.27**(C)** says: "Entrances to rooms and other guarded locations that contain exposed live parts shall be marked with conspicuous warning signs forbidding unqualified persons to enter."
This new paragraph 480.9(D) is for "marking of the space", whereas existing 480.9(B) (which references the same section) is for "guarding of live parts"'.
An informational note is added to reference NFPA 70E where, in addition to limited access, warning signs are also required for electrical hazard warnings, chemical hazard warnings, and PPE.
Panel Meeting Action: Accept in Principle in Part
Accept in Principle the revised language. Reject addition of the informational note.
Panel Statement: Panel action on Comment 13-24 has met the submitter's intent for the revised language and reference to Section 110.27.
Warning sign requirements exist in many places of the NEC and they are not accompanied by informational notes referencing NFPA 70E, *Standard for Electrical Safety in the Workplace*. The warning sign requirement is sufficiently clear without the additional informational note.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-27 Log #617 NEC-P13 **Final Action: Accept in Principle**
(480.9(E))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 13-45
Recommendation: Revise text to read as follows:
480.9 Battery Locations.
(E) Egress. Personnel door(s) intended for entrance to and egress from rooms designated as battery rooms shall be equipped with door(s) that open in the direction of egress and shall be equipped with <u>listed</u> panic <u>hardware</u> ~~bars, pressure plates, or other devices that are normally latched but open under simple pressure~~.
Substantiation: See for example:
110.27 Spaces About Electrical Equipment.
(C) Entrance to and Egress from Working Space.
(3) Personnel Doors. Where equipment rated 800 A or more that contains overcurrent devices, switching devices, or control devices is installed and there is a personnel door(s) intended for entrance to and egress from the working space less than 7.6 m (25 ft) from the nearest edge of the working space, the door(s) shall open in the direction of egress and be equipped with listed panic hardware.
Using the same text for the same meaning reduces confusion.
Panel Meeting Action: Accept in Principle
Revise 480.9(E) as follows:
(E) Egress. Personnel door(s), intended for entrance to and egress from rooms designated as battery rooms, shall ~~be equipped with door(s) that~~ open in the direction of egress and shall be equipped with listed panic hardware. ~~hardware bars, pressure plates, or other devices that are normally latched but open under simple pressure.~~
Panel Statement: The proposed revision has been modified for clarity.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-28 Log #861 NEC-P13 **Final Action: Accept**
(480.9(F) (New))

Submitter: Stephen McCluer, Schneider Electric / Rep. IEEE Stationary Battery Committee
Comment on Proposal No: 13-46
Recommendation: Add new revised text as proposed in 13-46 item 3.
<u>**480.9(F) Piping in Battery Rooms**</u>
<u>Gas piping shall not be permitted in dedicated battery rooms.</u>
Substantiation: The panel could have accepted Proposal 13-46 in part because the proposal has three parts, only one of which was addressed in the committee comment; i.e., "submitter did not provide adequate substantiation." We withdraw parts (1) and (2), but we recommend that the panel accept the proposal as submitted for part (3).
Gas piping proposes three possible hazards in a battery room: (1) The gas itself, if accidentally released into the room, could have a damaging effect on

the battery containers and/or connections; or (2) The gas (which is presumed to be flammable), could be ignited by the battery system, which is always energized (although we acknowledge that a battery will not spontaneously spark); or

(3) In the event of overcharging and/or thermal runaway on a battery system, atomized electrolyte could corrode or otherwise impair the integrity of metallic gas piping over time.

Battery systems, by their very nature, are used for critical and or emergency applications. Therefore, battery rooms should be designed to a somewhat higher standard than other occupancies to ensure the highest level of safety. The probability of mixing stored energy with flammable gas is quite low, but the risk could be eliminated (i.e., probability could be zero) if the space is designed for safety and fire prevention

Panel Meeting Action: Accept
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-29 Log #862 NEC-P13 **Final Action: Accept in Principle**
(480.9(X), Informational Note (New))

Submitter: Stephen McCluer, Schneider Electric / Rep. IEEE Stationary Battery Committee
Comment on Proposal No: 13-47
Recommendation: Add new text to read as follows:
<u>480.9(X) Illumination. Spaces containing battery systems shall comply with 110.26(D). The location of luminaires shall not:</u>
<u>(1) expose personnel to energized battery components when performing maintenance on the luminaires; or</u>
<u>(2) create a hazard to the battery upon failure of the luminaire.</u>
Substantiation: The committee's action should have been to accept in principle in part. In rejecting the proposal the panel stated that "Referencing Section 110.26(D) is incorrect since this section applies to service equipment, switchboards, panelboards, or motor control centers, not to battery rooms or areas containing batteries.' This COMMENT deletes the reference.

The panel also stated, "If illumination is required, that text needs to be provided in Article 480." We agree. We acknowledge that it is difficult to quantify how much lighting is sufficient to safely work on energized equipment. NFPA 70E requires lighting to be sufficient for a worker to be able to read documents. Because batteries cannot be de-energized, placement of luminaires in aisles addresses the law of gravity and minimizes the risk of short circuits or other hazards created by maintenance and/or equipment failure.

Panel Meeting Action: Accept in Principle
Revise text to read as follows:

480.9(G<u>) Illumination.</u> <u>Illumination shall be provided for working</u> spaces ~~Spaces~~ containing battery systems<u>. The lighting outlets shall not be controlled by automatic means only.</u> <u>Additional lighting outlets shall not be required where the work space is illuminated by an adjacent light source.</u> ~~shall comply with 110.26(D)~~. The location of luminaires shall not:

(1) expose personnel to energized battery components <u>while</u> ~~when~~ performing maintenance on the luminaires <u>in the battery space</u>; or

(2) create a hazard to the battery upon failure of the luminaire.

Note CMP 13 requests this new first level subdivision be the last subdivision in 480.9.

Panel Statement: The text used in this comment is based on the existing text in 110.26(D) but references battery spaces, rather than service equipment, switchboards, panelboards and motor control centers.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-30 Log #863 NEC-P13 **Final Action: Accept**
(480.11 (New))

Submitter: Stephen McCluer, Schneider Electric / Rep. IEEE Stationary Battery Committee
Comment on Proposal No: 13-48
Recommendation: No new text.
Substantiation: We concur with the panel's action to reject the proposal to add a new paragraph 480.11, which would require all batteries and accessories to be "listed." The proposal is too broad; Listing standards do not exist for all elements in a battery system. Furthermore, battery "systems" are usually customized and assembled at site, so this requirement would mandate site inspection and field marking on almost every installation, thereby creating unnecessary expense and time. Submitter has not demonstrated that a problem exists today that would be fixed with the listing requirement.
Panel Meeting Action: Accept
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

ARTICLE 490 — EQUIPMENT, OVER 1000 VOLTS, NOMINAL

9-77 Log #735 NEC-P09 **Final Action: Accept**
(490)

TCC Action: The Correlating Committee advises that article titles are the responsibility of the Correlating Committee and the Correlating Committee accepts the Panel Action.
Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 9-153
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Coghill, P.
Explanation of Negative:

FERRARO, J.: It is recognized that increasing voltage from 600 volts to 1000 volts may be applicable to specific installations. However, adequate technical substantiation has not been provided to support the change in this Article.

9-78 Log #154 NEC-P09 **Final Action: Accept**
(490.48 (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-179
Recommendation: The Correlating Committee directs that the panel clarify the panel action on this proposal pertaining to the last phrase in the Exception to comply with the permissive language requirement of the NEC Style Manual.
The Correlating Committee notes that the Exception is not written in mandatory language.
It was the action of the Correlating Committee that further consideration be given to the comments expressed in the voting relating to Proposal 9-171.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: Refer to Comment 9-79 for the required changes in text.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-79 Log #1567 NEC-P09 **Final Action: Accept**
(490.48)

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 9-179
Recommendation: Accept the proposal in principle; delete the word “legible” from the opening clause and reword the final clause of the exception to read “diagrams shall not be required.”
Substantiation: This comment addresses the Correlating Committee concerns about alleged lack of mandatory text in the exception and the inconsistency relative to the decision to delete the word “legible” in another location.
Panel Meeting Action: Accept
Panel Statement: CMP 9 notes that the changes are also included in the action on Comment 9-9.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

9-80 Log #599 NEC-P09 **Final Action: Accept**
(490.53)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 9-180
Recommendation: Revise text to read as follows:
490.53 Enclosures. All energized switching and control parts shall be enclosed in grounded metal cabinets or enclosures. These cabinets or enclosures shall be marked
“DANGER — HIGH VOLTAGE — KEEP OUT”
and shall be locked so that only authorized and qualified persons can enter. The danger marking(s) or labels shall comply with 110.21(B). Circuit breakers and protective equipment shall have the operating means projecting through the metal cabinet or enclosure so these units can be reset without opening locked doors. With doors closed, ~~reasonable~~ safe access for normal operation of these units shall be provided.
Substantiation: This is the only place in the *Code* that *safe* is modified by *reasonable*. This adjective could be construed to reduce the safety factor.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Coghill, P.

ARTICLE 500 — HAZARDOUS (CLASSIFIED) LOCATIONS, CLASSES I, II, AND III, DIVISIONS 1 AND 2

14-1 Log #392 NEC-P14 **Final Action: Accept in Principle**
(500.2, 504.2, 505.2, 506.2, 513.2, 515.2, and 516.2)

TCC Action: Definition of “Mobile Equipment” Retain in Article 513.
Definition of “Portable Equipment” Retain in Article 513.
Definition of “Flash-Off Area” Place in Article 516 as seen in Comment 14-1.
Definition of “Limited Finishing Workstation” Place in Article 516 as seen in Comment 14-1.
Definition of “Resin Application Area” Place in Article 516 as seen in Comment 14-1.
Definition of “Spray Area” Retain in Article 516 as revised.
Definition of “Spray Booth” Retain in Article 516 as revised.
Definition of “Spray Room” Retain in Article 516 as revised.
Definition of “Unenclosed Spray Area” Place in Article 516 as seen in Comment 14-1.
Submitter: John L. Simmons, Florida East Coast Electrical JATC
Comment on Proposal No: 14-3
Recommendation: Revise the text found in Sections 500.2, 504.2, 505.2, 506.2, 513.2, 515.2 and 516.2 as follows:
● Revise the parent text of 500.2 to include all definitions in Articles 500 – 516 that appear in more than one article. A new last sentence is added to make it clear that 500.2 may have definitions that apply to Articles 505 and 506 but that no other sections of Article 500 apply to 505 or 506 unless they are specifically referenced in the article. This will clarify the intent of CMP14 that Articles 505 and 506 are not a part of the hazardous locations protection methods prescribed in Article 500.
● Relocate the term “associated apparatus” from 504.2 to 500.2. The term is used in Articles 500, 504, 505 and 506.
● Include the new term “cord connector” which was introduced in Proposal 14-11b and accepted by CMP14.
● Update the standard dates in the informational note for dust-ignitionproof.
● Change the term dusttight to dusttight (as applied to Hazardous (Classified) Locations). This will in essence remove the conflict between the definition in 500.2 and Article 100 and it is consistent with the format used in Article 100 to allow two definitions for accessible (accessible (as applied to equipment) and accessible (as applied to wiring methods).
● Dusttight Informational Note – see panel action on Proposal 14-10.
● Electrical and Electronic Equipment Informational Note – see panel action on Proposal 14-10.
● Change the term explosionproof equipment to explosionproof equipment (as applied to Hazardous (Classified) Locations). This will in essence remove the conflict between the definition in 500.2 and Article 100 and it is consistent with the format used in Article 100 to allow two definitions for accessible (accessible (as applied to equipment) and accessible (as applied to wiring methods).
● Hermetically Sealed Informational Note – see panel action on Proposal 14-10.
● Relocate the definition of “intrinsically safe apparatus” from 504.2 to 500.2. The term is found in Articles 500, 503, 504, 505 and 506.
● Nonincendive Circuit Informational Note – see panel action on Proposal 14-10.
● Nonincendive Component Informational Note – see panel action on Proposal 14-10.
● Nonincendive Equipment Informational Note – see panel action on Proposal 14-10.
● Nonincendive Field Wiring Apparatus Informational Note – see panel action on Proposal 14-10.
● Delete the Informational Note for Oil Immersion. UL 698 has been withdrawn.
● Relocate the definition of “pressurized” and the Informational Note for the definition from 506.2 to 500.2. The term is found in Articles 501, 505 and 506. Since the term is also used in Article 326, the phrase “as applied to Hazardous (Classified) Locations” has been added to make it perfectly clear that this definition is not intended to define the term as used in that article.
● Relocate the definition of “simple apparatus” and the Informational Note for the definition from 504.2 to 500.2. The term is found in Articles 500, 501, 502, 503, 504, 505 and 506.
● Create new section 501.2 Definitions and refer back to 500.2. This will add clarity to the use of definitions in Articles 500 – 516.
● Create new section 502.2 Definitions and refer back to 500.2. This will add clarity to the use of definitions in Articles 500 – 516.
● Create new section 503.2 Definitions and refer back to 500.2. This will add clarity to the use of definitions in Articles 500 – 516.
● Create new parent text for 504.2. The new text will make it perfectly clear that the defined terms in the section apply specifically to Article 504.
● Delete the definition of “associated apparatus” from 504.2 and relocate it to 500.2. The term is used in Articles 500, 504, 505 and 506.
● Delete the control drawing reference to 500.2. With the proposed restructuring of the definitions in Article 500 – 516 it is perfectly clear that defined terms will be found in one of two locations; 500.2 if the term is used in more than one article and the dot 2 section of the article it appears in, if it is only used in that article.
● Delete the definition of “intrinsically safe apparatus” from 504.2 and relocate it to 500.2. The term is used in Articles 500, 503, 504, 505, and 506.
● Update the standard date in the Informational Note for “intrinsically safe circuit”.
● Delete the definition of “simple apparatus” from 504.2 and relocate it to 500.2. The term is used in Articles 500, 501, 502, 503, 504, 505, and 506.
● Revise the parent text for 505.2 to make it consistent with the new parent text of 504.2.
● Delete the definition of “combustible gas detection system” from 505.2. The term is defined in 500.2 and 505.2 in the current version of the NEC (2008). The term is used Articles 500 and 505. Under the proposed restructure, definitions of terms used in more than one article (500 – 516) are being placed in 500.2.
● Delete the definition of “electrical and electronic equipment” and its Informational Note from 505.2. The term is defined in 500.2 and 505.2 in the current version of the NEC (2008). The term is used Articles 500, 501, 502, 503, 505, and 506. Under the proposed restructure, definitions of terms used in more than one article (500 – 516) are being placed in 500.2.
● Revise Informational Note 1 and Note 2 for “encapsulation ‘m’.” See the panel action on Proposal 14-131.

● Revise the standard information in the Informational Note for “flameproof “d”. See the panel action on Proposal 14-129.

● Revise the standard information in the Informational Note for “intrinsic safety ‘i’”. See the panel action on Proposal 14-129.

● Oil Immersion “o” Informational Note: insert the standard date.

● Powder Filling “q” Informational Note: insert the standard date.

● Revise the standard information in the Informational Note for “pressurization “p””. See the panel action on Proposal 14-129.

● Revise the standard information in the Informational Note for “type of protection “n””. See the panel action on Proposal 14-129.

● Delete the definition of “unclassified locations” from 505.2. The term is defined in 500.2 and 505.2 in the current version of the NEC (2008). The term is used Articles 500, 501, 502, 503, 504, 505, 506, 513, 514, and 516. Under the proposed restructure, definitions of terms used in more than one article (500 – 516) are being placed in 500.2.

● Revise the parent text for 506.2 to make it consistent with the new parent text of 504.2.

● Delete the definition of “associated nonincendive field wiring apparatus” from 506.2. The term is defined in 500.2 and 506.2 in the current version of the NEC (2008). The term is used Articles 500, and 506. Under the proposed restructure, definitions of terms used in more than one article (500 – 516) are being placed in 500.2.

● Delete the definition of “combustible dust” from 506.2. The term is defined in 500.2 and 505.2 in the current version of the NEC (2008). The term is used Articles 500, 502, 504, 505, 506, and 516. Under the proposed restructure, definitions of terms used in more than one article (500 – 516) are being placed in 500.2.

● Delete the definition of “dust-ignitionproof” and its Informational Note from 506.2. The term is defined in 500.2 and 505.2 in the current version of the NEC (2008). The term is used Articles 500, 502, and 506. (Other than the definition in 506.2 the term is only used one other time in 506 and that is in an informational note.) Under the proposed restructure, definitions of terms used in more than one article (500 – 516) are being placed in 500.2.

● Delete the definition of “dusttight” from 506.2. The term is defined in Article 100 and sections 500.2 and 505.2 in the current version of the NEC (2008). The term is used Articles 500, 502, 503, and 506. Under the proposed restructure, definitions of terms used in more than one article (500 – 516) are being placed in 500.2.

● Delete the definition of “nonincendive circuit” and its Informational Note from 506.2. The term is defined in 500.2 and 506.2 in the current version of the NEC (2008). The term is used in Articles 500, 501, 502, 503, and 506.

● Delete the definition of “nonincendive equipment” and its Informational Note from 506.2. The term is defined in 500.2 and 506.2 in the current version of the NEC (2008). The term is used in Articles 500, 506, and 516.

● Delete the definition of “nonincendive field wiring” from 506.2. The term is defined in 500.2 and 506.2 in the current version of the NEC (2008). The term is used in Articles 500, 501, 502,503, 504, and 506.

● Delete the definition of “nonincendive field wiring apparatus” and its Informational Note from 506.2. The term is defined in 500.2 and 506.2 in the current version of the NEC (2008). The term is used in Articles 500, 501, 502, 503, and 506.

● Delete the definition of “pressurized” and its Informational Note from 506.2. The term is defined in 500.2 and 506.2 in the current version of the NEC (2008). The term is used in Articles 501, 505 and 506.

● Change protection by encapsulation “mD” to protection by encapsulation “m” and revise the standard in the Informational Note No. 1. Revise Informational Note No. 2. See panel action on Proposal 14-196.

● Change protection by enclosure “tD” to protection by encapsulation “t” and revise the standard in the Informational Note No. 1. Add new Informational Note No. 2. See panel action on Proposal 14-198.

● Revise the parent text for 513.2 to make it consistent with the new parent text of 504.2.

● Change the term portable equipment to portable equipment (as applied to Article 513). The term portable equipment appears in Articles 250,368, 430, 490, 511, 513, 516, 517, 518, 520, 525, 530, 540, 640, 668, 675, and 680. The term is defined in Articles 513, 520, 530, 640, and 680. This proposed change makes it clear that the definition found in 513.2 is specific to Article 513.

● Delete 515.2 in its entirety. See Proposal 14-241.

● Revise the parent text for 516.2 to make it consistent with the new parent text of 504.2.

A copy of the NEC code text with proposed changes follows:

500.2 Definitions. The definitions found in this section are specific to the Hazardous (Classified) Locations found in ~~For purposes of~~ Articles 500 through ~~504 and Articles 510 through~~ 516 ~~the following definitions apply~~. No other section of this Article shall apply to Article 505 or 506 unless it is specifically referenced in that article.

Associated Apparatus. Apparatus in which the circuits are not necessarily intrinsically safe themselves but that affect the energy in the intrinsically safe circuits and are relied on to maintain intrinsic safety. Associated apparatus may be either of the following:

(1) Electrical apparatus that has an alternative-type of protection for use in the appropriate hazardous (classified) location

(2) Electrical apparatus not so protected that shall not be used within a hazardous (classified) location

Informational Note No. 1: Associated apparatus has identified intrinsically safe connections for intrinsically safe apparatus and also may have connections for nonintrinsically safe apparatus.

Informational Note No. 2: An example of associated apparatus is an intrinsic safety barrier, which is a network designed to limit the energy (voltage and current) available to the protected circuit in the hazardous (classified) location, under specified fault conditions.

Associated Nonincendive Field Wiring Apparatus. Apparatus in which the circuits are not necessarily nonincendive themselves but that affect the energy in nonincendive field wiring circuits and are relied upon to maintain nonincendive energy levels. Associated nonincendive field wiring apparatus may be either of the following:

(1) Electrical apparatus that has an alternative type of protection for use in the appropriate hazardous (classified) location

(2) Electrical apparatus not so protected that shall not be used in a hazardous (classified) location Informational Note: Associated nonincendive field wiring apparatus has designated associated nonincendive field wiring apparatus connections for nonincendive field wiring apparatus and may also have connections for other electrical apparatus.

Combustible Dust. Any finely divided solid material that is 420 microns (0.017 in.) or smaller in diameter (material passing a U.S. No. 40 Standard Sieve) and presents a fire or explosion hazard when dispersed and ignited in air. [**499,** 2008]

Combustible Gas Detection System. A protection technique utilizing stationary gas detectors in industrial establishments.

Control Drawing. A drawing or other document provided by the manufacturer of the intrinsically safe or associated apparatus, or of the nonincendive field wiring apparatus or associated nonincendive field wiring apparatus, that details the allowed interconnections between the intrinsically safe and associated apparatus or between the nonincendive field wiring apparatus or associated nonincendive field wiring apparatus.

Cord Connector. A fitting intended to terminate a cord to a box or similar device and reduce the strain at points of termination and may include an explosionproof, a dust-ignition proof, or a flameproof seal.

Dust-Ignitionproof. Equipment enclosed in a manner that excludes dusts and does not permit arcs, sparks, or heat otherwise generated or liberated inside of the enclosure to cause ignition of exterior accumulations or atmospheric suspensions of a specified dust on or in the vicinity of the enclosure.

Informational Note: For further information on dustignitionproof enclosures, see Type 9 enclosure in ANSI/NEMA 250-~~1991~~ 2008, *Enclosures for Electrical Equipment*, and ANSI/UL 1203-~~1994~~ 2009, *Explosionproof and Dust-Ignitionproof Electrical Equipment for Hazardous (Classified) Locations*.

Dusttight (as applied to Hazardous (Classified) Locations). Enclosures constructed so that dust will not enter under specified test conditions.

Informational Note: See ~~ANSI/ISA-12.12.01-2007, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations*.~~ ANSI/ISA-12.12.01-2011, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*

Electrical and Electronic Equipment. Materials, fittings, devices, appliances, and the like that are part of, or in connection with, an electrical installation.

Informational Note: Portable or transportable equipment having self-contained power supplies, such as battery-operated equipment, could potentially become an ignition source in hazardous (classified) locations. See ~~ISA-RP12.12.03-2002, *Recommended Practice for Portable Electronic Products Suitable for Use in Class I and II, Division 2, Zone 2 and Class III, Division 1 and 2 Hazardous (Classified) Locations.*~~ ANSI/ISA-12.12.03-2011, *Standard for Portable Electronic Products Suitable for Use in Class I and II, Division 2, Zone 2 and Class III, Division 1 and 2 Hazardous (Classified) Locations*.

Explosionproof Equipment (as applied to Hazardous (Classified) Locations). Equipment enclosed in a case that is capable of withstanding an explosion of a specified gas or vapor that may occur within it and of preventing the ignition of a specified gas or vapor surrounding the enclosure by sparks, flashes, or explosion of the gas or vapor within, and that operates at such an external temperature that a surrounding flammable atmosphere will not be ignited thereby.

Informational Note: For further information, see ANSI/UL 1203-~~1994~~ 2009, *Explosion-Proof and Dust- Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations*.

Hermetically Sealed. Equipment sealed against the entrance of an external atmosphere where the seal is made by fusion, for example, soldering, brazing, welding, or the fusion of glass to metal.

~~Informational Note: For further information, see ANSI/ISA-12.12.01-2007, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Division 1 and 2 Hazardous (Classified) Locations*.~~ ANSI/ISA-12.12.01-2011, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*

Intrinsically Safe Apparatus. Apparatus in which all the circuits are intrinsically safe.

Nonincendive Circuit. A circuit, other than field wiring, in which any arc or thermal effect produced under intended operating conditions of the equipment, is not capable, under specified test conditions, of igniting the flammable gas–air, vapor–air, or dust–air mixture.

Informational Note: Conditions are described in ~~ANSI/ISA-12.12.01-2007, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and*~~

~~*Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*~~ ANSI/ISA-12.12.01-2011, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*

Nonincendive Component. A component having contacts for making or breaking an incendive circuit and the contacting mechanism is constructed so that the component is incapable of igniting the specified flammable gas–air or vapor–air mixture. The housing of a nonincendive component is not intended to exclude the flammable atmosphere or contain an explosion.

Informational Note: For further information, see ~~ANSI/ISA-12.12.01-2007, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*~~ ANSI/ISA-12.12.01-2011, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*

Nonincendive Equipment. Equipment having electrical/electronic circuitry that is incapable, under normal operating conditions, of causing ignition of a specified flammable gas–air, vapor–air, or dust–air mixture due to arcing or thermal means.

Informational Note: For further information, see ~~ANSI/ISA-12.12.01-2007, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*~~ ANSI/ISA-12.12.01-2011, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*

Nonincendive Field Wiring. Wiring that enters or leaves an equipment enclosure and, under normal operating conditions of the equipment, is not capable, due to arcing or thermal effects, of igniting the flammable gas–air, vapor–air, or dust–air mixture. Normal operation includes opening, shorting, or grounding the field wiring.

Nonincendive Field Wiring Apparatus. Apparatus intended to be connected to nonincendive field wiring.

Informational Note: For further information, see ~~ANSI/ISA-12.12.01-2007, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*~~ ANSI/ISA-12.12.01-2011, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*

Oil Immersion. Electrical equipment immersed in a protective liquid in such a way that an explosive atmosphere that may be above the liquid or outside the enclosure cannot be ignited.

~~Informational Note: For further information, see ANSI/UL 698-1995, *Industrial Control Equipment for Use in Hazardous (Classified) Locations*.~~

Pressurized (as applied to Hazardous (Classified) Locations). The process of supplying an enclosure with a protective gas with or without continuous flow at sufficient pressure to prevent the entrance of combustible dust or ignitable fibers/flyings.

Informational Note: For further information, see ANSI/NFPA 496-2008, *Standard for Purged and Pressurized Enclosures for Electrical Equipment.*

Purged and Pressurized. The process of (1) purging, supplying an enclosure with a protective gas at a sufficient flow and positive pressure to reduce the concentration of any flammable gas or vapor initially present to an acceptable level; and (2) pressurization, supplying an enclosure with a protective gas with or without continuous flow at sufficient pressure to prevent the entrance of a flammable gas or vapor, a combustible dust, or an ignitable fiber.

Informational Note: For further information, see ANSI/NFPA 496-2008, *Purged and Pressurized Enclosures for Electrical Equipment*.

Simple Apparatus. An electrical component or combination of components of simple construction with well defined electrical parameters that does not generate more than 1.5 volts, 100 milliamps, and 25 milliwatts, or a passive component that does not dissipate more than 1.3 watts and is compatible with the intrinsic safety of the circuit in which it is used.

Informational Note: The following apparatus are examples of simple apparatus:
a) Passive components, for example, switches, junction boxes, resistance temperature devices, and simple semiconductor devices such as LEDs
b) Sources of stored energy consisting of single components in simple circuits with well-defined parameters, for example, capacitors or inductors, whose values are considered when determining the overall safety of the system
c) Sources of generated energy, for example, thermocouples and photocells, which do not generate more than 1.5 V, 100 mA milliamps, and 25 mW milliwatts

Unclassified Locations. Locations determined to be neither Class I, Division 1; Class I, Division 2; Class I, Zone 0; Class I, Zone 1; Class I, Zone 2; Class II, Division 1; Class II, Division 2; Class III, Division 1; Class III, Division 2; Zone 20; Zone 21; Zone 22; or any combination thereof.

501.2 Definitions. See 500.2.

502.2 Definitions. See 500.2.

503.2 Definitions. See 500.2.

504.2 Definitions. Definitions found in this section are specific to this Article.

~~**Associated Apparatus.** Apparatus in which the circuits are not necessarily intrinsically safe themselves but that affect the energy in the intrinsically safe circuits and are relied on to maintain intrinsic safety. Associated apparatus may be either of the following:~~
~~(1) Electrical apparatus that has an alternative-type protection for use in the appropriate hazardous (classified) location~~
~~(2) Electrical apparatus not so protected that shall not be used within a hazardous (classified) location~~

~~Informational Note No. 1: Associated apparatus has identified intrinsically safe connections for intrinsically safe apparatus and also may have connections for nonintrinsically safe apparatus.~~

~~Informational Note No. 2: An example of associated apparatus is an intrinsic safety barrier, which is a network designed to limit the energy (voltage and current) available to the protected circuit in the hazardous (classified) location, under specified fault conditions.~~

~~**Control Drawing.** See the definition in 500.2.~~

Different Intrinsically Safe Circuits. Intrinsically safe circuits in which the possible interconnections have not been evaluated and identified as intrinsically safe.

~~**Intrinsically Safe Apparatus.** Apparatus in which all the circuits are intrinsically safe.~~

Intrinsically Safe Circuit. A circuit in which any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under prescribed test conditions.

Informational Note: Test conditions are described in ANSI/UL 913-~~1997~~ 2006, *Standard for Safety, Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations*.

Intrinsically Safe System. An assembly of interconnected intrinsically safe apparatus, associated apparatus, and interconnecting cables, in that those parts of the system that may be used in hazardous (classified) locations are intrinsically safe circuits.

Informational Note: An intrinsically safe system may include more than one intrinsically safe circuit.

~~**Simple Apparatus.** An electrical component or combination of components of simple construction with well defined electrical parameters that does not generate more than 1.5 volts, 100 milliamps, and 25 milliwatts, or a passive component that does not dissipate more than 1.3 watts and is compatible with the intrinsic safety of the circuit in which it is used.~~

~~Informational Note: The following apparatus are examples of simple apparatus:~~
~~d) Passive components, for example, switches, junction boxes, resistance temperature devices, and simple semiconductor devices such as LEDs~~
~~e) Sources of stored energy consisting of single components in simple circuits with well-defined parameters, for example, capacitors or inductors, whose values are considered when determining the overall safety of the system~~
~~f) Sources of generated energy, for example, thermocouples and photocells, which do not generate more than 1.5 V, 100 mA, and 25 mW~~

505.2 Definitions. ~~For purposes of this article, the following definitions apply.~~ Definitions found in this section are specific to this Article.

~~**Combustible Gas Detection System.** A protection technique utilizing stationary gas detectors in industrial establishments.~~

~~**Electrical and Electronic Equipment.** Materials, fittings, devices, appliances, and the like that are part of, or in connection with, an electrical installation.~~

~~Informational Note: Portable or transportable equipment having self-contained power supplies, such as battery operated equipment, could potentially become an ignition source in hazardous (classified) locations.~~

Encapsulation "m." Type of protection where electrical parts that could ignite an explosive atmosphere by either sparking or heating are enclosed in a compound in such a way that this explosive atmosphere cannot be ignited.

Informational Note No. 1: See ANSI/ISA-60079-18 (12.23.01)-2009, ~~*Electrical Apparatus for Use in Class I, Zone 1 Hazardous (Classified) Locations, Type of Protection — Encapsulation "m";*~~ *Explosive atmospheres - Part 18: Equipment protection by encapsulation "m",* ~~IEC 0079-18-1992, *Electrical apparatus for explosive gas atmospheres — Part 18: Encapsulation "m";*~~ and ANSI/UL 60079-18~~, *Electrical Apparatus for Explosive Gas Atmospheres — Part 18: Encapsulation "m"*~~ -2009, Explosive atmospheres - Part 18: Equipment protection by encapsulation "m".

Informational Note No. 2: Encapsulation is designated type of protection "ma" for use in Zone 0 locations. Encapsulation is designated type of protection "m" or "mb" for use in Zone 1 locations. Encapsulation is designated type of protection "mc" for use in Zone 2 locations.

Flameproof "d." Type of protection where the enclosure will withstand an internal explosion of a flammable mixture that has penetrated into the interior, without suffering damage and without causing ignition, through any joints or structural openings in the enclosure, of an external explosive gas atmosphere consisting of one or more of the gases or vapors for which it is designed.

Informational Note: See ~~ANSI/ISA-60079-1 (12.22.01)-2008, *Explosive Atmospheres, Part 1: Equipment protection by flameproof enclosures "d"*;~~ ANSI/ISA-60079-1-2009 (12.22.01), *Explosive Atmospheres, Part 1: Equipment protection by flameproof enclosures "d"* and ANSI/UL 60079–1-2009, *Electrical Apparatus for Explosive Gas Atmospheres — Part 1: Flameproof Enclosures"d."*

Increased Safety "e." Type of protection applied to electrical equipment that does not produce arcs or sparks in normal service and under specified abnormal conditions, in which additional measures are applied so as to give increased security against the possibility of excessive temperatures and of the occurrence of arcs and sparks.

Informational Note: See ANSI/ISA-60079-7 (12.16.01) - 2008, *Explosive Atmospheres, Part 7: Equipment protection by increased safety "e"*; and ANSI/UL 60079-7-2008, *Electrical Apparatus for Explosive Gas Atmospheres — Part 7:Increased Safety "e."*

Intrinsic Safety "i." Type of protection where any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under prescribed test conditions.

Informational Note No. 1: See ANSI/UL 913-~~1997~~ 2006, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Hazardous*

Locations; ~~ANSI/ISA-60079-11 (12.02.01)-2009, *Explosive Atmospheres, Part 11: Equipment protection by intrinsic safety "i"*~~; ANSI/ISA-60079-11-2011 (12.02.01), *Explosive Atmospheres: Part 11: Equipment protection by intrinsic safety"i"* and ANSI/UL 60079-11-2011, *Explosive Atmospheres, Part 11: Equipment protection by intrinsic safety "i."*

Informational Note No. 2: Intrinsic safety is designated type of protection "ia" for use in Zone 0 locations. Intrinsic safety is designated type of protection "ib" for use in Zone 1 locations. Intrinsic safety is designated type of protection "ic" for use in Zone 2 locations.

Informational Note No. 3: Intrinsically safe associated apparatus, designated by [ia], [ib], or [ic], is connected to intrinsically safe apparatus ("ia," "ib," or "ic," respectively) but is located outside the hazardous (classified) location unless also protected by another type of protection (such as flameproof).

Oil Immersion "o." Type of protection where electrical equipment is immersed in a protective liquid in such a way that an explosive atmosphere that may be above the liquid or outside the enclosure cannot be ignited.

Informational Note: See ANSI/ISA-60079-6 (12.00.05)-2009, *Explosive Atmospheres, Part 6: equipment protection by oil immersion "o"*; and ANSI/UL 60079-6-2009, *Electrical Apparatus for Explosive Gas Atmospheres — Part 6: Oil-Immersion "o."*

Powder Filling "q." Type of protection where electrical parts capable of igniting an explosive atmosphere are fixed in position and completely surrounded by filling material (glass or quartz powder) to prevent the ignition of an external explosive atmosphere.

Informational Note: See ANSI/ISA-60079-5 (12.00.04)-2009, *Explosive Atmospheres, Part 5: Equipment protection by powder filling "q"*; and ANSI/UL 60079-5-2009, *Electrical Apparatus for Explosive Gas Atmospheres — Part 5: Powder Filling "q."*

Pressurization "p." Type of protection for electrical equipment that uses the technique of guarding against the ingress of the external atmosphere, which may be explosive, into an enclosure by maintaining a protective gas therein at a pressure above that of the external atmosphere.

Informational Note: See ~~ANSI/ISA-60079-2 (12.04.01)-2004, *Explosive Atmospheres, Part 2: Equipment protection by pressurized enclosures "p"*~~; ANSI/ISA-60079-2-2010 (12.04.01), *Explosive Atmospheres, Part 2: Equipment protection by pressurized enclosures "p"* and IEC 60079-13-2010, *Electrical apparatus for explosive gas atmospheres — Part 13: Construction and use of rooms or buildings protected by pressurization*.

Type of Protection "n." Type of protection where electrical equipment, in normal operation, is not capable of igniting a surrounding explosive gas atmosphere and a fault capable of causing ignition is not likely to occur.

Informational Note: See ANSI/UL 60079-15, *Electrical Apparatus for Explosive Gas Atmospheres Part 15: Type of Protection "n"*; and ~~ANSI/ISA-60079-15 (12.12.02)-2008, *Electrical Apparatus for Use in Class I, Zone 2 Hazardous (Classified) Locations: Type of Protection "n."*~~ ANSI/ISA-60079-15-2009 (12.12.02)-2009, *Explosive Atmospheres – Part 15: Equipment protection by type of protection "n"*.

~~**Unclassified Locations.** Locations determined to be neither Class I, Division 1; Class I, Division 2; Class I, Zone 0; Zone 1; Zone 2; Class II, Division 1; Class II, Division 2; Class III, Division 1; Class III, Division 2; or any combination thereof.~~

506.2 Definitions. ~~For purposes of this article, the following definitions apply.~~ Definitions found in this section are specific to this Article.

~~**Associated Nonincendive Field Wiring Apparatus.** Apparatus in which the circuits are not necessarily nonincendive themselves but that affects the energy in nonincendive field wiring circuits and are relied upon to maintain nonincendive energy levels. Associated nonincendive field wiring apparatus may be either of the following:~~

~~(1) Electrical apparatus that has an alternative type of protection for use in the appropriate hazardous (classified) location~~

~~(2) Electrical apparatus not so protected that shall not be used in a hazardous (classified) location~~

~~Informational Note: Associated nonincendive field wiring apparatus has designated associated nonincendive field wiring apparatus connections for nonincendive field wiring apparatus and may also have connections for other electrical apparatus.~~

~~**Combustible Dust.** Any finely divided solid material that is 420 microns (0.017 in.) or smaller in diameter (material passing a U.S. No. 40 Standard Sieve) and presents a fire or explosion hazard when dispersed and ignited in air. [**499:**3.3.3]~~

Dust-Ignitionproof. ~~Equipment enclosed in a manner that excludes dusts and does not permit arcs, sparks, or heat otherwise generated or liberated inside of the enclosure to cause ignition of exterior accumulations or atmospheric suspensions of a specified dust on or in the vicinity of the enclosure.~~

~~Informational Note: For further information on dustignitionproof enclosures, see Type 9 enclosure in ANSI/NEMA 250-1991, *Enclosures for Electrical Equipment*, and ANSI/UL 1203-1994, *Explosionproof and Dust-Ignitionproof Electrical Equipment for Hazardous (Classified) Locations*.~~

~~**Dusttight.** Enclosures constructed so that dust will not enter under specified test conditions.~~

~~**Nonincendive Circuit.** A circuit, other than field wiring, in which any arc or thermal effect produced under intended operating conditions of the equipment, is not capable, under specified test conditions, of igniting the flammable gas–air, vapor–air, or dust–air mixture.~~

~~Informational Note: Conditions are described in ANSI/ISA-12.12.01-2007, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations*.~~

~~**Nonincendive Equipment.** Equipment having electrical/electronic circuitry that is incapable, under normal operating conditions, of causing ignition of a specified flammable gas–air, vapor–air, or dust–air mixture due to arcing or thermal means.~~

~~Informational Note: Conditions are described in ANSI/ISA-12.12.01-2007, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*~~

~~**Nonincendive Field Wiring.** Wiring that enters or leaves an equipment enclosure and, under normal operating conditions of the equipment, is not capable, due to arcing or thermal effects, of igniting the flammable gas–air, vapor–air, or dust–air mixture. Normal operation includes opening, shorting, or grounding the field wiring.~~

~~**Nonincendive Field Wiring Apparatus.** Apparatus intended to be connected to nonincendive field wiring.~~

~~Informational Note: Conditions are described in ANSI/ISA-12.12.01-2007, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*~~

~~**Pressurized.** The process of supplying an enclosure with a protective gas with or without continuous flow at sufficient pressure to prevent the entrance of combustible dust or ignitable fibers/flyings.~~

~~Informational Note: For further information, see ANSI/NFPA 496-2008, *Standard for Purged and Pressurized Enclosures for Electrical Equipment*.~~

Protection by Encapsulation "m~~D~~." Type of protection where electrical parts that could cause ignition of a mixture of combustible dust or fibers/flyings in air are protected by enclosing them in a compound in such a way that the explosive atmosphere cannot be ignited.

Informational Note No. 1: For additional information, see ~~ANSI/ISA-61241-18 (12.10.07)-2006, *Electrical Apparatus for Use in Zone 20, Zone 21 and Zone 22 Hazardous (Classified) Locations — Protection by Encapsulation "mD"*~~ ANSI/ISA-60079-18 (12.23.01)-2009, *Explosive atmospheres - Part 18: Equipment protection by encapsulation "m"*, ANSI/UL 60079-18-2009, *Explosive atmospheres - Part 18: Equipment protection by encapsulation "m"*, and ANSI/ISA-61241-18 (12.10.07)-2011, *Electrical Apparatus for Use in Zone 20, Zone 21 and Zone 22 Hazardous (Classified) Locations — Protection by Encapsulation "mD"*.

Informational Note No. 2: Encapsulation is designated level of protection "maD" or "ma" for use in Zone 20 locations. Encapsulation is designated level of protection "mbD" or "mb" for use in Zone 21 locations. Encapsulation is designated type of protection "mc" for use in Zone 22 locations.

Protection by Enclosure "t~~D~~." Type of protection for explosive dust atmospheres where electrical apparatus is provided with an enclosure providing dust ingress protection and a means to limit surface temperatures.

Informational Note 1: For additional information, see ANSI/ISA-60079-31 (12.10.03)-~~2006~~ 2009, *Explosive Atmospheres – Part 31: Equipment Dust Ignition Protection by Enclosure "t"* ~~ANSI/ISA-61241-0 (12.10.02)-2006, *Electrical Apparatus for Use in Zone 20, Zone 21 and Zone 22 Hazardous (Classified) Locations — General Requirement*~~, and ANSI/ISA-61241-1 (12.10.03)-~~2006~~ 2011, *Electrical Apparatus for Use in Zone 21 and Zone 22 Hazardous (Classified) Locations — Protection by Enclosure "tD"*.

Informational Note No. 2: Protection by Enclosure is designated level of protection "ta" for use in Zone 20 locations. Protection by Enclosure is designated level of protection "tb" or "tD" for use in Zone 21 locations. Protection by Enclosure is designated level of protection "tc" or "tD" for use in Zone 22 locations.

Protection by Intrinsic Safety "iD." Type of protection where any spark or thermal effect is incapable of causing ignition of a mixture of combustible dust, fibers, or flyings in air under prescribed test conditions.

Informational Note: For additional information, see ANSI/ISA-61241-11 (12.10.04), *Electrical Apparatus for Use in Zone 20, Zone 21 and Zone 22 Hazardous (Classified) Locations — Protection by Intrinsic Safety "iD."*

Protection by Pressurization "pD." Type of protection that guards against the ingress of a mixture of combustible dust or fibers/flyings in air into an enclosure containing electrical equipment by providing and maintaining a protective gas atmosphere inside the enclosure at a pressure above that of the external atmosphere.

Informational Note: For additional information, see ANSI/ISA-61241-2 (12.10.06), *Electrical Apparatus for Use in Zone 21 and Zone 22 Hazardous (Classified) Locations — Protection by Pressurization "pD*."

Zone 20 Hazardous (Classified) Location. An area where combustible dust or ignitable fibers/flyings are present continuously or for long periods of time in quantities sufficient to be hazardous, as classified by 506.5(B)(1).

Zone 21 Hazardous (Classified) Location. An area where combustible dust or ignitable fibers/flyings are likely to exist occasionally under normal operation in quantities sufficient to be hazardous, as classified by 506.5(B)(2).

Zone 22 Hazardous (Classified) Location. An area where combustible dust or ignitable fibers/flyings are not likely to occur under normal operation in quantities sufficient to be hazardous, as classified by 506.5(B)(3).

513.2 Definitions. ~~For the purpose of this article, the following definitions shall apply.~~ Definitions found in this section are specific to this Article.

Aircraft Painting Hangar. An aircraft hangar constructed for the express purpose of spray/coating/dipping applications and provided with dedicated ventilation supply and exhaust.

Mobile Equipment. Equipment with electrical components suitable to be moved only with mechanical aids or is provided with wheels for movement by person(s) or powered devices.

Portable Equipment (as applied to Article 513). Equipment with electrical components suitable to be moved by a single person without mechanical aids.

~~**515.2 Definition.**~~

~~**Bulk Plant or Terminal.** That portion of a property where liquids are received by tank vessel, pipelines, tank car, or tank vehicle and are stored or blended in bulk for the purpose of distributing such liquids by tank vessel, pipeline, tank car, tank vehicle, portable tank, or container. [**30:**3.3.32.1]~~

~~Informational Note: For further information, see NFPA 30-2008, *Flammable and Combustible Liquids Code*.~~

516.2 Definitions. ~~For the purpose of this article, the following definitions shall apply.~~ Definitions found in this section are specific to this Article.

Spray Area. Normally, locations outside of buildings or localized operations within a larger room or space. Such are normally provided with some local vapor extraction/ventilation system. In automated operations, the area limits shall be the maximum area in the direct path of spray operations. In manual operations, the area limits shall be the maximum area of spray when aimed at 180 degrees to the application surface.

Spray Booth. An enclosure or insert within a larger room used for spray/coating/dipping applications. A spray booth may be fully enclosed or have open front or face and may include separate conveyor entrance and exit. The spray booth is provided with a dedicated ventilation exhaust but may draw supply air from the larger room or have a dedicated air supply.

Spray Room. A purposefully enclosed room built for spray/coating/dipping applications provided with dedicated ventilation supply and exhaust. Normally the room is configured to house the item to be painted, providing reasonable access around the item/process. Depending on the size of the item being painted, such rooms may actually be the entire building or the major portion thereof.

Substantiation: This comment is the product of the task group request by the TCC (reference Proposal 14-3). The group was appointed by the panel chair Robert Jones. The task group chair is John Simmons. Panel members are: William Lawrence, Edward Briesch, Jack Jamison, Mark Goodman, Larry Burns, and David Wechsler.

The suggested changes resolve the issues surrounding any duplicate or conflicting definitions within the purview of CMP14. The revisions that are made involve relocating any definition used in more than one article (500-516) to 500.2. Definitions specific to any article remain in the article where they are used. Definitions found in Articles 500-516 that are found in articles other than 500-516 have been revised by changing the defined term (i.e. Dusttight (as applied to Hazardous (Classified) Locations)). The reorganization of the Article 500 – 516 definitions will add clarity to the code.

Panel Meeting Action: Accept in Principle

Revise the text found in Sections 500.2, 504.2, 505.2, 506.2, 513.2, 515.2 and 516.2 as follows:

500.2 Definitions. The definitions found in this section are specific to the Hazardous (Classified) Locations found in ~~For purposes of~~ Articles 500 through ~~504 and Articles 510 through~~ 516 ~~the following definitions apply~~. No other section of this Article shall apply to Article 505 or 506 unless it is specifically referenced in that article.

Associated Apparatus. Apparatus in which the circuits are not necessarily intrinsically safe themselves but that affect the energy in the intrinsically safe circuits and are relied on to maintain intrinsic safety. ~~Associated~~ Such apparatus ~~may be either~~ are one of the following:

(1) Electrical apparatus that has an alternative-type of protection for use in the appropriate hazardous (classified) location

(2) Electrical apparatus not so protected that shall not be used within a hazardous (classified) location

Informational Note No. 1: Associated apparatus has identified intrinsically safe connections for intrinsically safe apparatus and also may have connections for nonintrinsically safe apparatus.

Informational Note No. 2: An example of associated apparatus is an intrinsic safety barrier, which is a network designed to limit the energy (voltage and current) available to the protected circuit in the hazardous (classified) location, under specified fault conditions.

Associated Nonincendive Field Wiring Apparatus. Apparatus in which the circuits are not necessarily nonincendive themselves but that affect the energy in nonincendive field wiring circuits and are relied upon to maintain nonincendive energy levels. ~~Associated nonincendive field wiring~~ Such apparatus are one ~~may be either~~ of the following:

(1) Electrical apparatus that has an alternative type of protection for use in the appropriate hazardous (classified) location

(2) Electrical apparatus not so protected that shall not be used in a hazardous (classified) location Informational Note: Associated nonincendive field wiring apparatus has designated associated nonincendive field wiring apparatus connections for nonincendive field wiring apparatus and may also have connections for other electrical apparatus.

~~**Combustible Dust.** Any finely divided solid material that is 420 microns (0.017 in.) or smaller in diameter (material passing a U.S. No. 40 Standard Sieve) and presents a fire or explosion hazard when dispersed and ignited in air. [**499,** 2008]~~

Combustible Dust. Dust particles that are 500 microns or smaller (material passing a U.S. No. 35 Standard Sieve as defined in ASTM E 11, Standard Specification for Wire Cloth and Sieves for Testing Purposes) and present a fire or explosion hazard when dispersed and ignited in air.

Informational Note: See ASTM E 1226, Standard Test Method for Explosibility of Dust Clouds, or ISO 6184-1, Explosion protection systems - Part 1: Determination of explosion indices of combustible dusts in air, for procedures for determining the explosibility of dusts.

Combustible Gas Detection System. A protection technique utilizing stationary gas detectors in industrial establishments.

Control Drawing. A drawing or other document provided by the manufacturer of the intrinsically safe or associated apparatus, or of the nonincendive field wiring apparatus or associated nonincendive field wiring apparatus, that details the allowed interconnections between the intrinsically safe and associated apparatus or between the nonincendive field wiring apparatus or associated nonincendive field wiring apparatus.

Cord Connector. Cord Connector. A fitting intended to terminate a cord to a box or similar device and reduce the strain at points of termination and may include an explosionproof, a dust-ignition proof, or a flameproof seal.

Dust-Ignitionproof. Equipment enclosed in a manner that excludes dusts and does not permit arcs, sparks, or heat otherwise generated or liberated inside of the enclosure to cause ignition of exterior accumulations or atmospheric suspensions of a specified dust on or in the vicinity of the enclosure.

Informational Note: For further information on dustignitionproof enclosures, see Type 9 enclosure in ANSI/NEMA 250-~~1991~~ 2008, *Enclosures for Electrical Equipment*, and ANSI/UL 1203-~~1994~~ 2009, *Explosionproof and Dust-Ignitionproof Electrical Equipment for Hazardous (Classified) Locations*.

Dusttight (as applied to Hazardous (Classified) Locations). Enclosures constructed so that dust will not enter under specified test conditions.

Informational Note: See ~~ANSI/ISA-12.12.01-2007, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*~~ ANSI/ISA-12.12.01-2012, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*

Electrical and Electronic Equipment. Materials, fittings, devices, appliances, and the like that are part of, or in connection with, an electrical installation.

Informational Note: Portable or transportable equipment having self-contained power supplies, such as battery-operated equipment, could potentially become an ignition source in hazardous (classified) locations. See ~~ISA-RP12.12.03-2002, *Recommended Practice for Portable Electronic Products Suitable for Use in Class I and II, Division 2, Zone 2 and Class III, Division 1 and 2 Hazardous (Classified) Locations.*~~ **ANSI/ISA-12.12.03-2011, *Standard for Portable Electronic Products Suitable for Use in Class I and II, Division 2, Zone 2 and Class III, Division 1 and 2 Hazardous (Classified) Locations.***

Explosionproof Equipment (as applied to Hazardous (Classified) Locations). Equipment enclosed in a case that is capable of withstanding an explosion of a specified gas or vapor that may occur within it and of preventing the ignition of a specified gas or vapor surrounding the enclosure by sparks, flashes, or explosion of the gas or vapor within, and that operates at such an external temperature that a surrounding flammable atmosphere will not be ignited thereby.

Informational Note: For further information, see ANSI/UL 1203-~~1994~~ 2009, *Explosion-Proof and Dust- Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations*.

Hermetically Sealed. Equipment sealed against the entrance of an external atmosphere where the seal is made by fusion, for example, soldering, brazing, welding, or the fusion of glass to metal.

~~Informational Note: For further information, see ANSI/ISA-12.12.01-2007, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Division 1 and 2 Hazardous (Classified) Locations.*~~ ANSI/ISA-12.12.01-2012, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*

Intrinsically Safe Apparatus. Apparatus in which all the circuits are intrinsically safe.

Nonincendive Circuit. A circuit, other than field wiring, in which any arc or thermal effect produced under intended operating conditions of the equipment, is not capable, under specified test conditions, of igniting the flammable gas–air, vapor–air, or dust–air mixture.

Informational Note: Conditions are described in ~~ANSI/ISA-12.12.01-2007, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*~~ ANSI/ISA-12.12.01-2012, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*

Nonincendive Component. A component having contacts for making or breaking an incendive circuit and the contacting mechanism is constructed so that the component is incapable of igniting the specified flammable gas–air or vapor–air mixture. The housing of a nonincendive component is not intended to exclude the flammable atmosphere or contain an explosion.

Informational Note: For further information, see ~~ANSI/ISA-12.12.01-2007, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*~~ ANSI/ISA-12.12.01-201**2**, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*

Nonincendive Equipment. Equipment having electrical/electronic circuitry that is incapable, under normal operating conditions, of causing ignition of a specified flammable gas–air, vapor–air, or dust–air mixture due to arcing or thermal means.

Informational Note: For further information, see ~~ANSI/ISA-12.12.01-2007, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*~~ ANSI/ISA-12.12.01-201**2**, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*

Nonincendive Field Wiring. Wiring that enters or leaves an equipment enclosure and, under normal operating conditions of the equipment, is not capable, due to arcing or thermal effects, of igniting the flammable gas–air, vapor–air, or dust–air mixture. Normal operation includes opening, shorting, or grounding the field wiring.

Nonincendive Field Wiring Apparatus. Apparatus intended to be connected to nonincendive field wiring.

Informational Note: For further information, see ~~ANSI/ISA-12.12.01-2007, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*~~ ANSI/ISA-12.12.01-201**2**, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*

Oil Immersion. Electrical equipment immersed in a protective liquid in such a way that an explosive atmosphere that may be above the liquid or outside the enclosure cannot be ignited.

~~Informational Note: For further information, see ANSI/UL 698-1995, *Industrial Control Equipment for Use in Hazardous (Classified) Locations*.~~

Pressurized (as applied to Hazardous (Classified) Locations). The process of supplying an enclosure with a protective gas with or without continuous flow at sufficient pressure to prevent the entrance of combustible dust or ignitable fibers/flyings.

Informational Note: For further information, see ANSI/NFPA 496-2013, *Standard for Purged and Pressurized Enclosures for Electrical Equipment.*

Purged and Pressurized. The process of (1) purging, supplying an enclosure with a protective gas at a sufficient flow and positive pressure to reduce the concentration of any flammable gas or vapor initially present to an acceptable level; and (2) pressurization, supplying an enclosure with a protective gas with or without continuous flow at sufficient pressure to prevent the entrance of a flammable gas or vapor, a combustible dust, or an ignitable fiber.

Informational Note: For further information, see ANSI/NFPA 496-2013~~2008~~, *Purged and Pressurized Enclosures for Electrical Equipment*.

Simple Apparatus. An electrical component or combination of components of simple construction with well defined electrical parameters that does not generate more than 1.5 volts, 100 milliamps, and 25 milliwatts, or a passive component that does not dissipate more than 1.3 watts and is compatible with the intrinsic safety of the circuit in which it is used.

Informational Note: The following apparatus are examples of simple apparatus:

a) Passive components, for example, switches, junction boxes, resistance temperature devices, and simple semiconductor devices such as LEDs
b) Sources of stored energy consisting of single components in simple circuits with well-defined parameters, for example, capacitors or inductors, whose values are considered when determining the overall safety of the system
c) Sources of generated energy, for example, thermocouples and photocells, which do not generate more than 1.5 V, 100 ~~mA~~ milliamps, and 25 ~~mW~~ milliwatts

Unclassified Locations. Locations determined to be neither Class I, Division 1; Class I, Division 2; Class I, Zone 0; Class I, Zone 1; Class I, Zone 2; Class II, Division 1; Class II, Division 2; Class III, Division 1; Class III, Division 2; Zone 20; Zone 21; Zone 22; or any combination thereof.

501.2 Definitions. See 500.2.
502.2 Definitions. See 500.2.
503.2 Definitions. See 500.2.

504.2 Definitions. Definitions found in this section are specific to this Article.

Associated Apparatus. ~~Apparatus in which the circuits are not necessarily intrinsically safe themselves but that affect the energy in the intrinsically safe circuits and are relied on to maintain intrinsic safety. Associated apparatus may be either of the following:~~

~~(1) Electrical apparatus that has an alternative-type protection for use in the appropriate hazardous (classified) location~~
~~(2) Electrical apparatus not so protected that shall not be used within a hazardous (classified) location~~

~~Informational Note No. 1: Associated apparatus has identified intrinsically safe connections for intrinsically safe apparatus and also may have connections for nonintrinsically safe apparatus.~~

~~Informational Note No. 2: An example of associated apparatus is an intrinsic safety barrier, which is a network designed to limit the energy (voltage and current) available to the protected circuit in the hazardous (classified) location, under specified fault conditions.~~

~~**Control Drawing.** See the definition in 500.2.~~

Different Intrinsically Safe Circuits. Intrinsically safe circuits in which the possible interconnections have not been evaluated and identified as intrinsically safe.

~~**Intrinsically Safe Apparatus.** Apparatus in which all the circuits are intrinsically safe.~~

Intrinsically Safe Circuit. A circuit in which any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under prescribed test conditions.

Informational Note: Test conditions are described in ANSI/UL 913-~~1997~~ 2006, *Standard for Safety, Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations*.

Intrinsically Safe System. An assembly of interconnected intrinsically safe apparatus, associated apparatus, and interconnecting cables, in that those parts of the system that may be used in hazardous (classified) locations are intrinsically safe circuits.

Informational Note: An intrinsically safe system may include more than one intrinsically safe circuit.

~~**Simple Apparatus.** An electrical component or combination of components of simple construction with well defined electrical parameters that does not generate more than 1.5 volts, 100 milliamps, and 25 milliwatts, or a passive component that does not dissipate more than 1.3 watts and is compatible with the intrinsic safety of the circuit in which it is used.~~

~~Informational Note: The following apparatus are examples of simple apparatus:~~

d) ~~Passive components, for example, switches, junction boxes, resistance temperature devices, and simple semiconductor devices such as LEDs~~
e) ~~Sources of stored energy consisting of single components in simple circuits with well-defined parameters, for example, capacitors or inductors, whose values are considered when determining the overall safety of the system~~
f) ~~Sources of generated energy, for example, thermocouples and photocells, which do not generate more than 1.5 V, 100 mA, and 25 mW~~

505.2 Definitions. ~~For purposes of this article, the following definitions apply.~~ Definitions found in this section are specific to this Article.

~~**Combustible Gas Detection System.** A protection technique utilizing stationary gas detectors in industrial establishments.~~

~~**Electrical and Electronic Equipment.** Materials, fittings, devices, appliances, and the like that are part of, or in connection with, an electrical installation.~~

~~Informational Note: Portable or transportable equipment having self-contained power supplies, such as battery operated equipment, could potentially become an ignition source in hazardous (classified) locations.~~

Encapsulation "m." Type of protection where electrical parts that could ignite an explosive atmosphere by either sparking or heating are enclosed in a compound in such a way that this explosive atmosphere cannot be ignited.

Informational Note No. 1: See ANSI/ISA-60079-18 (12.23.01)-2009, ~~*Electrical Apparatus for Use in Class I, Zone 1 Hazardous (Classified) Locations, Type of Protection — Encapsulation "m";*~~ *Explosive atmospheres - Part 18: Equipment protection by encapsulation "m",* ~~IEC 0079-18-1992, *Electrical apparatus for explosive gas atmospheres — Part 18: Encapsulation "m";*~~ and ANSI/UL 60079-18~~, *Electrical Apparatus for Explosive Gas Atmospheres — Part 18: Encapsulation "m"*~~ -2009, Explosive atmospheres - Part 18: Equipment protection by encapsulation "m".

Informational Note No. 2: Encapsulation is designated type of protection "ma" for use in Zone 0 locations. Encapsulation is designated type of protection "m" or "mb" for use in Zone 1 locations. Encapsulation is designated type of protection "mc" for use in Zone 2 locations.

Flameproof "d." Type of protection where the enclosure will withstand an internal explosion of a flammable mixture that has penetrated into the interior, without suffering damage and without causing ignition, through any joints or structural openings in the enclosure, of an external explosive gas atmosphere consisting of one or more of the gases or vapors for which it is designed.

Informational Note: See ~~ANSI/ISA-60079-1 (12.22.01)-2008, *Explosive Atmospheres, Part 1: Equipment protection by flameproof enclosures "d";*~~ ANSI/ISA-60079-1-2009 (12.22.01), *Explosive Atmospheres, Part 1: Equipment protection by flameproof enclosures "d"* and ANSI/UL 60079–1-2009, *Electrical Apparatus for Explosive Gas Atmospheres — Part 1: Flameproof Enclosures"d."*

Increased Safety "e." Type of protection applied to electrical equipment that does not produce arcs or sparks in normal service and under specified abnormal conditions, in which additional measures are applied so as to give increased security against the possibility of excessive temperatures and of the occurrence of arcs and sparks.

Informational Note: See ANSI/ISA-60079-7 (12.16.01) - 2008, *Explosive Atmospheres, Part 7: Equipment protection by increased safety "e"*; and ANSI/UL 60079-7 - 2008, *Electrical Apparatus for Explosive Gas Atmospheres — Part 7:Increased Safety "e."*

Intrinsic Safety "i." Type of protection where any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under prescribed test conditions.

Informational Note No. 1: See ANSI/UL 913-~~1997~~ 2006, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Hazardous Locations*; ~~ANSI/ISA-60079-11 (12.02.01)-2009, *Explosive Atmospheres, Part 11: Equipment protection by intrinsic safety "i"*;~~ ANSI/ISA-60079-11-2011 (12.02.01), *Explosive Atmospheres: Part 11: Equipment protection by intrinsic safety"i"* and ANSI/UL 60079-11-2011, *Explosive Atmospheres, Part 11: Equipment protection by intrinsic safety "i."*

Informational Note No. 2: Intrinsic safety is designated type of protection "ia" for use in Zone 0 locations. Intrinsic safety is designated type of protection "ib" for use in Zone 1 locations. Intrinsic safety is designated type of protection "ic" for use in Zone 2 locations.

Informational Note No. 3: Intrinsically safe associated apparatus, designated by [ia], [ib], or [ic], is connected to intrinsically safe apparatus ("ia," "ib," or "ic," respectively) but is located outside the hazardous (classified) location unless also protected by another type of protection (such as flameproof).

Oil Immersion "o." Type of protection where electrical equipment is immersed in a protective liquid in such a way that an explosive atmosphere that may be above the liquid or outside the enclosure cannot be ignited.

Informational Note: See ANSI/ISA-60079-6 (12.00.05)-2009, *Explosive Atmospheres, Part 6: equipment protection by oil immersion "o"*; and ANSI/UL 60079-6-2009, *Electrical Apparatus for Explosive Gas Atmospheres — Part 6: Oil-Immersion "o."*

Powder Filling "q." Type of protection where electrical parts capable of igniting an explosive atmosphere are fixed in position and completely surrounded by filling material (glass or quartz powder) to prevent the ignition of an external explosive atmosphere.

Informational Note: See ANSI/ISA-60079-5 (12.00.04)-2009, *Explosive Atmospheres, Part 5: Equipment protection by powder filling "q"*; and ANSI/UL 60079-5-2009, *Electrical Apparatus for Explosive Gas Atmospheres — Part 5: Powder Filling "q."*

Pressurization "p." Type of protection for electrical equipment that uses the technique of guarding against the ingress of the external atmosphere, which may be explosive, into an enclosure by maintaining a protective gas therein at a pressure above that of the external atmosphere.

Informational Note: See ~~ANSI/ISA-60079-2 (12.04.01)-2004, *Explosive Atmospheres, Part 2: Equipment protection by pressurized enclosures "p"*;~~ ANSI/ISA-60079-2-2010 (12.04.01), *Explosive Atmospheres, Part 2: Equipment protection by pressurized enclosures "p"* and IEC 60079-13-2010, *Electrical apparatus for explosive gas atmospheres — Part 13: Construction and use of rooms or buildings protected by pressurization*.

Type of Protection "n." Type of protection where electrical equipment, in normal operation, is not capable of igniting a surrounding explosive gas atmosphere and a fault capable of causing ignition is not likely to occur.

Informational Note: See ANSI/UL 60079-15, *Electrical Apparatus for Explosive Gas Atmospheres Part 15: Type of Protection "n"*; and ~~ANSI/ISA-60079-15 (12.12.02)-2008, *Electrical Apparatus for Use in Class I, Zone 2 Hazardous (Classified) Locations: Type of Protection "n."*~~ ANSI/ISA-60079-15-2009 (12.12.02)-2009, *Explosive Atmospheres – Part 15: Equipment protection by type of protection "n".*

~~**Unclassified Locations.** Locations determined to be neither Class I, Division 1; Class I, Division 2; Class I, Zone 0; Zone 1; Zone 2; Class II, Division 1; Class II, Division 2; Class III, Division 1; Class III, Division 2; or any combination thereof.~~

506.2 Definitions. ~~For purposes of this article, the following definitions apply.~~ Definitions found in this section are specific to this Article.

~~**Associated Nonincendive Field Wiring Apparatus.** Apparatus in which the circuits are not necessarily nonincendive themselves but that affects the energy in nonincendive field wiring circuits and are relied upon to maintain nonincendive energy levels. Associated nonincendive field wiring apparatus may be either of the following:~~

~~(1) Electrical apparatus that has an alternative type of protection for use in the appropriate hazardous (classified) location~~

~~(2) Electrical apparatus not so protected that shall not be used in a hazardous (classified) location~~

~~Informational Note: Associated nonincendive field wiring apparatus has designated associated nonincendive field wiring apparatus connections for nonincendive field wiring apparatus and may also have connections for other electrical apparatus.~~

~~**Combustible Dust.** Any finely divided solid material that is 420 microns (0.017 in.) or smaller in diameter (material passing a U.S. No. 40 Standard Sieve) and presents a fire or explosion hazard when dispersed and ignited in air. [**499:**3.3.3]~~

~~**Dust-Ignitionproof.** Equipment enclosed in a manner that excludes dusts and does not permit arcs, sparks, or heat otherwise generated or liberated inside of the enclosure to cause ignition of exterior accumulations or atmospheric suspensions of a specified dust on or in the vicinity of the enclosure.~~

~~Informational Note: For further information on dustignitionproof enclosures, see Type 9 enclosure in ANSI/NEMA 250-1991, *Enclosures for Electrical Equipment*, and ANSI/UL 1203-1994, *Explosionproof and Dust-Ignitionproof Electrical Equipment for Hazardous (Classified) Locations*.~~

~~**Dusttight.** Enclosures constructed so that dust will not enter under specified test conditions.~~

~~**Nonincendive Circuit.** A circuit, other than field wiring, in which any arc or thermal effect produced under intended operating conditions of the equipment, is not capable, under specified test conditions, of igniting the flammable gas–air, vapor–air, or dust–air mixture.~~

~~Informational Note: Conditions are described in ANSI/ISA-12.12.01-2007, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations*.~~

~~**Nonincendive Equipment.** Equipment having electrical/electronic circuitry that is incapable, under normal operating conditions, of causing ignition of a specified flammable gas–air, vapor–air, or dust–air mixture due to arcing or thermal means.~~

~~Informational Note: Conditions are described in ANSI/ISA-12.12.01-2007, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*~~

~~**Nonincendive Field Wiring.** Wiring that enters or leaves an equipment enclosure and, under normal operating conditions of the equipment, is not capable, due to arcing or thermal effects, of igniting the flammable gas–air, vapor–air, or dust–air mixture. Normal operation includes opening, shorting, or grounding the field wiring.~~

~~**Nonincendive Field Wiring Apparatus.** Apparatus intended to be connected to nonincendive field wiring.~~

~~Informational Note: Conditions are described in ANSI/ISA-12.12.01-2007, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.*~~

~~**Pressurized.** The process of supplying an enclosure with a protective gas with or without continuous flow at sufficient pressure to prevent the entrance of combustible dust or ignitable fibers/flyings.~~

~~Informational Note: For further information, see ANSI/NFPA 496-2008, *Standard for Purged and Pressurized Enclosures for Electrical Equipment*.~~

Protection by Encapsulation "m~~D~~." Type of protection where electrical parts that could cause ignition of a mixture of combustible dust or fibers/flyings in air are protected by enclosing them in a compound in such a way that the explosive atmosphere cannot be ignited.

Informational Note No. 1: For additional information, see ~~ANSI/ISA-61241-18 (12.10.07)-2006, *Electrical Apparatus for Use in Zone 20, Zone 21 and Zone 22 Hazardous (Classified) Locations — Protection by Encapsulation "mD"*~~ ANSI/ISA-60079-18 (12.23.01)-2009, *Explosive atmospheres - Part 18: Equipment protection by encapsulation "m"*, ANSI/UL 60079-18-2009, *Explosive atmospheres - Part 18: Equipment protection by encapsulation "m"*, and ANSI/ISA-61241-18 (12.10.07)-2011, *Electrical Apparatus for Use in Zone 20, Zone 21 and Zone 22 Hazardous (Classified) Locations — Protection by Encapsulation "mD"*.

Informational Note No. 2: Encapsulation is designated level of protection "maD" or "ma" for use in Zone 20 locations. Encapsulation is designated level of protection "mbD" or "mb" for use in Zone 21 locations. Encapsulation is designated type of protection "mc" for use in Zone 22 locations.

Protection by Enclosure "t~~D~~." Type of protection for explosive dust atmospheres where electrical apparatus is provided with an enclosure providing dust ingress protection and a means to limit surface temperatures.

Informational Note 1: For additional information, see ANSI/ISA-60079-31 (12.10.03)-~~2006~~ 2009, *Explosive Atmospheres – Part 31: Equipment Dust Ignition Protection by Enclosure "t"* ~~ANSI/ISA-61241-0 (12.10.02)-2006, *Electrical Apparatus for Use in Zone 20, Zone 21 and Zone 22 Hazardous (Classified) Locations — General Requirement*~~, and ANSI/ISA-61241-1 (12.10.03)-~~2006~~ 2011, *Electrical Apparatus for Use in Zone 21 and Zone 22 Hazardous (Classified) Locations — Protection by Enclosure "tD"*.

Informational Note No. 2: Protection by Enclosure is designated level of protection "ta" for use in Zone 20 locations. Protection by Enclosure is designated level of protection "tb" or "tD" for use in Zone 21 locations. Protection by Enclosure is designated level of protection "tc" or "tD" for use in Zone 22 locations.

Protection by Intrinsic Safety "iD." Type of protection where any spark or thermal effect is incapable of causing ignition of a mixture of combustible dust, fibers, or flyings in air under prescribed test conditions.

Informational Note: For additional information, see ANSI/ISA-61241-11 (12.10.04), *Electrical Apparatus for Use in Zone 20, Zone 21 and Zone 22 Hazardous (Classified) Locations — Protection by Intrinsic Safety "iD."*

Protection by Pressurization "pD." Type of protection that guards against the ingress of a mixture of combustible dust or fibers/flyings in air into an enclosure containing electrical equipment by providing and maintaining a protective gas atmosphere inside the enclosure at a pressure above that of the external atmosphere.

Informational Note: For additional information, see ANSI/ISA-61241-2 (12.10.06), *Electrical Apparatus for Use in Zone 21 and Zone 22 Hazardous (Classified) Locations — Protection by Pressurization "pD."*

Zone 20 Hazardous (Classified) Location. An area where combustible dust or ignitable fibers/flyings are present continuously or for long periods of time in quantities sufficient to be hazardous, as classified by 506.5(B)(1).

Zone 21 Hazardous (Classified) Location. An area where combustible dust or ignitable fibers/flyings are likely to exist occasionally under normal operation in quantities sufficient to be hazardous, as classified by 506.5(B)(2).

Zone 22 Hazardous (Classified) Location. An area where combustible dust or ignitable fibers/flyings are not likely to occur under normal operation in quantities sufficient to be hazardous, as classified by 506.5(B)(3).

513.2 Definitions. ~~For the purpose of this article, the following definitions shall apply.~~ Definitions found in this section are specific to this Article.

Aircraft Painting Hangar. An aircraft hangar constructed for the express purpose of spray/coating/dipping applications and provided with dedicated ventilation supply and exhaust.

Mobile Equipment. Equipment with electrical components suitable to be moved only with mechanical aids or is provided with wheels for movement by person(s) or powered devices.

Portable Equipment (as applied to Article 513. Equipment with electrical components suitable to be moved by a single person without mechanical aids.

~~515.2 Definition.~~

~~Bulk Plant or Terminal. That portion of a property where liquids are received by tank vessel, pipelines, tank car, or tank vehicle and are stored or blended in bulk for the purpose of distributing such liquids by tank vessel, pipeline, tank car, tank vehicle, portable tank, or container. [**30:**3.3.32.1]~~

~~Informational Note: For further information, see NFPA 30-2008, *Flammable and Combustible Liquids Code*.~~

516.2 Definitions. ~~For the purpose of this article, the following definitions shall apply.~~ Definitions found in this section are specific to this Article.

Flash-Off Area. An open or enclosed area after a spray application process where vapors are released due to exposure to ambient air or a heated atmosphere. [33:3.3.1.1]

Limited Finishing Workstation. An apparatus that is capable of confining the vapors, mists, residues, dusts, or deposits that are generated by a spray application process and that meets the requirements of Section 14.3 of NFPA 33, *Standard for Spray Application Using Flammable or Combustible Materials*, but does not meet the requireme: ents of a spray booth or spray room, as herein defined. [33:3.3.15.1]

Resin Application Area. Any area in which polyester resins or gelcoats are spray applied. [33:3.3.1.2]

Spray Area. Any fully enclosed, partly enclosed, or unenclosed area in which ignitable quantities of flammable or combustible vapors, mists, residues, dusts, or deposits are present due to the operation of spray processes, including

(1) any area in the direct path of a spray application process;

(2) the interior of a spray booth or spray room or limited finishing workstation, as herein defined;

(3) the interior of any exhaust plenum, eliminator section, or scrubber section;

(4) the interior of any exhaust duct or exhaust stack leading from a spray application process;

(5) the interior of any air recirculation filter house or enclosure, including secondary recirculation particulate filters;

(6) any solvent concentrator (pollution abatement) unit or solvent recovery (distillation) unit.

The following are not considered to be a part of the spray area:

(1) fresh air make-up units;

(2) air supply ducts and air supply plenums;

(3) recirculation air supply ducts downstream of secondary filters; (4) exhaust ducts from solvent concentrator (pollution abatement) units. [33: 3.3.2.3]

Informational Note: Unenclosed spray areas are ~~normally~~ locations outside of buildings or are localized operations within a larger room or space. Such are normally provided with some local vapor extraction/ventilation system. In automated operations, the area limits are ~~shall be~~ the maximum area in the direct path of spray operations. In manual operations, the area limits are the maximum area of spray when aimed at ~~180~~ 90 degrees to the application surface.

Spray Booth. A power-ventilated enclosure for a spray application operation or process that confines and limits the escape of the material being sprayed, including vapors, mists, dusts, and residues that are produced by the spraying operation and conducts or directs these materials to an exhaust system. [33:3.3.14]

Informational Note: A spray booth is an enclosure or insert within a larger room used for spray/coating/dipping applications. A spray booth may be fully enclosed or have open front or face and may include separate conveyor entrance and exit. The spray booth is provided with a dedicated ventilation exhaust but may draw supply air from the larger room or have a dedicated air supply.

Spray Room. A power-ventilated fully enclosed room ysed exclusively for open spraying of flammable or combustible materials. A spray room is a purposefully enclosed room built for spray/coating/dipping applications provided with dedicated ventilation supply and exhaust. Normally the room is configured to house the item to be painted, providing reasonable access around the item/process. Depending on the size of the item being painted, such rooms may actually be the entire building or the major portion thereof. [33:3.3.15]

Unenclosed Spray Area. Any spray area that is not confined by a limited finishing workstation, spray booth, or spray room, as herein defined. [33:3.3.2.3.2]

Also, change the edition date of NFPA 496 from 2008 to 2013 wherever NFPA 496 is referenced in Chapter 5.

Panel Statement: CMP-14 has reorganized the definitions in Article 500 through 516, as directed by the Correlating Committee. CMP-14 notes that the amended text reflects other actions taken by the panel, as reflected elsewhere in the ROC. These include the actions on Comments 14-4, 14-6, 14-34, 14-51, 14-52, 14-54, 14-55, and 14-67.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 12 Negative: 2

Explanation of Negative:

MCBRIDE, W.: IEEE statement opposing the panel action:

The term "cord connector" should not be defined as CMP14 has accepted. The term cord connector is commonly used in the field to describe a wiring device that is connected to a cord. Wiring device manufacturer's websites indicate that cord connectors are used to describe wiring devices. Other locations in the NEC use the term cord connector where referring to a wiring device and 626.2 actually defines it as such. Using the same term to define different items in the NEC should not be done, is inconsistent, will create confusion and likely misinterpretation of the associated requirements.

The term fitting as suggested by a commenter includes the concept of it primarily performing a mechanical function. If CMP14 does not like the use of the term fitting then a different term should be chosen, although Article 400 uses the term fitting when referring to products used to secure cords to enclosures.

Users of Chapter 5 are not exempt from the requirements in Chapters 1 through 4, Chapter 5 requirements can supplement or modify the general rules.

WECHSLER, D.: [1] Defined Term 'Cord Connector'. This issue needs to be addressed by the NEC Correlating Committee.

As stated in 90.3 Chapter 5 Articles can supplement or modify the general rules but Chapters 1 through 4 apply except as amended by Chapter 5 for the particular conditions. Cord Connector is a term commonly used to describe a wiring device and is used that way in wiring device manufacturers publications. Additionally the term cord connector is used in 210.50 as a wiring device and even defined that way in 626.2.

The term fitting is typically used in Article 400 to describe a product that is used secure cords and cables to enclosures. It is also presently used that way in portions of Chapter 5 for both cords and cables.

The term cord connector or anything similar should not be re-defined in Chapter 5 to mean something different than what it does in the rest of the NEC. Some product standards do not appear to use constant terminology related to this issue and it is better to revise those to be consistent with the NEC not create confusion and inconsistency within the NEC.

A better approach is to modify the sections in Chapter 5, such as 501.140, related to flexible cord terminations to state that fittings that include strain relief are required for securing cords to enclosures.

This problem began in the 2011 NEC when CMP14 used the term cord connector for what the industry refers to as a fitting.

[2] Other definitions located in 500.2 and modified with additional language "(as applied to Hazardous (Classified) Locations)." This issue also needs to be addressed by the NEC Correlating Committee.

CMP 14 chose to copy some definitions that are presently in Article 100, add the additional language (as applied to Hazardous (Classified) Locations) and locate them in 500.2. It appears that other wording changes were also sometimes made. Some definitions would now appear in Article 100 and in 500.2. For example Dusttight (as applied to Hazardous (Classified) Locations) will be in 500.2 and Dusttight will be in Article 100, each with slightly different wording. This was apparently done to have definitions in 500.2 that were used in Articles 500 through 516. Why is there a need to have a different definition or a duplicated definition other than to get around the provision that if a term is used in more than one article it can be located in Article 100. Who now has the responsibility for the definitions in Article 100 with slightly different wording? This is likely to create confusion and should not be permitted.

14-2 Log #885 NEC-P14 **Final Action: Reject**

(500.2, 501.140(B)(4), 502.140(B)(4), 503.140(B)(4), 505.2, 505.17(5), 506.2, 506.17(5))

Submitter: David Wechsler, American Chemical Council

Comment on Proposal No: 14-11b

Recommendation: Do not add a new definition to 500.2, 505.2 and 506.2 reading:

~~Cord Connector. A fitting intended to terminate a cord to a box or similar device and reduce the strain at points of termination and may include an explosionproof, a dust ignition proof, or a flameproof seal.~~

Under 501.140 (B) (4) change cord connector to cord fitting as shown below:

(4) In Division 1 locations or in Division 2 locations where the boxes, fittings, or enclosures are required to be explosionproof, the cord shall be terminated with a cord fitting ~~connector~~ or attachment plug listed for the location or a cord fitting ~~connector~~ installed with a seal listed for the location. In Division 2 locations where explosionproof equipment is not required, the cord shall be terminated with a listed cord fitting ~~connector~~ or listed attachment plug.

Under 502.140 (B) (4) change cord connector to fitting as shown below:

(4) In Division 1 locations, the cord shall be terminated with a cord fitting ~~connector~~ listed for the location or a listed cord fitting ~~connector~~ installed with a seal listed for the location. In Division 2 locations, the cord shall be terminated with a listed dusttight cord fitting ~~connector~~.

Under 503.140 (B) (4) change cord connector to fitting as shown below:

(4) Be terminated with a listed dusttight cord fitting ~~connector~~.

Under 505.17(5) change cord connector to fitting as shown below:

(5) Be terminated with a listed cord fitting ~~connector~~ that maintains the type of protection where the flexible cord enters boxes, fittings, or enclosures that are required to be explosionproof or flameproof.

Under 506.17(5) change cord connector to fitting as shown below:

(5) Be terminated with a listed cord fitting ~~connector~~ that maintains the protection technique of the terminal compartment.

NOTE: Separate comments were submitted for each of the respective sections shown above to comply with the Style Manual.

Substantiation: This proposal was offered to attempt to correct the incorrect use of the term ‘connector’. However the action taken simply makes this problem more unclear as the term ‘cord connector’ is not appropriate in this case and a different term that includes the word “fitting” should be used as part of the term, not to describe something different. The action addressed in the proposed text revisions provides appropriate solutions.

ANSI/UL 514B is not limited for use in hazardous (classified) areas. The term fitting is widely used in UL product standards to refer to these and other types of products that are used to secure wiring methods and cords to equipment. The actual title of UL 514B uses the term fittings, not connectors “Conduit, Tubing, and Cable Fittings”. Section 1.2 of UL 514B uses the phrase “fittings for flexible cord” Interestingly 1.4 states “These requirements do not cover FITTINGS intended for use in hazardous locations as defined in the National Electrical Code, ANSI/NFPA 70, the Canadian Electrical Code (CEC), Part I, CSA C22.1, and the Standard for Electrical Installations, NOM-001-SEDE.”

The term cord connector is used in other places in the NEC as a wiring device such as in 210.50(A) where it permits a “cord connector” to be considered a receptacle outlet. Section 626.2 defines a cord connector as a device for establishing a connection. The term fitting is commonly used in the NEC and product standards related to flexible cords products that are attached to enclosures. Section 400.7(B) uses the term cord connector body as device used to energize an attachment plug.

The term “cord fitting” as indicated should be used in sections 501.140(B)(4), 502.140(4), 503.140(4), 505.17(5), 506.17(5) and anywhere else the term is used to describe the fitting.

As presently used in these articles the term cord connector is confusing whether the term is defined differently (for no good reason) or not. The term “cord connector” is commonly used in the field to describe a wiring device that is connected to a cord.

Users of Chapter 5 are not exempt from the requirements in Chapters 1 through 4, chapter 5 requirements can supplement or modify the general rules but creating using the same term to define different items should not be done and will create confusion and likely misinterpretation of the associated requirements.

The term “fitting” is used in many other NEC sections to describe the product used to secure a cord to an enclosure.

Panel Meeting Action: Reject

Panel Statement: The definition of “connector” in UL 514B includes cord and cable, but the definition of “fitting” does not include cord. For this reason, CMP-14 affirms that the definition for the term “cord connector” is appropriate and does not agree that it should be replaced by the term “fitting”. The term “fitting” is defined in Article 100 and is a generic term that includes locknuts and bushings. The use of the term “connector” emphasizes the need to provide strain relief at the point of termination of the cord and the need to reduce the risk of the termination being compromised due to excess strain on the connection. The use of the term “cord connector”, without the definition, does not make the strain relief requirement explicit.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 12 Negative: 2

Explanation of Negative:

MCBRIDE, W.: IEEE statement opposing the panel action:

The term “cord connector” should not be defined as CMP14 has accepted. The term cord connector is commonly used in the field to describe a wiring device that is connected to a cord. Wiring device manufacturer’s websites indicate that cord connectors are used to describe wiring devices. Other locations in the NEC use the term cord connector where referring to a wiring device and 626.2 actually defines it as such. Using the same term to define different items in the NEC should not be done, is inconsistent, will create confusion and likely misinterpretation of the associated requirements.

The term fitting as suggested by a commenter includes the concept of it primarily performing a mechanical function. If CMP14 does not like the use of the term fitting then a different term should be chosen, although Article 400 uses the term fitting when referring to products used to secure cords to enclosures.

Users of Chapter 5 are not exempt from the requirements in Chapters 1 through 4, Chapter 5 requirements can supplement or modify the general rules.

WECHSLER, D.: See my negative comment related to “[1] cord connector” in Comment 14-1. This issue needs to be addressed by the NEC Correlating Committee.

Additionally, the Panel Statement states “CMP-14 affirms that the definition for the term ‘cord connector’ {presented in Comment 14-1} is appropriate and does not agree that it should be replaced by the term ‘fitting’.” However the Comment 14-1 term “cord connector” is defined as a ‘fitting’ as follows: “Cord Connector. A fitting intended to terminate a cord to a box or similar device and reduce the strain at points of termination and may include an explosionproof, a dust-ignition proof, or a flameproof seal.” Therefore since the term ‘fitting’ is used in many other NEC sections to describe the product used to secure a cord to an enclosure, rather than creating different terms within the NEC, perhaps it is the product standard which needs to be revised accordingly and not one chapter of the NEC.

14-3 Log #891 NEC-P14 **Final Action: Reject**
(500.2, 501.140(B)(4), 502.140(B)(4), 503.140(B)(4), 505.2, 505.17(5), 506.2, and 506.17(5))

Submitter: David Wechsler, American Chemical Council

Comment on Proposal No: 14-11b

Recommendation: Do not add a new definition to 500.2, 505.2 and 506.2 reading:

~~Cord Connector. A fitting intended to terminate a cord to a box or similar device and reduce the strain at points of termination and may include an explosionproof, a dust ignition proof, or a flameproof seal.~~

Under 501.140 (B) (4) change cord connector to cord fitting as shown below:

(4) In Division 1 locations or in Division 2 locations where the boxes, fittings, or enclosures are required to be explosionproof, the cord shall be terminated with a cord fitting ~~connector~~ or attachment plug listed for the location or a cord fitting ~~connector~~ installed with a seal listed for the location. In Division 2 locations where explosionproof equipment is not required, the cord shall be terminated with a listed cord fitting ~~connector~~ or listed attachment plug.

Under 502.140 (B) (4) change cord connector to fitting as shown below:

(4) In Division 1 locations, the cord shall be terminated with a cord fitting ~~connector~~ listed for the location or a listed cord fitting ~~connector~~ installed with a seal listed for the location. In Division 2 locations, the cord shall be terminated with a listed dusttight cord fitting ~~connector~~.

Under 503.140 (B) (4) change cord connector to fitting as shown below:

(4) Be terminated with a listed dusttight cord fitting ~~connector~~.

Under 505.17(5) change cord connector to fitting as shown below:

(5) Be terminated with a listed cord fitting ~~connector~~ that maintains the type of protection where the flexible cord enters boxes, fittings, or enclosures that are required to be explosionproof or flameproof.

Under 506.17(5) change cord connector to fitting as shown below:

(5) Be terminated with a listed cord fitting ~~connector~~ that maintains the protection technique of the terminal compartment.

NOTE: Separate comments were submitted for each of the respective sections shown above to comply with the Style Manual.

Substantiation: This proposal was offered to attempt to correct the incorrect use of the term ‘connector’. However the action taken simply makes this problem more unclear as the term ‘cord connector’ is not appropriate in this case and a different term that includes the word “fitting” should be used as part of the term, not to describe something different. The action addressed in the proposed text revisions provides appropriate solutions.

ANSI/UL 514B is not limited for use in hazardous (classified) areas. The term fitting is widely used in UL product standards to refer to these and other types of products that are used to secure wiring methods and cords to equipment. The actual title of UL 514B uses the term fittings, not connectors “Conduit, Tubing, and Cable Fittings”. Section 1.2 of UL 514B uses the phrase “fittings for flexible cord” Interestingly 1.4 states “These requirements do not cover FITTINGS intended for use in hazardous locations as defined in the National Electrical Code, ANSI/NFPA 70, the Canadian Electrical Code (CEC), Part I, CSA C22.1, and the Standard for Electrical Installations, NOM-001-SEDE.”

The term cord connector is used in other places in the NEC as a wiring device such as in 210.50(A) where it permits a “cord connector” to be considered a receptacle outlet. Section 626.2 defines a cord connector as a device for establishing a connection. The term fitting is commonly used in the NEC and product standards related to flexible cords products that are attached to enclosures. Section 400.7(B) uses the term cord connector body as device used to energize an attachment plug.

The term “cord fitting” as indicated should be used in sections 501.140(B)(4), 502.140(4), 503.140(4), 505.17(5), 506.17(5) and anywhere else the term is used to describe the fitting.

As presently used in these articles the term cord connector is confusing whether the term is defined differently (for no good reason) or not. The term "cord connector" is commonly used in the field to describe a wiring device that is connected to a cord.

Users of Chapter 5 are not exempt from the requirements in Chapters 1 through 4, chapter 5 requirements can supplement or modify the general rules but creating using the same term to define different items should not be done and will create confusion and likely misinterpretation of the associated requirements.

The term "fitting" is used in many other NEC sections to describe the product used to secure a cord to an enclosure.

Panel Meeting Action: Reject

Panel Statement: The definition of "connector" in UL 514B includes cord and cable, but the definition of "fitting" does not include cord. For this reason, CMP-14 affirms that the definition for the term "cord connector" is appropriate and does not agree that it should be replaced by the term "fitting". The term "fitting" is defined in Article 100 and is a generic term that includes locknuts and bushings. The use of the term "connector" emphasizes the need to provide strain relief at the point of termination of the cord and the need to reduce the risk of the termination being compromised due to excess strain on the connection. The use of the term "cord connector", without the definition, does not make the strain relief requirement explicit.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 12 Negative: 2

Explanation of Negative:

MCBRIDE, W.: IEEE statement opposing the panel action:

The term "cord connector" should not be defined as CMP14 has accepted. The term cord connector is commonly used in the field to describe a wiring device that is connected to a cord. Wiring device manufacturer's websites indicate that cord connectors are used to describe wiring devices. Other locations in the NEC use the term cord connector where referring to a wiring device and 626.2 actually defines it as such. Using the same term to define different items in the NEC should not be done, is inconsistent, will create confusion and likely misinterpretation of the associated requirements.

The term fitting as suggested by a commenter includes the concept of it primarily performing a mechanical function. If CMP14 does not like the use of the term fitting then a different term should be chosen, although Article 400 uses the term fitting when referring to products used to secure cords to enclosures.

Users of Chapter 5 are not exempt from the requirements in Chapters 1 through 4, Chapter 5 requirements can supplement or modify the general rules.

WECHSLER, D.: See my negative ballot comment related to "[1] cord connector" in Comment 14-1 and Comment 14-2.

14-4 Log #1178 NEC-P14 **Final Action: Accept**
(500.2)

Submitter: Eliana Brazda, ISA

Comment on Proposal No: 14-10

Recommendation: Revise text to read as follows:

ANSI/ISA-12.12.01-201~~1~~2, Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.

Substantiation: Change the ISA standards date of publication to the current publication date.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-5 Log #489 NEC-P14 **Final Action: Reject**
(500.2.Combustible Dust)

Submitter: Marcelo M. Hirschler, GBH International

Comment on Proposal No: 14-11a

Recommendation: Revise text to read as follows:

Combustible Dust. Finely divided solid particles that present a dust fire or dust explosion hazard when dispersed and ignited in air. (499-2013)

~~**Combustible Dust.** Any finely divided solid material that is 420 microns (0.017 in.) or smaller in diameter (material passing a U.S. No. 40 Standard Sieve) and presents a fire or explosion hazard when dispersed and ignited in air. [**499,** 2008]~~

Substantiation: Standards Council issued 499-2013 and it includes the updated definition of "combustible dust" as indicated in this comment. This definition was adopted as a result of a successful NITMAM at the June 2012 Annual Meeting and the resulting Standards Council decision D#12-13 upholding the action of the assembly. The NEC should adopt the updated definition of a key concept.

The existing definition in the NEC (and the proposed definition in the ROP) contains requirements that are unacceptable in NEC definitions. Note that the NEC TCC highlights one of the problems with the ROP proposed definition (use of ASTM and ISO standards).

Panel Meeting Action: Reject

Panel Statement: Acceptance of this comment would create confusion for users of the Code because there are multiple NFPA definitions for what constitutes a combustible dust, as found in NFPA 61, *Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities*; NFPA 499, *Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*; NFPA 654, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing*; and their respective annexes. See CMP-14's action on Comment 14-6 for its resolution to this problem.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-6 Log #573 NEC-P14 **Final Action: Accept in Principle**
(500.2.Combustible Dust)

TCC Action: See Correlating Committee Action on Comment 14-1.
Note: When the ballot result does not confirm the TC action on a Proposal by a two-thirds affirmative vote, the Report on Proposals shall be published with a specific request for public comment on that Proposal. The Proposal is now being reconsidered by the TC as a public comment.

Submitter: Code-Making Panel 14,

Comment on Proposal No: 14-11a

Recommendation: In 500.2 replace the current definition of Combustible Dust with the following:

Combustible Dust. Dust particles of 500 microns or smaller (material passing a U.S. No. 35 Standard Sieve as defined in ASTM E 11, Standard Specification for Wire Cloth and Sieves for Testing Purposes) are considered to present a dust fire or dust explosion hazard unless determined otherwise. (See ASTM E 1226 or ISO 6184/1). [499:3.3.3]

Substantiation: Definition is extracted from NFPA 499 and the definition in the 2012 Edition of NFPA 499 has been revised.

Panel Meeting Action: Accept in Principle

Replace the current definition of Combustible Dust in 500.2 with the following:

Combustible Dust. Dust particles that are 500 microns or smaller (material passing a U.S. No. 35 Standard Sieve as defined in ASTM E 11, Standard Specification for Wire Cloth and Sieves for Testing Purposes) and present a fire or explosion hazard when dispersed and ignited in air.

Informational Note: See ASTM E 1226, Standard Test Method for Explosibility of Dust Clouds, or ISO 6184-1, Explosion protection systems - Part 1: Determination of explosion indices of combustible dusts in air, for procedures for determining the explosibility of dusts.

Panel Statement: CMP-14 has adopted a new definition for combustible dust because the definition published in NFPA 499, *Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*, 2013 is not usable for an enforceable Code. The particle size in this new definition is specified as 500 microns to harmonize with national and international area classification standards and their annexes. The reference previously incorporated in the proposed definition has been moved to an Informational Note, in accordance with the National Electrical Code Style Manual. In adopting this new definition, CMP-14 affirms that particle size is necessary to properly classify and to not overclassify a location where combustible dust is present. See also the panel statement to Comment 14-5.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-7 Log #898 NEC-P14 **Final Action: Reject**
(500.2.Electrical and Electronic Equipment)

Submitter: David Wechsler, American Chemical Council

Comment on Proposal No: 14-111

Recommendation: Revise the definition of Electrical and Electronic Equipment as follows:

Electrical and Electronic Equipment. Materials, fittings, devices, appliances, and the like that are part of, or in connection with, an electrical installation, or portable or transportable equipment having self-contained power supplies, such as battery-operated equipment, which could potentially become an ignition source in hazardous (classified) locations.

FPN: ~~Portable or transportable equipment having self-contained power supplies, such as battery-operated equipment, could potentially become an ignition source in hazardous (classified) locations.~~ See ISA-RP12.12.03-2002, Portable Electronic Products Suitable for Use in Class I and II, Division 2, Class I Zone 2 and Class III, Division 1 and 2 Hazardous (Classified) Locations.

Substantiation: This comment was developed on the basis of existing texts in the current NEC and the CMP-14 Technical substantiation to Proposal Log 14-111 Log #1754 stating in part "The proposed language belongs in a product standard, not in an installation Code." While an argument may be made that overall the intent of the NEC is to address installations, as in the general requirements of Chapters 1-4, Chapter 5 addresses special occupancies and these encompass a different scope. The NEC Chapter 5 states "500.1 Scope — Articles 500 Through 504

Articles 500 through 504 cover the requirements for electrical and electronic equipment and wiring for all voltages in Class I, Divisions 1 and 2; Class II, Divisions 1 and 2; and Class III, Divisions 1 and 2 locations where fire or explosion hazards may exist due to flammable gases, flammable liquid–

produced vapors, combustible liquid–produced vapors, combustible dusts, or ignitible fibers/flyings."

This scope does not state 'installation only'. Additionally the defined equipment protection methods say nothing about the designs being only for fixed/connected by cord or cable installations or usage and not applicable to portable or transportable equipment having power supplies.

If the position of the Panel is that portables and transportable having self contained power supplies are not addressed under Chapter 5, then where are the requirements and the protection designs for portable electrical/electronic equipment found? What basis can there be to have portable devices marked in accordance with the requirements of the NEC, if the NEC has no requirements? How can listings/approvals be made for unregulated equipment designs?

The revision provided addresses this important issue. Please also see the NEC structure as contained on page 5 (Figure 90.3) of the 2011 NEC Handbook which properly reflects that Chapter 5 is either supplements or modifies the basic Chapters 1-4 of the NEC with the requirement in Chapter 5 beginning with essentially locations shall be classified… for electrical and electronic equipment and wiring for all voltages in Class I,.... where fire or explosion hazards may exist..:

Panel Meeting Action: Reject

Panel Statement: The NEC is an installation document that does not address equipment having self-contained power supplies. Chapter 5 addresses special occupancies and can modify Chapters 1 through 4; however, it cannot modify the scope of Article 90.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13 Negative: 1

Explanation of Negative:

WECHSLER, D.: This issue of "hazardous area classification" and "installation" needs to be reviewed by the NEC Correlating Committee to address the hazardous classified location requirement found in Article 500 and the validity of the Panel Statement that "Chapter 5 addresses special occupancies and can modify Chapters 1 through 4; however, it cannot modify the scope of Article 90."

Essentially the critical issue is does the hazardous area classification requirement found in Article 500.1 Scope, only apply to the '90-2 Scope covered installations' or does it apply as a 90.3 modification or supplement to the location containing electrical and electronic equipment and wiring for all voltages as determined to exist in Class I, Divisions 1 and 2; Class II, Divisions 1 and 2; and Class III, Divisions 1 and 2 locations where fire or explosion hazards may exist due to flammable gases, flammable liquid - produced vapors, combustible liquid -produced vapors, combustible dusts, or ignitible fibers/flyings?

The Committee as evidenced by the FPN found under 500.2, has for some time recognized that portable or transportable equipment having self contained power supplies, such as battery operated equipment, could potentially become an ignition source in hazardous classified locations which are those hazardous classified locations defined within this Article. This then infers that the hazardous area classification applies to the location and not just the installation. The hazardous area classification would be applicable to portable or transportable equipment used. The design of this equipment could be addressed in other standards.

Therefore as a minimum the Panel Statement should be revised to include a statement that the special hazards potentially associated with locations addressed by the hazardous area classification found in the Scope of 500.1 is required.

Comment on Affirmative:

SIMMONS, J.: My support of the panel action on this comment does not indicate that portable equipment used in Hazardous (Classified) Locations should not be evaluated for fire or explosion hazards that may exist in the location. All portable electrical and electronic equipment used in hazardous locations should be evaluated to determine that such use is safe and does not pose a hazard. I am in full agreement with the panel statement.

14-8 Log #1599 NEC-P14 **Final Action: Accept**
(500.4(B), Informational Note 2)

Submitter: Mark Goodman, Mark Goodman Electrical Consulting
Comment on Proposal No: 14-14
Recommendation: Revise text to read as follows:

ANSI/API RP500 ~~1997~~ 2012, *Recommended Practice for Classification of Locations of Electrical Installations at Petroleum Facilities Classified as Class I, Division I and Division 2.*

Substantiation: This and the companion Comment propose to update the date references to ANSI/API RP 500. The latest edition of ANSI/API RP 500 has been approved and released by API.

Panel Meeting Action: Accept

Panel Statement: API RP500 has been fully balloted and is pending release. It is anticipated to be released before the end of 2012.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-9 Log #1600 NEC-P14 **Final Action: Accept**
(500.4(B), Informational Note 4)

Submitter: Mark Goodman, Mark Goodman Electrical Consulting
Comment on Proposal No: 14-15
Recommendation: Revise text to read as follows:

ANSI/API RP500 ~~1997~~ 2012, *Recommended Practice for Classification of Locations of Electrical Installations at Petroleum Facilities Classified as Class I, Division I and Division 2.*

Substantiation: This and the companion Comment propose to update the date references to ANSI/API RP 500. The latest edition of ANSI/API RP 500 has been approved and released by API.

Panel Meeting Action: Accept

Panel Statement: API RP500 has been fully balloted and is pending release. It is anticipated to be released before the end of 2012.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

ARTICLE 501 — CLASS 1 LOCATIONS

14-10 Log #313 NEC-P14 **Final Action: Accept**
(501.10(A)(1)(e))

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 14-32
Recommendation: Revise text to read as follows:

(e) ~~Fiber~~ Optical fiber cables ~~of the~~ types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in raceways as stated in 501.10(A). These ~~Fiber Optic~~ optical fiber cables shall be sealed in accordance with 501.15.

Substantiation: This is an editorial comment. Terminology should be consistent throughout the code. Article 770 covers optical fiber cables not fiber optic cables. There are many places this change needs to be made to correlate with Article 770.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-11 Log #1343 NEC-P14 **Final Action: Accept in Principle**
(501.10(A)(1)(e) (New))

Submitter: William E. McBride, Northern Electric Company
Comment on Proposal No: 14-33
Recommendation: Modify existing Text:

(I) General. In Class I, Division I locations, the wiring methods in (a) through (e) shall be permitted.

Add new text

(g) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the
installation, and where the cable is not subject to physical damage listed Type TC-ER-HL Cable, up to I inch in diameter, that complies with the crush and impact
requirements of Type MC HL cable, and is identified for such use with the marking Type TC-ER-HL shall be permitted. The cable shall contain separate equipment
bonding conductor(s) in accordance with 250.122, and terminated with fittings listed for the application. Type TC-ER-HL Cable shall be installed in accordance with
the provisions of TC-ER Cable in Article 336.

Substantiation: Existing small diameter MC-HL cables that arc run between enclosures and instruments are easily kinked during initial installation and routine maintenance. The risk
of ignition is not from the middle of cables, but from the devices and terminations of cables where the conductor is exposed.

If the Code Making panel thinks it necessary they might further restrict the circuit voltage of these TGER-J-IL Cables to be restricted to less than half of the conductor
insulation voltage rating. The application is mostly for 24 volt instrumentation, but may also include some 120 volt utilization devices, yet the cable is rated for 600
volts.

Panel Meeting Action: Accept in Principle

Revise the suggested text as shown below and relocate to 501.10(A)(2):

501.10(A)(2) Flexible Connections. Where necessary to employ flexible connections, as at motor terminals, the following shall be permitted:

(a) flexible fittings listed for the location or

(b) flexible cord in accordance with the provisions of 501.140 terminated with cord connectors listed for the location ~~shall be permitted~~ or

(c) in industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, for applications limited to 600 volts nominal or less, and where protected from damage by location or a suitable guard, listed Type

TC-ER-HL cable with an overall jacket and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the location.

Panel Statement: CMP-14 has determined that this issue can be addressed in a manner similar to that which has been used to address Comment 14-43. However, CMP-14 has relocated the new text to 501.10(A)(2) to limit its usage to those locations where flexibility is required. As the wiring method is only allowed for flexible connections, the requirement to install the cable in accordance with Article 336 has been removed. The “1 in. or less” restriction has been removed because motor conductors are often larger in size. The prior text has been editorially amended to accommodate the new text.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

Comment on Affirmative:

BRIESCH, E.: The recorded panel action does not accurately reflect the intent of the Panel. The original intent of the introduction of Type TC-ER-HL cable in Comment 14-43 was for Type TC-ER-HL cable to be permitted in Zone 1 locations and be listed for Zone 1 locations. This concept was then broadened by the submitter of Comment 14-11 and the Panel Action on Comment 14-11 to permit its use in Division 1 locations when there is a need for flexibility. When restricted to installation per 501.10(A)(2) only, listing Type TC-ER-HL cable for Division 1 is unnecessary. It should be noted that flexible cord as permitted in 501.10(A)(2)(b) is not required to be listed for Division 1 locations. The panel action should read as follows:

Revise the suggested text as shown below and relocate to 501.10(A)(2):

501.10(A)(2) Flexible Connections. Where necessary to employ flexible connections, as at motor terminals, the following shall be permitted:

(a) flexible fittings listed for the location or

(b) flexible cord in accordance with the provisions of 501.140 terminated with cord connectors listed for the location

~~shall be permitted~~ or

(c) in industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, for applications limited to 600 volts nominal or less, and where protected from damage by location or a suitable guard, listed Type TC-ER-HL cable with an overall jacket and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the location.

LAWRENCE, JR., W.: The recorded panel action does not accurately reflect the intent of the Panel. The original intent of the introduction of Type TC-ER-HL cable in Comment 14-43 was for Type TC-ER-HL cable to be permitted in Zone 1 locations and be listed for Zone 1 locations. This concept was then broadened by the submitter of Comment 14-11 and the Panel Action on Comment 14-11 to permit its use in Division 1 locations when there is a need for flexibility. When restricted to installation per 501.10(A)(2) only, listing Type TC-ER-HL cable for Division 1 is unnecessary. It should be noted that flexible cord as permitted in 501.10(A)(2)(b) is not required to be listed for Division 1 locations. The panel action should read as follows:

Revise the suggested text as shown below and relocate to 501.10(A)(2):

501.10(A)(2) Flexible Connections. Where necessary to employ flexible connections, as at motor terminals, the following shall be permitted:

(a) flexible fittings listed for the location or

(b) flexible cord in accordance with the provisions of 501.140 terminated with cord connectors listed for the location~~ shall be permitted or~~

(c) in industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, for applications limited to 600 volts nominal or less, and where protected from damage by location or a suitable guard, listed Type TC-ER-HL cable with an overall jacket and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the location.

MASSEY, L.: The recorded panel action does not accurately reflect the intent of the Panel. The original intent of the introduction of Type TC-ER-HL cable in Comment 14-43 was for Type TC-ER-HL cable to be permitted in Zone 1 locations and be listed for Zone 1 locations. This concept was then broadened by the submitter of Comment 14-11 and the Panel Action on Comment 14-11 to permit its use in Division 1 locations when there is a need for flexibility. When restricted to installation per 501.10(A)(2) only, listing Type TC-ER-HL cable for Division 1 is unnecessary. It should be noted that flexible cord as permitted in 501.10(A)(2)(b) is not required to be listed for Division 1 locations. The panel action should read as follows:

Revise the suggested text as shown below and relocate to 501.10(A)(2):

501.10(A)(2) Flexible Connections. Where necessary to employ flexible connections, as at motor terminals, the following shall be permitted:

(a) flexible fittings listed for the location or

(b) flexible cord in accordance with the provisions of 501.140 terminated with cord connectors listed for the location

~~shall be permitted~~ or

(c) in industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, for applications limited to 600 volts nominal or less, and where protected from damage by location or a suitable guard, listed Type TC-ER-HL cable with an overall jacket and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the location.

MCBRIDE, W.: The language needs to be modified to avoid a conflict with the TC-ER-HL requirements for Class I, Zone 1 installations and the UL Standard 2225. The cable will not be listed for Division 1 locations, but only for Zone 1 locations. Without revision the cable will not be able to be listed for Zone 1 locations if it is over 1 inch diameter.

The proposed text should be modified as follows:

(c) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, for applications limited to 600 volts or less, and where protected from damage by location or a suitable guard, Type TC-ER-HL Cable, listed for use in Class I, ~~Division~~ Zone1 locations with an overall jacket and a separate equipment bonding conductor(s) in accordance with 250.122, and terminated with fittings listed for the location.

14-12 Log #314 NEC-P14 **Final Action: Accept**
(501.10(B)(1)(7))

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.

Comment on Proposal No: 14-37

Recommendation: Revise text to read as follows:

~~Fiber~~ Optical fiber cables~~ of the~~ types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in cable trays or any other raceway as stated in 501.10(B). ~~Fiber~~ Optical fiber cables shall be sealed in accordance with 501.15.

Substantiation: This is an editorial comment. Terminology should be consistent throughout the code. Article 770 covers optical fiber cables not fiber optic cables. There are many places this change needs to be made to correlate with Article 770.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-13 Log #183 NEC-P14 **Final Action: Accept**
(501.10(B)(2), 501.10(B)(2)(6)(New))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 14-37a

Recommendation: The Correlating Committee directs that the panel reconsider the language in this proposal and Proposal 14-38 and correlate the language.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Revise text to read as follows:

(2) Flexible Connections. Where provision must be made for flexibility, one or more of the following shall be permitted:

(1) Listed flexible metal fittings.

(2) Flexible metal conduit with listed fittings.

(3) Interlocked armor Type MC cable with listed fittings.

(4) Liquidtight flexible metal conduit with listed fittings.

(5) Liquidtight flexible nonmetallic conduit with listed fittings.

(6) Flexible cord listed for extra-hard usage and terminated with listed fittings. A conductor for use as an equipment grounding conductor shall be included in the flexible cord.

(7) For elevator use, an identified elevator cable, type EO, ETP, or ETT, and as shown under the “use” column in Table 400.4 for “Hazardous (classified) locations” and terminated with listed fittings.

Informational Note: See 501.30(B) for grounding requirements where flexible conduit is used.

Panel Statement: CMP-14 affirms the revisions made in Proposals 14-37a and 14-38 and as shown in the draft of the 2014 NEC. The revised section, as presented in the draft is shown here.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-14 Log #184 NEC-P14 **Final Action: Accept**
(501.10(B)(2))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 14-38

Recommendation: The Correlating Committee directs that the panel reconsider the language in this proposal and Proposal 14-37a and correlate the language.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

See panel action on Comment 14-13.

Panel Statement: See panel statement on Comment 14-13.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-15 Log #185 NEC-P14 **Final Action: Accept**
(501.15(A)(4))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 14-44
Recommendation: The Correlating Committee directs the panel to review the entire text of 501.15 for consistency with respect to using complete sentences.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise 501.15 as follows:
501.15 Sealing and Drainage. Seals in conduit and cable systems shall comply with 501.15(A) through (F). Sealing compound shall be used in Type MI cable termination fittings to exclude moisture and other fluids from the cable insulation.
Informational Note No. 1: Seals are provided in conduit and cable systems to minimize the passage of gases and vapors and prevent the passage of flames from one portion of the electrical installation to another through the conduit. Such communication through Type MI cable is inherently prevented by construction of the cable. Unless specifically designed and tested for the purpose, conduit and cable seals are not intended to prevent the passage of liquids, gases, or vapors at a continuous pressure differential across the seal. Even at differences in pressure across the seal equivalent to a few inches of water, there may be a slow passage of gas or vapor through a seal and through conductors passing through the seal. ~~See 501.15(E)(2).~~ Temperature extremes and highly corrosive liquids and vapors can affect the ability of seals to perform their intended function. ~~See 501.15(C)(2).~~
Informational Note No. 2: Gas or vapor leakage and propagation of flames may occur through the interstices between the strands of standard stranded conductors larger than 2 AWG. Special conductor constructions~~, for example,~~ such as compacted strands or sealing of the individual strands~~,~~ are means of reducing leakage and preventing the propagation of flames.
(A) Conduit Seals, Class I, Division 1. In Class I, Division 1 locations, conduit seals shall be located in accordance with 501.15(A)(1) through (A)(4).
(1) Entering Enclosures. ~~In each~~ Each conduit entry into an explosionproof enclosure shall have a conduit seal where either~~ of the following apply~~:
(1)~~ The~~ the enclosure contains apparatus, such as switches, circuit breakers, fuses, relays, or resistors~~,~~ that may produce arcs, sparks, or ~~high~~ temperatures that exceed 80 percent of the auto ignition temperature, in degrees Celsius, of the gas or vapor involved ~~that are considered to be an ignition source~~ in normal operation~~.~~
Exception to 501.15(A)(1)(1): Seals shall not be required for conduit entering an enclosure ~~where such switches, circuit breakers, fuses, relays, or resistors comply with one of the following:~~ under any one of the following conditions:
(1) ~~Are~~ The switch, circuit breaker, fuse, relay or resistor is enclosed within a chamber hermetically sealed against the entrance of gases or vapors
(2) ~~Are~~ The switch, circuit breaker, fuse, relay or resistor is immersed in oil in accordance with 501.115(B)(1)(2)
(3) ~~Are~~ The switch, circuit breaker, fuse, relay or resistor is enclosed within a factory-sealed explosionproof chamber located within the enclosure, identified for the location, and marked "factory sealed" or equivalent, ~~unless the enclosure entry is metric designator 53 (trade size 2) or larger~~
(4) ~~Are~~ The switch, circuit breaker, fuse, relay or resistor is part of a ~~in~~ nonincendive circuit~~s~~.
(2) ~~The~~ the entry is metric designator 53 (trade size 2) or larger and the enclosure contains terminals, splices, or taps.
~~For the purposes of this section, high temperatures shall be considered to be any temperatures exceeding 80 percent of the auto ignition temperature in degrees Celsius of the gas or vapor involved.~~
~~Exception to 501.15(A)(1)(1): Seals shall not be required for conduit entering an enclosure where such switches, circuit breakers, fuses, relays, or resistors comply with one of the following: under any of the following conditions.~~
Factory-sealed enclosures shall not be considered to serve as a seal for another adjacent explosionproof enclosure that is required to have a conduit seal.
Conduit seals shall be installed within 450 mm (18 in.) from the enclosure. Only explosionproof unions, couplings, reducers, elbows, capped elbows, and conduit bodies similar to L, T, and Cross types that are not larger than the trade size of the conduit shall be permitted between the sealing fitting and the explosionproof enclosure.
(2) Pressurized Enclosures. Conduit seals shall be installed within 450 mm (18 in.) of the enclosure in ~~In~~ each conduit entry into a pressurized enclosure where the conduit is not pressurized as part of the protection system. ~~Conduit seals shall be installed within 450 mm (18 in.) from the pressurized enclosure.~~
Informational Note No. 1: Installing the seal as close as possible to the enclosure will reduce problems with purging the dead airspace in the pressurized conduit.
Informational Note No. 2: For further information, see NFPA 496-2013, *Standard for Purged and Pressurized Enclosures for Electrical Equipment.*
(3) Two or More Explosionproof Enclosures. Where two or more explosionproof enclosures ~~for~~ which require conduit seals ~~are required under 501.15(A)(1)~~ are connected by nipples or ~~by~~ runs of conduit not more than 900 mm (36 in.) long, a single conduit seal in each such nipple connection or run of conduit shall be considered sufficient if the seal is located not more than 450 mm (18 in.) from either enclosure.
(4) Class I, Division 1 Boundary. A conduit seal shall be required in ~~In~~ each conduit run leaving a ~~Class I,~~ Division 1 location. The sealing fitting shall be permitted to be installed on either side of the boundary ~~of such location~~ within 3.05 m (10 ft) of the boundary and it shall be designed and installed ~~so as~~ to minimize the amount of gas or vapor within the ~~Division 1~~ portion of the conduit installed in the Division 1 location ~~from being~~ that can be communicated ~~to the conduit~~ beyond the seal. The conduit run between the conduit seal and the point at which the conduit leaves the Division 1 location shall contain no union, coupling, box or other fitting except for a listed explosionproof reducer installed at the conduit seal. ~~Except for listed explosionproof reducers at the conduit seal, there shall be no union, coupling, box, or fitting between the conduit seal and the point at which the conduit leaves the Division 1 location.~~
Exception No. 1: Metal conduit that contains no unions, couplings, boxes, or fittings, ~~and~~ that passes completely through a ~~Class I,~~ Division 1 location with no fittings installed within ~~less than~~ 300 mm (12 in.) ~~beyond each~~ of either side of the boundary, shall not require a conduit seal if the termination points of the unbroken conduit are located in unclassified locations.
Exception No. 2: For underground conduit installed in accordance with 300.5 where the boundary is below grade, the sealing fitting shall be permitted to be installed after the conduit emerges from below grade, but there shall be no union, coupling, box, or fitting, other than listed explosionproof reducers at the sealing fitting, in the conduit between the sealing fitting and the point at which the conduit emerges from below grade
(B) Conduit Seals, Class I, Division 2. In Class I, Division 2 locations, conduit seals shall be located in accordance with 501.15(B)(1) and (B)(2).
(1) Entering Enclosures. For connections to enclosures that are required to be explosionproof, a conduit seal shall be provided in accordance with 501.15(A)(1)(1) and (A)(3). All portions of the conduit run or nipple between the seal and ~~such~~ enclosure shall comply with 501.10(A).
(2) Class I, Division 2 Boundary. A conduit seal shall be required in ~~In~~ each conduit run leaving a Class I, Division 2 location. The sealing fitting shall be permitted to be installed on either side of the boundary ~~of such location~~ within 3.05 m (10 ft) of the boundary and it shall be designed and installed ~~so as~~ to minimize the amount of gas or vapor within the ~~Division 1~~ portion of the conduit installed in the Division 2 location ~~from being~~ that can be communicated ~~to the conduit~~ beyond the seal. Rigid metal conduit or threaded steel intermediate metal conduit shall be used between the sealing fitting and the point at which the conduit leaves the Division 2 location, and a threaded connection shall be used at the sealing fitting. The conduit run between the conduit seal and the point at which the conduit leaves the Division 2 location shall contain no union, coupling, box or other fitting except for a listed explosionproof reducer installed at the conduit seal. ~~In each conduit run passing from a Class I, Division 2 location into an unclassified location. The sealing fitting shall be permitted on either side of the boundary of such location within 3.05 m (10 ft) of the boundary. Rigid metal conduit or threaded steel intermediate metal conduit shall be used between the sealing fitting and the point at which the conduit leaves the Division 2 location, and a threaded connection shall be used at the sealing fitting. Except for listed reducers at the conduit seal, there shall be no union, coupling, box, or fitting between the conduit seal and the point at which the conduit leaves the Division 2 location. Conduits shall be sealed to minimize the amount of gas or vapor within the Division 2 portion of the conduit from being communicated to the conduit beyond the seal.~~ Such seals shall not be required to be explosionproof but shall be identified for the purpose of minimizing the passage of gases to the rate permitted for seal fittings [200 cm3/hr (0.007 ft3/hr) of air at a pressure of 1500 pascals (6 in. of water)] ~~permitted~~ under normal operating conditions and shall be accessible.
Informational Note: For further information, refer to ANSI/UL 514B-2012, Conduit, Tubing, and Cable Fittings.
Exception No. 1: Metal conduit that contains no unions, couplings, boxes, or fittings, ~~and~~ that passes completely through a ~~Class I,~~ Division 2 location with no fittings installed within ~~less than~~ 300 mm (12 in.) ~~beyond each~~ of either side of the boundary, shall not be required to be sealed if the termination points of the unbroken conduit are located in unclassified locations.
Exception No. 2: Conduit systems terminating ~~at~~ in an unclassified location where ~~a wiring method~~ the metal conduit transitions ~~is made~~ to cable tray, cablebus, ventilated busway, Type MI cable, or to cable not installed in any cable tray or raceway system shall not be required to be sealed where passing from the ~~Class I,~~ Division 2 location into the unclassified location under the following conditions. ~~The unclassified location shall be outdoors or, if the conduit system is all in one room, it shall be permitted to be indoors. The unclassified location shall be~~ is ~~outdoors or, if the conduit system is all in one room, it shall be permitted to be indoors.~~

(1). The unclassified location ~~shall be~~ is outdoors or, the unclassified location is indoors and ~~if~~ the conduit system is all in one room, ~~it shall be permitted to be indoors.~~

(2). The conduits shall not terminate at an enclosure containing an ignition source in normal operation.

Exception No. 3: Conduit systems passing from an enclosure or a room that is unclassified, as a result of pressurization, into a ~~Class I,~~ Division 2 location shall not require a seal at the boundary.

Informational Note: For further information, refer to NFPA 496-2008, *Standard for Purged and Pressurized Enclosures for Electrical Equipment*.

Exception No. 4: Segments of aboveground conduit systems shall not be required to be sealed where passing from a ~~Class I,~~ Division 2 location into an unclassified location if all of the following conditions are met:

(1). No part of the conduit system segment passes through a ~~Class I,~~ Division 1 location where the conduit segment contains unions, couplings, boxes, or fittings that are located within 300 mm (12 in.) of the ~~Class I,~~ Division 1 location.

(2). The conduit system segment is located entirely in outdoor locations.

(3). The conduit system segment is not directly connected to canned pumps, process or service connections for flow, pressure, or analysis measurement, and so forth, that depend on a single compression seal, diaphragm, or tube to prevent flammable or combustible fluids from entering the conduit system.

(4). The conduit system segment contains only threaded metal conduit, unions, couplings, conduit bodies, and fittings in the unclassified location.

(5). The conduit system segment is sealed at its entry to each enclosure or fitting ~~housing~~ located in the ~~Class I,~~ Division 2 location that contains terminals, splices, or taps ~~in Class I, Division 2 locations~~.

(C) Class I, Divisions 1 and 2. Seals installed in Class I, Division 1 and Division 2 locations shall comply with 501.15(C)(1) through (C)(6).

Exception: Seals that are not required to be explosionproof by 501.15(B)(2) or 504.70 shall not be required to comply.

(1) Fittings. Enclosures ~~for~~ that contain connections or equipment shall be provided with an integral ~~means for~~ sealing means, or sealing fittings listed for the location shall be used. Sealing fittings shall be listed for use with one or more specific compounds and shall be accessible.

(2) Compound. The compound shall provide a seal ~~against~~ to minimize the passage of gas and/or vapors through the sealing fitting, and shall not be affected by the surrounding atmosphere or liquids~~,~~. ~~and~~ The melting point of the compound shall not ~~have a melting point of~~ be less than 93°C (200°F).

(3) Thickness of Compounds. The thickness of the sealing compound installed in completed seals, ~~except for~~ other than listed cable sealing fittings ~~Except for listed cable sealing fittings, the thickness of the sealing compound in a completed seal~~ shall not be less than the metric designator (trade size) of the sealing fitting expressed in the units of measurement employed~~, and~~ however in no case shall the thickness of the compound be less than 16 mm (5⁄8 in.).

(4) Splices and Taps. Splices and taps shall not be made in fittings intended only for sealing with compound, nor shall other fittings in which splices or taps are made be filled with compound.

(5) Assemblies. ~~In an~~ An entire assembly shall be identified for the location where the equipment that may produce arcs, sparks, or high temperatures is located in a compartment that is separate from the compartment containing splices or taps, and an integral seal is provided where conductors pass from one compartment to the other~~, the entire assembly shall be identified for the location~~. ~~Seals~~. In ~~Class I,~~ Division 1 locations, seals shall be provided in conduit ~~connections~~ connecting to the compartment containing splices or taps ~~shall be provided in Class I, Division 1 locations~~ where required by 501.15(A)(1)(2).

(6) Conductor or Optical Fiber Fill. The cross-sectional area of the conductors or optical fiber tubes (metallic or nonmetallic) permitted in a seal shall not exceed 25 percent of the cross-sectional area of a rigid metal conduit of the same trade size unless ~~it~~ the seal is specifically identified for a higher percentage of fill.

(D) Cable Seals, Class I, Division 1. In ~~Class I,~~ Division 1 locations, cable seals shall be located according to 501.15(D)(1) through (D)(3).

(1) At Terminations. Cables shall be sealed with sealing fittings that comply with 501.15(C) at all terminations. ~~The sealing fitting shall comply with 501.15(C). Multiconductor~~ Type MC-HL cables with a gas/vaportight continuous corrugated metallic sheath and an overall jacket of suitable polymeric material shall be sealed with a listed fitting after ~~removing~~ the jacket and any other covering has been removed so that the sealing compound can surround~~s~~ each individual insulated conductor in such a manner as to minimize the passage of gases and vapors.

Exception: Shielded cables and twisted pair cables shall not require the removal of the shielding material or separation of the twisted pairs, provided the termination is sealed by an approved means to minimize the entrance of gases or vapors and prevent propagation of flame into the cable core.

(2) Cables Capable of Transmitting Gases or Vapors.

Cables ~~in conduit~~ with a gas/vaportight continuous sheath capable of transmitting gases or vapors through the cable core, installed in conduit, shall be sealed in the Class I, Division 1 location after ~~removing~~ the jacket and any other coverings has been removed so that the sealing compound ~~will~~ can surround each individual insulated conductor or optical fiber tube and the outer jacket.

Exception: Multiconductor cables with a gas/vaportight continuous sheath capable of transmitting gases or vapors through the cable core shall be permitted to be considered as a single conductor by sealing the cable in the conduit within 450 mm (18 in.) of the enclosure and the cable end within the enclosure by an approved means to minimize the entrance of gases or vapors and prevent the propagation of flame into the cable core, or by other approved methods. ~~For shielded cables and twisted pair cables, it~~ It shall not be required to remove the shielding material or separate the twisted pairs ~~for~~ of shielded cables and twisted pair cables.

(3) Cables Incapable of Transmitting Gases or Vapors.

Each multiconductor cable installed in conduit shall be considered as a single conductor if the cable is incapable of transmitting gases or vapors through the cable core. These cables shall be sealed in accordance with 501.15(A).

(E) Cable Seals, Class I, Division 2. In ~~Class I,~~ Division 2 locations, cable seals shall be located in accordance with 501.15(E)(1) through (E)(4).

Exception: Cables with an unbroken gas/vaportight continuous sheath shall be permitted to pass through a Division 2 location without seals.

(1)Terminations. Cables entering enclosures that are required to be explosionproof shall be sealed at the point of entrance. The sealing fitting shall comply with 501.15(B)(1) or be explosionproof. Multiconductor or optical multifiber cables with a gas/vaportight continuous sheath capable of transmitting gases or vapors through the cable core that are installed in a Division 2 location shall be sealed ~~in~~ with a listed fitting ~~in the Division 2 location~~ after ~~removing~~ the jacket and any other coverings have been removed so that the sealing compound can surround~~s~~ each individual insulated conductor or optical fiber tube in such a manner as to minimize the passage of gases and vapors. Multiconductor or optical multifiber cables installed in conduit shall be sealed as described in 501.15(D).

Exception No. 1: Cables ~~passing from~~ leaving an enclosure or room that is unclassified as a result of Type Z pressurization and entering into a ~~Class I,~~ Division 2 location shall not require a seal at the boundary.

Exception No. 2: Shielded cables and twisted pair cables shall not require the removal of the shielding material or separation of the twisted pairs, provided the termination is by an approved means to minimize the entrance of gases or vapors and prevent propagation of flame into the cable core.

(2) Cables That Do Not Transmit Gases or Vapors. Cables that have a gas/vaportight continuous sheath and do not transmit gases or vapors through the cable core in excess of the quantity permitted for seal fittings shall not be required to be sealed except as required in 501.15(E)(1). The minimum length of such a cable run shall not be less than ~~that~~ the length ~~that~~ needed to limit~~s~~ gas or vapor flow through the cable core, not including the interstices of the conductor strands, to the rate permitted for seal fittings ~~[~~200 cm3/hr (0.007 ft3/hr) of air at a pressure of 1500 pascals (6 in. of water)].

~~Informational Note: The cable core does not include the interstices of the conductor strands.~~

(3) Cables Capable of Transmitting Gases or Vapors. Cables with a gas/vaportight continuous sheath capable of transmitting gases or vapors through the cable core shall ~~not be required to~~ be sealed ~~except~~ as required in 501.15(E)(1), unless the cable is attached to process equipment or devices that may cause a pressure in excess of 1500 pascals (6 in. of water) to be exerted at a cable end, in which case a seal, barrier, or other means shall be provided to prevent migration of flammables into an unclassified location.

~~*Exception: Cables with an unbroken gas/vaportight continuous sheath shall be permitted to pass through a Class I, Division 2 location without seals.*~~

(4) Cables Without Gas/Vaportight Sheath. Cables that do not have gas/vaportight continuous sheath shall be sealed at the boundary of the Division 2 and unclassified location in such a manner as to minimize the passage of gases or vapors into an unclassified location.

(F) Drainage.

(1) Control Equipment. Where there is a probability that liquid or other condensed vapor may be trapped within enclosures for control equipment or at any point in the raceway system, approved means shall be provided to prevent accumulation or to permit periodic draining of such liquid or condensed vapor.

(2) Motors and Generators. Where ~~the authority having jurisdiction judges that there is a probability that~~ liquid or condensed vapor may accumulate within motors or generators, joints and conduit systems shall be arranged to minimize the entrance of liquid. If means to prevent accumulation or to permit periodic draining are ~~judged~~ necessary, such means shall be provided at the time of manufacture and shall be considered an integral part of the machine.

Panel Statement: CMP-14 has reviewed and editorially revised the entirety of 501.15 to comply with the directive of the Correlating Committee. The revised text shown here also incorporates amendments effected via Comments 14-16 and 14-17.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-16 Log #449 NEC-P14 **Final Action: Accept in Principle in Part**

(501.15(B)(2))

Submitter: William Fiske, Intertek

Comment on Proposal No: 14-46

Recommendation: Reverse CMP-14 action on Proposal 14-46 and return to the language in NEC 2011.

Substantiation: The authority having jurisdiction would not be able to determine whether or not a seal complies with the proposed requirements, as AHJs do not possess the equipment or the expertise needed to test seals in the field. As stated in NEC 90.7, [listing] "avoids the necessity for repetition of examinations by different examiners, frequently with inadequate facilities for such work …" Adding a leak rate specification for seals would create a de facto requirement for listing, yet the submitter's substantiation does not indicate that listing of seals is necessary. Note also that the existing language of 501.15(A)(4), covering seals at a Class I Division 1 boundary, does not include a requirement for listed seals, does not contain a leak rate specification, and none has been proposed for 501.15(A)(4).

Panel Meeting Action: Accept in Principle in Part

Revise the last sentence of 501.15(B)(2) to read:

Such seals shall not be required to be explosionproof but shall be identified for the purpose of minimizing the passage of gases ~~to the rate permitted for seal fittings [200 cm3/hr (0.007 ft3/hr) of air at a pressure of 1500 pascals (6 in. of water)]~~ permitted under normal operating conditions and shall be accessible.

Informational Note: For further information, refer to ANSI/UL 514B-2012, Conduit, Tubing, and Cable Fittings.

Panel Statement: CMP-14 affirms that the requirements for these types of seals need to be identified for the user and has created an Informational Note to reference the proper ANSI standard that addresses the requirements for the intended application.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-17 Log #186 NEC-P14 **Final Action: Accept**

(501.15(E)(1))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 14-50

Recommendation: The Correlating Committee directs the panel to reconsider Proposals 14-50 and 14-51 which were accepted with conflicting text in the second sentence of (1).

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Revise Section 501.15(E)(1) to read as follows:

(1) Terminations. Cables entering enclosures that are required to be explosionproof shall be sealed at the point of entrance. The sealing fitting shall comply with 501.15(B)(1) or be explosionproof. Multiconductor or optical multifiber cables with a gas/vaportight continuous sheath capable of transmitting gases or vapors through the cable core that are installed in a Division 2 location shall be sealed with a listed fitting after the jacket and any other coverings have been removed so that the sealing compound can surround each individual insulated conductor or optical fiber tube in such a manner as to minimize the passage of gases and vapors. Multiconductor or optical multifiber cables installed in conduit shall be sealed as described in 501.15(D).

Panel Statement: CMP-14 affirms the revisions made in Proposals 14-50 and 14-51 and as shown in the draft of the 2014 NEC, as shown here.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-18 Log #187 NEC-P14 **Final Action: Accept**

(501.15(E)(1))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 14-51

Recommendation: The Correlating Committee directs the panel to reconsider Proposals 14-50 and 14-51 which were accepted with conflicting text in the second sentence of (1).

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

See panel action on Comment 14-17.

Panel Statement: See panel statement on Comment 14-17.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-19 Log #374 NEC-P14 **Final Action: Accept**

(501.30)

Submitter: Robert A. Jones, Independent Electrical Contractors, Inc.

Comment on Proposal No: 14-56a

Recommendation: Revise text to read as follows:

Regardless of the voltage of the electrical system, wiring and equipment in Class I, Division 1 and 2 locations shall be grounded as specified in Article 250 and in accordance with the requirements of 501.30(A) and (B).

Substantiation: CMP 14 had a long discussion about deleting the informational note about referring to 250.100. During the discussion the phrase "regardless of the voltage of the electrical system" was considered important to minimize the possibility of an ignition; however Proposal 14-56a did not insert these words in the sections affected.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-20 Log #188 NEC-P14 **Final Action: Accept**

(501.105(B)(6))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 14-61

Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action taken on Proposal 1-114.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Panel Statement: CMP-14 has taken the direction of the Correlating Committee and reconsidered the action taken on Proposal 14-61. CMP-14 continues to reject Proposal 14-61 because the additional text is not necessary. Since Articles 500 through 516 do not amend the requirements of 110.21, these requirements already apply.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-21 Log #373 NEC-P14 **Final Action: Accept**

(501.105(B)(6)(1))

Submitter: Robert A. Jones, IEC Texas Gulf Coast

Comment on Proposal No: 14-62

Recommendation: Revise text to read as follows:

A switch complying with 501.105(B)(1) is provided so that the attachment plug is not depended on to interrupt current.~~, unless the circuit is nonincendive field wiring, in which case the switch is not required.~~

Exception: The switch is not required if the circuit is nonincendive field wiring.

Substantiation: Action taken by CMP 14 on this proposal is not in accordance with the National Electrical Code® style manual. The added phrase is really an exception to the previous phrase.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-22 Log #189 NEC-P14 **Final Action: Accept**

(501.125(B) Informational Note 4)

TCC Action: The Correlating Committee directs that the date of the latest referenced standard in 501.125(B) Informational Note 4 will be included in the Code.

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 14-66

Recommendation: The Correlating Committee directs that the panel rewrite this Informational Note to eliminate the following phrase "…it is important to consider the risk of…" which is in violation of 3.1.3 of the NEC Style Manual.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Revise new Informational Note 4 to read as follows:

Informational Note No. 4: Reciprocating engine driven generators, compressors, and other equipment installed in Class I Division 2 locations, may present a risk of ignition of flammable materials associated with fuel, starting, compression, etc. due to inadvertent release or equipment malfunction by the engine ignition system and controls. For further information on the requirements for ignition systems for reciprocating engines installed in Class I Division 2 hazardous (classified) locations, see ANSI/ISA-12.20.01, *General Requirements for Electrical Ignition Systems for Internal Combustion Engines in Class I, Division 2 or Zone 2, Hazardous (Classified) Locations*.

Panel Statement: CMP-14 has made the change as directed by the Correlating Committee. Also, CMP-14 has replaced the word "loads" with "equipment".

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-23 Log #512 NEC-P14 **Final Action: Accept**

(501.130(B)(4) Exception)

Submitter: Edward M. Briesch, UL LLC

Comment on Proposal No: 14-72

Recommendation: Accept Proposal 14-72. Revise the Exception to 501.130(B)(4) as follows:

(4) Portable Lighting Equipment. Portable lighting equipment shall comply with 501.130(A)(1).

Exception: Where portable lighting equipment is mounted on movable stands and is connected by flexible cords, as covered in 501.140, it shall be permitted to comply with 501.130(B)(1), where mounted in any position, provided ~~if~~ it also complies with ~~conforms to~~ 501.130(B)(2).

Substantiation: This proposal should be accepted. It does not, as the Panel Statement indicates, reduce the level of protection from Division 1 to Division 2. This exception first appears in the 1984 NEC in 501-9(b)(1). The exception states that portable lighting equipment in Class I, Division 2 need not comply with the requirements for Class I, Division 1 if it complies with "Section 501-9(b)(2) below". Section 501-9(b)(2) of the 1984 NEC details the requirements for fixed lighting in Class I, Division 2. Those requirements now are found in 501.130(B)(1).The intent of Proposal 14-72 is to clarify that this was indeed the case.

A review of Proposal 14-62 for the 1984 NEC and the resultant action of the Panel as documented in the National Electrical Code Technical Committee Report for the 1984 NEC clearly indicates that the intent of the proposal was to permit portable lighting on moveable stands and connected by cord to comply with the Division 2 requirements instead of the Division 1 requirements. The submitter's substantiation for Proposal 14-62 also states that this was needed for temporary lighting during periods of maintenance but at that time the Panel chose not to limit the usage in this way. The final wording was modified to conform to the style manual by Comment 14-75 from the NEC Correlating Committee.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-24 Log #886 NEC-P14 **Final Action: Reject**

(501.140(B)(4))

Submitter: David Wechsler, American Chemical Council

Comment on Proposal No: 14-11b

Recommendation: Do not add a new definition to 500.2, 505.2 and 506.2 reading:

~~Cord Connector. A fitting intended to terminate a cord to a box or similar device and reduce the strain at points of termination and may include an explosionproof, a dust ignition proof, or a flameproof seal.~~

Under 501.140 (B) (4) change cord connector to cord fitting as shown below:

(4) In Division 1 locations or in Division 2 locations where the boxes, fittings, or enclosures are required to be explosionproof, the cord shall be terminated with a cord <u>fitting</u> ~~connector~~ or attachment plug listed for the location or a cord <u>fitting</u> ~~connector~~ installed with a seal listed for the location. In Division 2 locations where explosionproof equipment is not required, the cord shall be terminated with a listed cord <u>fitting</u> ~~connector~~ or listed attachment plug.

Under 502.140 (B) (4) change cord connector to fitting as shown below:

(4) In Division 1 locations, the cord shall be terminated with a cord <u>fitting</u> ~~connector~~ listed for the location or a listed cord <u>fitting</u> ~~connector~~ installed with a seal listed for the location. In Division 2 locations, the cord shall be terminated with a listed dusttight cord <u>fitting</u> ~~connector~~.

Under 503.140 (B) (4) change cord connector to fitting as shown below:

(4) Be terminated with a listed dusttight cord <u>fitting</u> ~~connector~~.

Under 505.17(5) change cord connector to fitting as shown below:

(5) Be terminated with a listed cord <u>fitting</u> ~~connector~~ that maintains the type of protection where the flexible cord enters boxes, fittings, or enclosures that are required to be explosionproof or flameproof.

Under 506.17(5) change cord connector to fitting as shown below:

(5) Be terminated with a listed cord <u>fitting</u> ~~connector~~ that maintains the protection technique of the terminal compartment.

NOTE: Separate comments were submitted for each of the respective sections shown above to comply with the Style Manual.

Substantiation: This proposal was offered to attempt to correct the incorrect use of the term 'connector'. However the action taken simply makes this problem more unclear as the term 'cord connector' is not appropriate in this case and a different term that includes the word "fitting" should be used as part of the term, not to describe something different. The action addressed in the proposed text revisions provides appropriate solutions.

ANSI/UL 514B is not limited for use in hazardous (classified) areas. The term fitting is widely used in UL product standards to refer to these and other types of products that are used to secure wiring methods and cords to equipment. The actual title of UL 514B uses the term fittings, not connectors "Conduit, Tubing, and Cable Fittings". Section 1.2 of UL 514B uses the phrase "fittings for flexible cord" Interestingly 1.4 states "These requirements do not cover FITTINGS intended for use in hazardous locations as defined in the National Electrical Code, ANSI/NFPA 70, the Canadian Electrical Code (CEC), Part I, CSA C22.1, and the Standard for Electrical Installations, NOM-001-SEDE."

The term cord connector is used in other places in the NEC as a wiring device such as in 210.50(A) where it permits a "cord connector" to be considered a receptacle outlet. Section 626.2 defines a cord connector as a device for establishing a connection. The term fitting is commonly used in the NEC and product standards related to flexible cords products that are attached to enclosures. Section 400.7(B) uses the term cord connector body as device used to energize an attachment plug.

The term "cord fitting" as indicated should be used in sections 501.140(B)(4), 502.140(4), 503.140(4), 505.17(5), 506.17(5) and anywhere else the term is used to describe the fitting.

As presently used in these articles the term cord connector is confusing whether the term is defined differently (for no good reason) or not. The term "cord connector" is commonly used in the field to describe a wiring device that is connected to a cord.

Users of Chapter 5 are not exempt from the requirements in Chapters 1 through 4, chapter 5 requirements can supplement or modify the general rules but creating using the same term to define different items should not be done and will create confusion and likely misinterpretation of the associated requirements.

The term "fitting" is used in many other NEC sections to describe the product used to secure a cord to an enclosure.

Panel Meeting Action: Reject

Panel Statement: The definition of "connector" in UL 514B includes cord and cable, but the definition of "fitting" does not include cord. For this reason, CMP-14 affirms that the definition for the term "cord connector" is appropriate and does not agree that it should be replaced by the term "fitting". The term "fitting" is defined in Article 100 and is a generic term that includes locknuts and bushings. The use of the term "connector" emphasizes the need to provide strain relief at the point of termination of the cord and the need to reduce the risk of the termination being compromised due to excess strain on the connection. The use of the term "cord connector", without the definition, does not make the strain relief requirement explicit.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 12 Negative: 2

Explanation of Negative:

MCBRIDE, W.: IEEE statement opposing the panel action:

The term "cord connector" should not be defined as CMP14 has accepted. The term cord connector is commonly used in the field to describe a wiring device that is connected to a cord. Wiring device manufacturer's websites indicate that cord connectors are used to describe wiring devices. Other locations in the NEC use the term cord connector where referring to a wiring device and 626.2 actually defines it as such. Using the same term to define different items in the NEC should not be done, is inconsistent, will create confusion and likely misinterpretation of the associated requirements.

The term fitting as suggested by a commenter includes the concept of it primarily performing a mechanical function. If CMP14 does not like the use of the term fitting then a different term should be chosen, although Article 400 uses the term fitting when referring to products used to secure cords to enclosures.

Users of Chapter 5 are not exempt from the requirements in Chapters 1 through 4, Chapter 5 requirements can supplement or modify the general rules.

WECHSLER, D.: See my negative ballot comment related to "[1] cord connector" in Comment 14-1 and Comment 14-2 and 14-3.

14-25 Log #315 NEC-P14 **Final Action: Accept**

(502.10(A)(1)(5))

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.

Comment on Proposal No: 14-83

Recommendation: Revise text to read as follows:

~~Fiber~~ Optic<u>al fiber</u> cable~~s of the~~ types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in raceways as stated in 502.10(A). ~~Fiber~~ Optic<u>al fiber</u> cables shall be sealed in accordance with 502.15.

Substantiation: This is an editorial comment. Terminology should be consistent throughout the code. Article 770 covers optical fiber cables not fiber optic cables. There are many places this change needs to be made to correlate with Article 770.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

ARTICLE 502— CLASS II LOCATIONS

14-26 Log #316 NEC-P14 **Final Action: Accept**

(502.10(B)(1)(8))

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.

Comment on Proposal No: 14-88

Recommendation: Revise text to read as follows:

~~Fiber~~ Optic<u>al fiber</u> cable~~s of the~~ types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in cable trays or any other raceway as stated in 502.10(B). ~~Fiber~~ Optic<u>al fiber</u> cables shall be sealed in accordance with 502.15.

Substantiation: This is an editorial comment. Terminology should be consistent throughout the code. Article 770 covers optical fiber cables not fiber optic cables. There are many places this change needs to be made to correlate with Article 770.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-27 Log #190 NEC-P14 **Final Action: Accept**

(502.10(B)(2)(6) (New))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 14-88a

Recommendation: The Correlating Committee directs that the panel clarify the location of the list item.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Add the proposed new text as new 502.10(A)(2)(6).
Panel Statement: The new text has been moved to its proper location.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

14-28 Log #375 NEC-P14 **Final Action: Accept**
(502.30(A))

Submitter: Robert A. Jones, Independent Electrical Contractors, Inc.
Comment on Proposal No: 14-56a
Recommendation: Revise text to read as follows:
<u>Regardless of the voltage of the electrical system,</u> wiring and equipment in Class II, Division 1 and 2 locations shall be grounded as specified in Article 250 and in accordance with the requirements of 502.30(A) and (B).
Substantiation: CMP 14 had a long discussion about deleting the informational note about referring to 250.100. During the discussion the phrase "regardless of the voltage of the electrical system" was considered important to minimize the possibility of an ignition; however Proposal 14-56a did not insert these words in the sections affected.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

14-29 Log #1259 NEC-P14 **Final Action: Accept**
(502.100(B)(3))

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 14-93
Recommendation: I ask the panel to continue to reject this proposal. The proposal which would change 600 volts to 1000 volts.
Substantiation: Replacing 600 volts with 1000 volts will have a major impact on installers, component manufacturers, and industry standards. Increased spacing must be considered when going from 600 volts to 1000 volts. Personal safety must also be considered.
Because the proposer has not provided enough information to the public to justify and understand all the ramifications of the proposal, the committee should continue to reject the original submitters proposal.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

14-30 Log #887 NEC-P14 **Final Action: Reject**
(502.140(B)(4))

Submitter: David Wechsler, American Chemical Council
Comment on Proposal No: 14-11b
Recommendation: Do not add a new definition to 500.2, 505.2 and 506.2 reading:
~~Cord Connector. A fitting intended to terminate a cord to a box or similar device and reduce the strain at points of termination and may include an explosionproof, a dust ignition proof, or a flameproof seal.~~
Under 501.140 (B) (4) change cord connector to cord fitting as shown below:
(4) In Division 1 locations or in Division 2 locations where the boxes, fittings, or enclosures are required to be explosionproof, the cord shall be terminated with a cord <u>fitting</u> ~~connector~~ or attachment plug listed for the location or a cord <u>fitting</u> ~~connector~~ installed with a seal listed for the location. In Division 2 locations where explosionproof equipment is not required, the cord shall be terminated with a listed cord <u>fitting</u> ~~connector~~ or listed attachment plug.
Under 502.140 (B) (4) change cord connector to fitting as shown below:
(4) In Division 1 locations, the cord shall be terminated with a cord <u>fitting</u> ~~connector~~ listed for the location or a listed cord <u>fitting</u> ~~connector~~ installed with a seal listed for the location. In Division 2 locations, the cord shall be terminated with a listed dusttight cord <u>fitting</u> ~~connector~~.
Under 503.140 (B) (4) change cord connector to fitting as shown below:
(4) Be terminated with a listed dusttight cord <u>fitting</u> ~~connector~~.
Under 505.17(5) change cord connector to fitting as shown below:
(5) Be terminated with a listed cord <u>fitting</u> ~~connector~~ that maintains the type of protection where the flexible cord enters boxes, fittings, or enclosures that are required to be explosionproof or flameproof.
Under 506.17(5) change cord connector to fitting as shown below:
(5) Be terminated with a listed cord <u>fitting</u> ~~connector~~ that maintains the protection technique of the terminal compartment.
NOTE: Separate comments were submitted for each of the respective sections shown above to comply with the Style Manual.
Substantiation: This proposal was offered to attempt to correct the incorrect use of the term 'connector'. However the action taken simply makes this problem more unclear as the term 'cord connector' is not appropriate in this case and a different term that includes the word "fitting" should be used as part of the term, not to describe something different. The action addressed in the proposed text revisions provides appropriate solutions.
ANSI/UL 514B is not limited for use in hazardous (classified) areas. The term fitting is widely used in UL product standards to refer to these and other types of products that are used to secure wiring methods and cords to equipment. The actual title of UL 514B uses the term fittings, not connectors "Conduit, Tubing, and Cable Fittings". Section 1.2 of UL 514B uses the phrase "fittings for flexible cord" Interestingly 1.4 states "These requirements do not cover FITTINGS intended for use in hazardous locations as defined in the National Electrical Code, ANSI/NFPA 70, the Canadian Electrical Code (CEC), Part I, CSA C22.1, and the Standard for Electrical Installations, NOM-001-SEDE."
The term cord connector is used in other places in the NEC as a wiring device such as in 210.50(A) where it permits a "cord connector" to be considered a receptacle outlet. Section 626.2 defines a cord connector as a device for establishing a connection. The term fitting is commonly used in the NEC and product standards related to flexible cords products that are attached to enclosures. Section 400.7(B) uses the term cord connector body as device used to energize an attachment plug.
The term "cord fitting" as indicated should be used in sections 501.140(B)(4), 502.140(4), 503.140(4), 505.17(5), 506.17(5) and anywhere else the term is used to describe the fitting.
As presently used in these articles the term cord connector is confusing whether the term is defined differently (for no good reason) or not. The term "cord connector" is commonly used in the field to describe a wiring device that is connected to a cord.
Users of Chapter 5 are not exempt from the requirements in Chapters 1 through 4, chapter 5 requirements can supplement or modify the general rules but creating using the same term to define different items should not be done and will create confusion and likely misinterpretation of the associated requirements.
The term "fitting" is used in many other NEC sections to describe the product used to secure a cord to an enclosure.
Panel Meeting Action: Reject
Panel Statement: The definition of "connector" in UL 514B includes cord and cable, but the definition of "fitting" does not include cord. For this reason, CMP-14 affirms that the definition for the term "cord connector" is appropriate and does not agree that it should be replaced by the term "fitting". The term "fitting" is defined in Article 100 and is a generic term that includes locknuts and bushings. The use of the term "connector" emphasizes the need to provide strain relief at the point of termination of the cord and the need to reduce the risk of the termination being compromised due to excess strain on the connection. The use of the term "cord connector", without the definition, does not make the strain relief requirement explicit.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 12 Negative: 2
Explanation of Negative:
MCBRIDE, W.: IEEE statement opposing the panel action:
The term "cord connector" should not be defined as CMP14 has accepted. The term cord connector is commonly used in the field to describe a wiring device that is connected to a cord. Wiring device manufacturer's websites indicate that cord connectors are used to describe wiring devices. Other locations in the NEC use the term cord connector where referring to a wiring device and 626.2 actually defines it as such. Using the same term to define different items in the NEC should not be done, is inconsistent, will create confusion and likely misinterpretation of the associated requirements.
The term fitting as suggested by a commenter includes the concept of it primarily performing a mechanical function. If CMP14 does not like the use of the term fitting then a different term should be chosen, although Article 400 uses the term fitting when referring to products used to secure cords to enclosures.
Users of Chapter 5 are not exempt from the requirements in Chapters 1 through 4, Chapter 5 requirements can supplement or modify the general rules.
WECHSLER, D.: See my negative ballot comment related to "[1] cord connector" in Comment 14-1 and Comments 14-2, 14-3 and Comment 14-24.

ARTICLE 503 — CLASS III LOCATIONS

14-31 Log #376 NEC-P14 **Final Action: Accept**
(503.30)

TCC Action: The Correlating Committee notes that there were additional modifications to 503.30 in the recommendation that are not shown in legislative text and the Correlating Committee understands that the underlined text is is the only change to this section.
Submitter: Robert A. Jones, Independent Electrical Contractors, Inc.
Comment on Proposal No: 14-56a
Recommendation: Revise text to read as follows:
<u>Regardless of the voltage of the electrical system,</u> wiring and equipment in Class III, Division 1 and 2 locations shall be grounded as specified in Article 250 and in accordance with the requirements of 503.30(A) and (B).
Substantiation: CMP 14 had a long discussion about deleting the informational note about referring to 250.100. During the discussion the phrase "regardless of the voltage of the electrical system" was considered important to minimize the possibility of an ignition; however Proposal 14-56a did not insert these words in the sections affected.

Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

14-32 Log #888 NEC-P14 **Final Action: Reject**
(503.140(B)(4))

Submitter: David Wechsler, American Chemical Council
Comment on Proposal No: 14-11b
Recommendation: Do not add a new definition to 500.2, 505.2 and 506.2 reading:
~~Cord Connector. A fitting intended to terminate a cord to a box or similar device and reduce the strain at points of termination and may include an explosionproof, a dust ignition proof, or a flameproof seal.~~
Under 501.140 (B) (4) change cord connector to cord fitting as shown below:
(4) In Division 1 locations or in Division 2 locations where the boxes, fittings, or enclosures are required to be explosionproof, the cord shall be terminated with a cord fitting ~~connector~~ or attachment plug listed for the location or a cord fitting ~~connector~~ installed with a seal listed for the location. In Division 2 locations where explosionproof equipment is not required, the cord shall be terminated with a listed cord fitting ~~connector~~ or listed attachment plug.
Under 502.140 (B) (4) change cord connector to fitting as shown below:
(4) In Division 1 locations, the cord shall be terminated with a cord fitting ~~connector~~ listed for the location or a listed cord fitting ~~connector~~ installed with a seal listed for the location. In Division 2 locations, the cord shall be terminated with a listed dusttight cord fitting ~~connector~~.
Under 503.140 (B) (4) change cord connector to fitting as shown below:
(4) Be terminated with a listed dusttight cord fitting ~~connector~~.
Under 505.17(5) change cord connector to fitting as shown below:
(5) Be terminated with a listed cord fitting ~~connector~~ that maintains the type of protection where the flexible cord enters boxes, fittings, or enclosures that are required to be explosionproof or flameproof.
Under 506.17(5) change cord connector to fitting as shown below:
(5) Be terminated with a listed cord fitting ~~connector~~ that maintains the protection technique of the terminal compartment.
NOTE: Separate comments were submitted for each of the respective sections shown above to comply with the Style Manual.
Substantiation: This proposal was offered to attempt to correct the incorrect use of the term ‘connector’. However the action taken simply makes this problem more unclear as the term ‘cord connector’ is not appropriate in this case and a different term that includes the word “fitting” should be used as part of the term, not to describe something different. The action addressed in the proposed text revisions provides appropriate solutions.
ANSI/UL 514B is not limited for use in hazardous (classified) areas. The term fitting is widely used in UL product standards to refer to these and other types of products that are used to secure wiring methods and cords to equipment. The actual title of UL 514B uses the term fittings, not connectors “Conduit, Tubing, and Cable Fittings”. Section 1.2 of UL 514B uses the phrase “fittings for flexible cord” Interestingly 1.4 states “These requirements do not cover FITTINGS intended for use in hazardous locations as defined in the National Electrical Code, ANSI/NFPA 70, the Canadian Electrical Code (CEC), Part I, CSA C22.1, and the Standard for Electrical Installations, NOM-001-SEDE.”
The term cord connector is used in other places in the NEC as a wiring device such as in 210.50(A) where it permits a “cord connector” to be considered a receptacle outlet. Section 626.2 defines a cord connector as a device for establishing a connection. The term fitting is commonly used in the NEC and product standards related to flexible cords products that are attached to enclosures. Section 400.7(B) uses the term cord connector body as device used to energize an attachment plug.
The term “cord fitting” as indicated should be used in sections 501.140(B)(4), 502.140(4), 503.140(4), 505.17(5), 506.17(5) and anywhere else the term is used to describe the fitting.
As presently used in these articles the term cord connector is confusing whether the term is defined differently (for no good reason) or not. The term “cord connector” is commonly used in the field to describe a wiring device that is connected to a cord.
Users of Chapter 5 are not exempt from the requirements in Chapters 1 through 4, chapter 5 requirements can supplement or modify the general rules but creating using the same term to define different items should not be done and will create confusion and likely misinterpretation of the associated requirements.
The term “fitting” is used in many other NEC sections to describe the product used to secure a cord to an enclosure.
Panel Meeting Action: Reject
Panel Statement: The definition of “connector” in UL 514B includes cord and cable, but the definition of “fitting” does not include cord. For this reason, CMP-14 affirms that the definition for the term “cord connector” is appropriate and does not agree that it should be replaced by the term “fitting”. The term “fitting” is defined in Article 100 and is a generic term that includes locknuts and bushings. The use of the term “connector” emphasizes the need to provide strain relief at the point of termination of the cord and the need to reduce the risk of the termination being compromised due to excess strain on the connection. The use of the term “cord connector”, without the definition, does not make the strain relief requirement explicit.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 12 Negative: 2
Explanation of Negative:
MCBRIDE, W.: IEEE statement opposing the panel action:
The term “cord connector” should not be defined as CMP14 has accepted. The term cord connector is commonly used in the field to describe a wiring device that is connected to a cord. Wiring device manufacturer’s websites indicate that cord connectors are used to describe wiring devices. Other locations in the NEC use the term cord connector where referring to a wiring device and 626.2 actually defines it as such. Using the same term to define different items in the NEC should not be done, is inconsistent, will create confusion and likely misinterpretation of the associated requirements.
The term fitting as suggested by a commenter includes the concept of it primarily performing a mechanical function. If CMP14 does not like the use of the term fitting then a different term should be chosen, although Article 400 uses the term fitting when referring to products used to secure cords to enclosures.
Users of Chapter 5 are not exempt from the requirements in Chapters 1 through 4, Chapter 5 requirements can supplement or modify the general rules.
WECHSLER, D.: See Negative ballot comment related to “[1] cord connector” in Comment 14-1 and Comments 14-2, 14-3, 14-24, and Comment 14-30.

ARTICLE 504 — INTRINSICALLY SAFE SYSTEMS

14-33 Log #191 NEC-P14 **Final Action: Accept**
(504)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 14-112
Recommendation: The Correlating Committee understands that the date references to the ISA Standards are to remain as shown in the panel action.
Furthermore, it was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action taken on Proposal 14-117.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-14 accepts the action taken on Proposal 14-112 and not that of Proposal 14-117. The text agreed to by CMP-14 is accurately reflected in the draft of the proposed 2014 edition of the NEC. See also Comment 14-36.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

14-34 Log #490 NEC-P14 **Final Action: Accept in Principle**
(504.2.Associated Apparatus)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 14-114
Recommendation: Revise text to read as follows:
Associated Apparatus. Apparatus in which the circuits are not necessarily intrinsically safe themselves but that affect the energy in the intrinsically safe circuits and are relied on to maintain intrinsic safety. Examples of such ~~Associated~~ apparatus are ~~may be either of~~ the following:
(1) Electrical apparatus that has an alternative-type protection for use in the appropriate hazardous (classified) location
(2) Electrical apparatus not so protected that shall not be used within a hazardous (classified) location
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term in the last sentence and the NEC manual of style does not permit the definition to contain the defined term. Definitions are not requirements. The proposed changes eliminate the defined term. Alternatively CMP 14 might want to place the examples in an alternate suitable location in Article 504 as a requirement. The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Panel Meeting Action: Accept in Principle
Revise text to read as follows:
Associated Apparatus. Apparatus in which the circuits are not necessarily intrinsically safe themselves but that affect the energy in the intrinsically safe circuits and are relied on to maintain intrinsic safety. Such ~~Associated~~ apparatus are one ~~may be either~~ of the following:
(1) Electrical apparatus that has an alternative-type protection for use in the appropriate hazardous (classified) location
(2) Electrical apparatus not so protected that shall not be used within a hazardous (classified) location

Panel Statement: Associated apparatus are limited to the two cases cited. The Style Manual has been satisfied by the minor adjustment to the text. CMP-14 notes that, by the action on Comment 14-1, this definition will be relocated to Section 500.2.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

14-35 Log #897 NEC-P14 **Final Action: Reject**
(504.4)

Submitter: David Wechsler, American Chemical Council
Comment on Proposal No: 14-111
Recommendation: Insert the following new text in 504.4:
504.4 Equipment. All intrinsically safe apparatus and associated apparatus shall be listed.
Testing for energy for intrinsically safe circuits shall be permitted to utilize a factor of 1.5 applied to energy or, both 1.5 applied to voltage and 1.5 applied to current.
Exception: Simple apparatus, as described on the control drawing, shall not be required to be listed.
504.10 Equipment Installation.
Substantiation: In the Panel Statement the Panel states that there are at least two US documents on intrinsic safety and this suggests that either would be acceptable for use. This comment addresses currently a major issue dealing with energy and the factor being considered and merely affirms this acceptable use within the NEC.
Panel Meeting Action: Reject
Panel Statement: This comment is attempting to modify testing requirements that do not exist in the Code.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

14-36 Log #192 NEC-P14 **Final Action: Accept**
(504.10(B))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 14-117
Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action taken on Proposal 14-112.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-14 accepts the action taken on Proposal 14-112 and not that of Proposal 14-117. The text agreed to by CMP-14 is accurately reflected in the draft of the proposed 2014 edition of the NEC.
See also Comment 14-33.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

ARTICLE 505 — ZONE 0, 1, AND 2 LOCATIONS

14-37 Log #889 NEC-P14 **Final Action: Reject**
(505.2 and 505.17(5))

Submitter: David Wechsler, American Chemical Council
Comment on Proposal No: 14-11b
Recommendation: Do not add a new definition to 500.2, 505.2 and 506.2 reading:
~~Cord Connector. A fitting intended to terminate a cord to a box or similar device and reduce the strain at points of termination and may include an explosionproof, a dust ignition proof, or a flameproof seal.~~
Under 501.140 (B) (4) change cord connector to cord fitting as shown below:
(4) In Division 1 locations or in Division 2 locations where the boxes, fittings, or enclosures are required to be explosionproof, the cord shall be terminated with a cord fitting ~~connector~~ or attachment plug listed for the location or a cord fitting ~~connector~~ installed with a seal listed for the location. In Division 2 locations where explosionproof equipment is not required, the cord shall be terminated with a listed cord fitting ~~connector~~ or listed attachment plug.
Under 502.140 (B) (4) change cord connector to fitting as shown below:
(4) In Division 1 locations, the cord shall be terminated with a cord fitting ~~connector~~ listed for the location or a listed cord fitting ~~connector~~ installed with a seal listed for the location. In Division 2 locations, the cord shall be terminated with a listed dusttight cord fitting ~~connector~~.
Under 503.140 (B) (4) change cord connector to fitting as shown below:
(4) Be terminated with a listed dusttight cord fitting ~~connector~~.
Under 505.17(5) change cord connector to fitting as shown below:
(5) Be terminated with a listed cord fitting ~~connector~~ that maintains the type of protection where the flexible cord enters boxes, fittings, or enclosures that are required to be explosionproof or flameproof.
Under 506.17(5) change cord connector to fitting as shown below:
(5) Be terminated with a listed cord fitting ~~connector~~ that maintains the protection technique of the terminal compartment.
NOTE: Separate comments were submitted for each of the respective sections shown above to comply with the Style Manual.
Substantiation: This proposal was offered to attempt to correct the incorrect use of the term ‘connector’. However the action taken simply makes this problem more unclear as the term ‘cord connector’ is not appropriate in this case and a different term that includes the word “fitting” should be used as part of the term, not to describe something different. The action addressed in the proposed text revisions provides appropriate solutions.
ANSI/UL 514B is not limited for use in hazardous (classified) areas. The term fitting is widely used in UL product standards to refer to these and other types of products that are used to secure wiring methods and cords to equipment. The actual title of UL 514B uses the term fittings, not connectors “Conduit, Tubing, and Cable Fittings”. Section 1.2 of UL 514B uses the phrase “fittings for flexible cord” Interestingly 1.4 states “These requirements do not cover FITTINGS intended for use in hazardous locations as defined in the National Electrical Code, ANSI/NFPA 70, the Canadian Electrical Code (CEC), Part I, CSA C22.1, and the Standard for Electrical Installations, NOM-001-SEDE.”
The term cord connector is used in other places in the NEC as a wiring device such as in 210.50(A) where it permits a “cord connector” to be considered a receptacle outlet. Section 626.2 defines a cord connector as a device for establishing a connection. The term fitting is commonly used in the NEC and product standards related to flexible cords products that are attached to enclosures. Section 400.7(B) uses the term cord connector body as device used to energize an attachment plug.
The term “cord fitting” as indicated should be used in sections 501.140(B)(4), 502.140(4), 503.140(4), 505.17(5), 506.17(5) and anywhere else the term is used to describe the fitting.
As presently used in these articles the term cord connector is confusing whether the term is defined differently (for no good reason) or not. The term “cord connector” is commonly used in the field to describe a wiring device that is connected to a cord.
Users of Chapter 5 are not exempt from the requirements in Chapters 1 through 4, chapter 5 requirements can supplement or modify the general rules but creating using the same term to define different items should not be done and will create confusion and likely misinterpretation of the associated requirements.
The term “fitting” is used in many other NEC sections to describe the product used to secure a cord to an enclosure.
Panel Meeting Action: Reject
Panel Statement: The definition of “connector” in UL 514B includes cord and cable, but the definition of “fitting” does not include cord. For this reason, CMP-14 affirms that the definition for the term “cord connector” is appropriate and does not agree that it should be replaced by the term “fitting”. The term “fitting” is defined in Article 100 and is a generic term that includes locknuts and bushings. The use of the term “connector” emphasizes the need to provide strain relief at the point of termination of the cord and the need to reduce the risk of the termination being compromised due to excess strain on the connection. The use of the term “cord connector”, without the definition, does not make the strain relief requirement explicit.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 12 Negative: 2
Explanation of Negative:
MCBRIDE, W.: IEEE statement opposing the panel action:
The term “cord connector” should not be defined as CMP14 has accepted. The term cord connector is commonly used in the field to describe a wiring device that is connected to a cord. Wiring device manufacturer’s websites indicate that cord connectors are used to describe wiring devices. Other locations in the NEC use the term cord connector where referring to a wiring device and 626.2 actually defines it as such. Using the same term to define different items in the NEC should not be done, is inconsistent, will create confusion and likely misinterpretation of the associated requirements.
The term fitting as suggested by a commenter includes the concept of it primarily performing a mechanical function. If CMP14 does not like the use of the term fitting then a different term should be chosen, although Article 400 uses the term fitting when referring to products used to secure cords to enclosures.
Users of Chapter 5 are not exempt from the requirements in Chapters 1 through 4, Chapter 5 requirements can supplement or modify the general rules.
WECHSLER, D.: See Negative ballot comment related to “[1] cord connector” in Comment 14-1 and Comments 14-2, 14-3, 14-24, 14-30, and Comment 14-32.

14-38 Log #193 NEC-P14 **Final Action: Accept**
(505.5(A))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 14-136a
Recommendation: The Correlating Committee directs that the panel clarify the action on this proposal.
The Correlating Committee notes that this proposal incorporates changes in the first sentence that were not identified in legislative format.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Replace the first paragraph of current text of 505.5(A) with the following:

(A) Classification of Locations. Locations shall be classified depending on the properties of the flammable gases, flammable liquid-produced vapors, ~~liquids, or gases~~ combustible-liquid produced vapors, combustible dusts, or fibers/flyings that may be present and the likelihood that a flammable or combustible concentration or quantity is present. Each room, section, or area shall be considered individually in determining its classification. Where pyrophoric materials are the only materials used or handled, these locations are outside the scope of this article ~~shall not be classified~~

~~Each room, section, or area shall be considered individually in determining its classification.~~"

Panel Statement: CMP-14 has restated the action of Proposal 14-136a, to indicate the amendments, as directed by the Correlating Committee.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-39 Log #194 NEC-P14 **Final Action: Accept**

(505.6, Informational Note 2)

TCC Action: The Correlating Committee directs that Information Note No. 3 be revised as follows:

Group II is currently subdivided into Groups "IIA", "IIB", and "IIC". Prior marking requirements allowed some types of protection to be marked without a subdivision, showing only Group "II". ~~Equipment so marked should be is considered to be suitable for Group IIC applications.~~

The last sentence has been deleted to bring the Informational Note into compliance with the NEC Style Manual.

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 14-139

Recommendation: It was the action of the Correlating Committee that the panel reconsider this proposal. The third sentence of the Informational Note contains a recommendation which does not comply with 3.1.3 of the NEC Style Manual.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Revise text to read as follows:

~~Group II shall be subdivided into IIC, IIB, and IIA, as noted in 505.6(A), (B), and (C), according to the nature of the gas or vapor, for protection techniques "d," "ia," "ib," "[ia]," and "[ib]," and, where applicable, "n" and "o.".~~

Informational Note No. 3~~2~~: ~~Verification of electrical equipment utilizing protection techniques "e," "m," "p," and "q," due to design technique, does not require tests involving MESG or MIC. Therefore, Group II is not required to be subdivided for these protection techniques.~~ Group II is currently subdivided into Groups "IIA", "IIB", and "IIC". Prior marking requirements allowed some types of protection to be marked without a subdivision, showing only Group "II". Equipment so marked ~~should be~~ is considered to be suitable for Group IIC applications.

Panel Statement: CMP-14 has amended the subject text at the direction of the Correlating Committee. CMP-14 also recognizes that this Note is to be renumbered.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-40 Log #1284 NEC-P14 **Final Action: Accept**

(505.7(F) (New))

Submitter: William G. Lawrence, Jr., S. Yarmouth, MA

Comment on Proposal No: 14-141

Recommendation: Add new text to read as follows:

Proposed as normative text based on comment:

(F) Available Short-Circuit Current for Type of Protection "e" - The available short circuit current for electrical equipment using type of protection "e" for the field wiring connections in Zone 1 locations shall be limited to 10,000 rms symmetrical amperes to reduce the likelihood of ignition of a flammable atmosphere by an arc during a short circuit event.

Informational Note 3: Limitation of the available short circuit current to this level may require the application of current-limiting fuses or current-limiting circuit breakers.

Substantiation: The short circuit current rating of terminals and terminal blocks, according to ANSI/UL 508A, is 10,000 rms symmetrical amperes unless otherwise evaluated. To align with the ratings of these components, the available short circuit current should be limited to corresponding values. This is consistent with the approach in Article 409 for industrial control panels. The addition of this requirement to 505.7 is necessary as these terminals are used in many applications other than industrial control panels.

Panel Meeting Action: Accept

Panel Statement: CMP-14 notes that the informational note does not need to be numbered.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-41 Log #195 NEC-P14 **Final Action: Accept**

(505.15)

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 14-160

Recommendation: The Correlating Committee directs that the panel reconsider the actions taken on this proposal.

The Correlating Committee notes that the panel omitted the last sentence of 505.15(B)(1)(b) without identifying this as a change.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Correct 505.15(B)(1)(b) as indicated:

(b) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, and where the cable is not subject to physical damage, Type MC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vaportight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the application. Type MC-HL cable shall be installed in accordance with the provisions of Article 330, Part II.

Panel Statement: CMP-14 has reinserted existing text that was inadvertently deleted during transcription at the ROP stage.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-42 Log #317 NEC-P14 **Final Action: Accept**

(505.15(B)(1)(g))

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.

Comment on Proposal No: 14-163

Recommendation: Revise text to read as follows:

(e) ~~Fiber~~ Optical fiber cables ~~of the~~ types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in raceways as stated in 505.15(B). These ~~Fiber Optic~~ optical fiber cables shall be sealed in accordance with 505.16.

Substantiation: This is an editorial comment. Terminology should be consistent throughout the code. Article 770 covers optical fiber cables not fiber optic cables. There are many places this change needs to be made to correlate with Article 770.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-43 Log #1267 NEC-P14 **Final Action: Accept in Principle**

(505.15(B)(1)(g) (New))

Submitter: Donald W. Ankele, UL LLC

Comment on Proposal No: 14-164

Recommendation: The Panel Action should be Accept in Principle.

CMP 14 Task Group on 14-164 proposes a new 505.15(B)(1)(g) as follows:

(g) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, and where the cable is not subject to physical damage, Type TC-ER-HL cable listed for use in Class I, Zone 1 locations with an overall jacket of suitable material and terminated with fittings listed for the location.

Informational Note: See 336.10(7) for restrictions on the installation of Type TC-ER cable.

Substantiation: The wiring methods currently permitted by 505.15(B)(1) are not always well suited for connection to electrical equipment employing many of the Zone 1 types of protection.

Because Zone 1 is not as onerous as Division 1, as Division 1 encompasses conditions that constitute both Zone 0 and Zone 1, meeting the -HL crush and impact performance requirements without requiring an armor construction requirements is acceptable because of the lower level of the risk of a flammable atmosphere being present, combined with the installation requirements in Section 336.10(7) for TC-ER cable that require continuous support and mechanical protection for Type TC-ER cable.

Proposal 14-164 to add Type TC-HL cable that is dual listed as Shipboard cable into 505.15 is not viable because no installation requirements exist in Chapter 3 for Shipboard cable, whereas Type TC-ER which is intended for installation in industrial establishments has installation requirements currently found in Article 336. Listed termination fittings currently exist for both flameproof "d" and increased safety "e" types of protection.

Type TC-ER-HL cable will be required meet the crush and impact resistance requirements for -HL cables that is already established in ANSI/UL 2225 for Type MC-HL, and Type ITC-HL; however, a metal sheath or armor will not be required for TC-ER-HL. Data show that some current Type TC-ER cables meet or exceed the UL 2225 Type MC-HL and Type TC-HL requirements.

This comment was prepared by a Task Group consisting of Don Ankele, convener, and the following members of Code Making Panel 14: Bill Fisk, Bill Lawrence, Will McBride, Richard Holub, Jack Jamison, and John Simmons.
Panel Meeting Action: Accept in Principle
Revise new 505.15(B)(1)(g) to read:
In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, for applications limited to 600 volts nominal or less, for cable diameters 25 mm (1 in.) or less, and where the cable is not subject to physical damage, Type TC-ER-HL cable listed for use in Class I, Zone 1 locations, with an overall jacket and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the location. Type TC-ER-HL cable shall be installed in accordance with the provisions of Article 336, including the restrictions of 336.10(7).
Panel Statement: The submitter's comment has been amended to ensure proper application and compliance with Article 336. The voltage limitation has been introduced to avoid the risks associated with unshielded high voltage conductors. The size limitation has been introduced to address problems encountered in the field with MC-HL cable with diameters less than 1 in. due to kinking of the armor.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

14-44 Log #1344 NEC-P14 **Final Action: Accept in Principle**
(505.15(B)(1)(g) (New))

Submitter: William E. McBride, Northern Electric Company
Comment on Proposal No: 14-164
Recommendation: Modify existing Text:
(1) General. In Class I, zone I locations, the wiring methods in 8(1)(8) through (8)(I)(g) shall be permitted.
Add new text
(g) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the
installation, and where the cable is not subject to physical damage listed Type TC-ER-HL Cable, up to I inch in diameter, that complies with the crush and impact
requirements of Type MC-HL cable, and is identified for such use with the marking Type TC-ER-HL shall be permitted. The cable shall contain separate equipment
bonding conductor(s) in accordance with 250.119, and terminated with fittings listed for the application. Type TC-ER·HL Cable shall be installed in accordance with
the provisions of TC·ER Cable in Article 336.
Substantiation: Existing small diameter MC·HL cables that are run between enclosures and instruments are easily kinked during initial installation and routine maintenance. The risk
of ignition is not from the middle of cables, but from the devices and reminations of cables where the conductor is exposed.
If the Code Making panel thinks it necessary they might further restrict the circuit voltage of these TG-ER-HL Cables to be restricted to less than half of the cond uctor
insulation voltage rating. The application is mostly for 24 volt instrumentation, but may also include some 120 volt utilization devices, yet the cable is rated for 600
volts.
Panel Meeting Action: Accept in Principle
See Panel Action on Comment 14-43.
Panel Statement: The action taken on Comment 14-43 address the submitter's concerns.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

14-45 Log #318 NEC-P14 **Final Action: Accept**
(505.15(C)(1)(h))

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 14-169
Recommendation: Revise text to read as follows:
~~Fiber~~ Optic<u>al fiber</u> cable~~s of the~~ types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in cable trays or any other raceway as stated in 505.15(C). ~~Fiber~~ Optic<u>al fiber</u> cables shall be sealed in accordance with 502.16.
Substantiation: This is an editorial comment. Terminology should be consistent throughout the code. Article 770 covers optical fiber cables not fiber optic cables. There are many places this change needs to be made to correlate with Article 770.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

14-46 Log #513 NEC-P14 **Final Action: Accept**
(505.17(B)(1))

Submitter: Edward M. Briesch, UL LLC
Comment on Proposal No: 14-180
Recommendation: In 505.17(B)(1) as documented in the Panel Meeting Action for Proposal 14-180, revise text as follows:
505.17(B) Instrumentation Connections for Zone 2. To facilitate replacements, process control instruments shall be permitted to be connected through flexible cord, attachment plug, and receptacle, provided all of the following conditions apply:
(1) A switch <u>listed</u> ~~identified~~ for Zone 2 is provided so that the attachment plug is not depended on to interrupt current, unless the circuit is type of protection "ia, ib, or ic" then the switch <u>shall</u> ~~is~~ not <u>be</u> required.
Substantiation: In 505.17(B)(1) the switch should be required to be "listed" and not "identified". Equipment in Zone 2 locations is required to be listed by 505.20(C) and there was no technical rationale provided in the Proposal or Panel Statement to take an exception to that requirement. Also, the end of the sentence was modified to conform to the Style Manual.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

14-47 Log #196 NEC-P14 **Final Action: Accept**
(505.22, Informational Note)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 14-185
Recommendation: The Correlating Committee directs that the panel reconsider this Informational Note to eliminate the following phrase "…it is important to consider the risk of…" which is in violation of 3.1.3 of the NEC Style Manual.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise new Informational Note to read as follows:
Informational Note: Reciprocating engine driven generators, compressors, and other equipment installed in Class I Zone 2 locations, may present a risk of ignition of flammable materials associated with fuel, starting, compression, etc. due to inadvertent release or equipment malfunction by the engine ignition system and controls. For further information on the requirements for ignition systems for reciprocating engines installed in Class I Zone 2 hazardous (classified) locations, see ANSI/ISA-12.20.01, *General Requirements for Electrical Ignition Systems for Internal Combustion Engines in Class I, Division 2 or Zone 2, Hazardous (Classified) Locations*.
Panel Statement: CMP-14 has made the change as directed by the Correlating Committee. Also, CMP-14 has replaced the word "loads" with "equipment".
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

14-48 Log #377 NEC-P14 **Final Action: Accept**
(505.25)

Submitter: Robert A. Jones, Independent Electrical Contractors, Inc.
Comment on Proposal No: 14-56a
Recommendation: Revise text to read as follows:
<u>Regardless of the voltage of the electrical system,</u> grounding and bonding shall comply with Article 250 and the requirements in 505.25(A) and (B).
Substantiation: CMP 14 had a long discussion about deleting the informational note about referring to 250.100. During the discussion the phrase "regardless of the voltage of the electrical system" was considered important to minimize the possibility of an ignition; however Proposal 14-56a did not insert these words in the sections affected.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

ARTICLE 506 — ZONE 20, 21, AND 22 LOCATIONS FOR COMBUSTIBLE DUSTS, FIBERS, AND FLYINGS

14-49 Log #892 NEC-P14 **Final Action: Reject**
(506.1)

Submitter: David Wechsler, American Chemical Council
Comment on Proposal No: 14-190a
Recommendation: Restore the following last sentence under 506.1 Scope:
<u>Combustible metallic dusts are not covered by the requirements of this article.</u>
Substantiation: The statement in this Article is correct. The Proposal action was based upon ANSI/ISA standard 60079-0. However, the ISA Standard 60079-0 which is a draft is taking a US deviation from the IEC 60079-0 standard by replacing that term 'conductive' with metal which differs from that found in its Group IIIC definition. The IEC 60079-0 standard under 3.18.1.1

defines **conductive dust** as 'combustible dust with electrical resistivity equal to or less than 10^3 ohm m'. There also is a note: "Note: IEC 61241-2-2 contains the test method for determining the electrical resistivity of dusts." which suggests that a simple replacement of the term 'metal' for 'conductive' may not reflect the same potential hazards. The NEC rejected defining combustible dust using resistivity.

Panel Meeting Action: Reject

Panel Statement: The substantiation does not support the submitter's recommendation. CMP-14 confirms its intent to include metal dusts in Article 506.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13 Negative: 1

Explanation of Negative:

WECHSLER, D.: See my explanation of negative vote on Comment 14-56.

14-50 Log #890 NEC-P14 **Final Action: Reject**

(506.2 and 506.17(5))

Submitter: David Wechsler, American Chemical Council

Comment on Proposal No: 14-11b

Recommendation: Do not add a new definition to 500.2, 505.2 and 506.2 reading:

~~Cord Connector. A fitting intended to terminate a cord to a box or similar device and reduce the strain at points of termination and may include an explosionproof, a dust ignition proof, or a flameproof seal.~~

Under 501.140 (B) (4) change cord connector to cord fitting as shown below:

(4) In Division 1 locations or in Division 2 locations where the boxes, fittings, or enclosures are required to be explosionproof, the cord shall be terminated with a cord fitting ~~connector~~ or attachment plug listed for the location or a cord fitting ~~connector~~ installed with a seal listed for the location. In Division 2 locations where explosionproof equipment is not required, the cord shall be terminated with a listed cord fitting ~~connector~~ or listed attachment plug.

Under 502.140 (B) (4) change cord connector to fitting as shown below:

(4) In Division 1 locations, the cord shall be terminated with a cord fitting ~~connector~~ listed for the location or a listed cord fitting ~~connector~~ installed with a seal listed for the location. In Division 2 locations, the cord shall be terminated with a listed dusttight cord fitting ~~connector~~.

Under 503.140 (B) (4) change cord connector to fitting as shown below:

(4) Be terminated with a listed dusttight cord fitting ~~connector~~.

Under 505.17(5) change cord connector to fitting as shown below:

(5) Be terminated with a listed cord fitting ~~connector~~ that maintains the type of protection where the flexible cord enters boxes, fittings, or enclosures that are required to be explosionproof or flameproof.

Under 506.17(5) change cord connector to fitting as shown below:

(5) Be terminated with a listed cord fitting ~~connector~~ that maintains the protection technique of the terminal compartment.

NOTE: Separate comments were submitted for each of the respective sections shown above to comply with the Style Manual.

Substantiation: This proposal was offered to attempt to correct the incorrect use of the term 'connector'. However the action taken simply makes this problem more unclear as the term 'cord connector' is not appropriate in this case and a different term that includes the word "fitting" should be used as part of the term, not to describe something different. The action addressed in the proposed text revisions provides appropriate solutions.

ANSI/UL 514B is not limited for use in hazardous (classified) areas. The term fitting is widely used in UL product standards to refer to these and other types of products that are used to secure wiring methods and cords to equipment. The actual title of UL 514B uses the term fittings, not connectors "Conduit, Tubing, and Cable Fittings". Section 1.2 of UL 514B uses the phrase "fittings for flexible cord" Interestingly 1.4 states "These requirements do not cover FITTINGS intended for use in hazardous locations as defined in the National Electrical Code, ANSI/NFPA 70, the Canadian Electrical Code (CEC), Part I, CSA C22.1, and the Standard for Electrical Installations, NOM-001-SEDE."

The term cord connector is used in other places in the NEC as a wiring device such as in 210.50(A) where it permits a "cord connector" to be considered a receptacle outlet. Section 626.2 defines a cord connector as a device for establishing a connection. The term fitting is commonly used in the NEC and product standards related to flexible cords products that are attached to enclosures. Section 400.7(B) uses the term cord connector body as device used to energize an attachment plug.

The term "cord fitting" as indicated should be used in sections 501.140(B)(4), 502.140(4), 503.140(4), 505.17(5), 506.17(5) and anywhere else the term is used to describe the fitting.

As presently used in these articles the term cord connector is confusing whether the term is defined differently (for no good reason) or not. The term "cord connector" is commonly used in the field to describe a wiring device that is connected to a cord.

Users of Chapter 5 are not exempt from the requirements in Chapters 1 through 4, chapter 5 requirements can supplement or modify the general rules but creating using the same term to define different items should not be done and will create confusion and likely misinterpretation of the associated requirements.

The term "fitting" is used in many other NEC sections to describe the product used to secure a cord to an enclosure.

Panel Meeting Action: Reject

Panel Statement: The definition of "connector" in UL 514B includes cord and cable, but the definition of "fitting" does not include cord. For this reason, CMP-14 affirms that the definition for the term "cord connector" is appropriate and does not agree that it should be replaced by the term "fitting". The term "fitting" is defined in Article 100 and is a generic term that includes locknuts and bushings. The use of the term "connector" emphasizes the need to provide strain relief at the point of termination of the cord and the need to reduce the risk of the termination being compromised due to excess strain on the connection. The use of the term "cord connector", without the definition, does not make the strain relief requirement explicit.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 12 Negative: 2

Explanation of Negative:

MCBRIDE, W.: IEEE statement opposing the panel action:

The term "cord connector" should not be defined as CMP14 has accepted. The term cord connector is commonly used in the field to describe a wiring device that is connected to a cord. Wiring device manufacturer's websites indicate that cord connectors are used to describe wiring devices. Other locations in the NEC use the term cord connector where referring to a wiring device and 626.2 actually defines it as such. Using the same term to define different items in the NEC should not be done, is inconsistent, will create confusion and likely misinterpretation of the associated requirements.

The term fitting as suggested by a commenter includes the concept of it primarily performing a mechanical function. If CMP14 does not like the use of the term fitting then a different term should be chosen, although Article 400 uses the term fitting when referring to products used to secure cords to enclosures.

Users of Chapter 5 are not exempt from the requirements in Chapters 1 through 4, Chapter 5 requirements can supplement or modify the general rules.

WECHSLER, D.: See Negative ballot comment related to "[1] cord connector" in Comment 14-1 and Comments 14-2, 14-3, 14-24, 14-30, 14-32, and Comment 14-37.

14-51 Log #1179 NEC-P14 **Final Action: Accept**

(506.2)

Submitter: Eliana Brazda, ISA

Comment on Proposal No: 14-194

Recommendation: Revise text to read as follows:

ANSI/ISA-12.12.01-201~~1~~2, Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.

Substantiation: Change the ISA standards date of publication to the current publication date.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-52 Log #491 NEC-P14 **Final Action: Accept in Principle**

(506.2.Associated Nonincendive Field Wiring Apparatus and Informational Note)

Submitter: Marcelo M. Hirschler, GBH International

Comment on Proposal No: 14-191

Recommendation: Revise text to read as follows:

Associated Nonincendive Field Wiring Apparatus. Apparatus in which the circuits are not necessarily nonincendive themselves but that affect the energy in nonincendive field wiring circuits and are relied upon to maintain nonincendive energy levels. ~~Associated nonincendive field wiring~~ Examples of such apparatus are ~~may be either of~~ the following:

(1) Electrical apparatus that has an alternative type of protection for use in the appropriate hazardous (classified) location

(2) Electrical apparatus not so protected that shall not be used in a hazardous (classified) location

Informational Note: Associated nonincendive field wiring apparatus has designated associated nonincendive field wiring apparatus connections for nonincendive field wiring apparatus and may also have connections for other electrical apparatus.

Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term in the last sentence and the NEC manual of style does not permit the definition to contain the defined term. Definitions are not requirements. The proposed changes eliminate the defined term. Alternatively CMP 14 might want to place the examples in an alternate suitable location in Article 506 as a requirement. The NEC Manual of Style states as follows:

2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.

Panel Meeting Action: Accept in Principle

Revise text to read as follows:

Associated Nonincendive Field Wiring Apparatus. Apparatus in which the circuits are not necessarily nonincendive themselves but that affect the energy in nonincendive field wiring circuits and are relied upon to maintain nonincendive energy levels. ~~Associated nonincendive field wiring~~ Such apparatus are one ~~may be either~~ of the following:

(1) Electrical apparatus that has an alternative type of protection for use in the appropriate hazardous (classified) location

(2) Electrical apparatus not so protected that shall not be used in a hazardous (classified) location

Informational Note: Associated nonincendive field wiring apparatus has designated associated nonincendive field wiring apparatus connections for nonincendive field wiring apparatus and may also have connections for other electrical apparatus.

Panel Statement: Associated nonincendive field wiring apparatus are limited to the two cases cited. The Style Manual has been satisfied by the minor adjustment to the text. CMP-14 notes that, by the action on Comment 14-1, this definition will be relocated to Section 500.2.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-53 Log #574 NEC-P14 **Final Action: Reject**

(506.2.Combustible Dust)

Note: When the ballot result does not confirm the TC action on a Proposal by a two-thirds affirmative vote, the Report on Proposals shall be published with a specific request for public comment on that Proposal. The Proposal is now being reconsidered by the TC as a public comment.

Submitter: Code-Making Panel 14,

Comment on Proposal No: 14-192a

Recommendation: In 506.2 replace the current definition of Combustible Dust with the following:

Combustible Dust. Dust particles of 500 microns or smaller (material passing a U.S. No. 35 Standard Sieve as defined in ASTM E 11, Standard Specification for Wire Cloth and Sieves for Testing Purposes) are considered to present a dust fire or dust explosion hazard unless determined otherwise. (See ASTM E 1226 or ISO 6184/1). [499:3.3.3]

Substantiation: Definition is extracted from NFPA 499 and the definition in the 2012 Edition of NFPA 499 has been revised.

Panel Meeting Action: Reject

Panel Statement: CMP-14 affirms that the definition should be revised and this has been done in Comment 14-6. However, the action on Comment 14-1 deletes the definition from this section and retains it in 500.2 with appropriate language.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-54 Log #197 NEC-P14 **Final Action: Accept**

(506.2. Nonincendive Circuit, Nonincendive Equipment, Nonincendive Field Wiring, Nonincendive Field Wiring Apparatus.)

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 14-193

Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 14-194.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Panel Statement: CMP-14 affirms that the draft of NFPA 70-2014 has correctly interpreted the intent of Proposals 14-193 and 14-194. CMP-14 affirms that it was its intent to delete the references and their associated informational notes.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-55 Log #198 NEC-P14 **Final Action: Accept**

(506.2. Nonincendive Circuit, Informational Note; Nonincendive Equipment, Informational Note; Nonincendive Field Wiring Apparatus, Informational Note; Protection by Encapsulation "mD", Informational Note; Protection by Enclosure "tD", Informational Note.)

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 14-194

Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 14-193.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Panel Statement: CMP-14 affirms that the draft of NFPA 70-2014 has correctly interpreted the intent of Proposals 14-193 and 14-194. CMP-14 affirms that it was its intent to delete the references and their associated informational notes.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

14-56 Log #893 NEC-P14 **Final Action: Reject**

(506.6)

Submitter: David Wechsler, American Chemical Council

Comment on Proposal No: 14-200a

Recommendation: Delete new 506.6 and renumber accordingly.

Substantiation: First the Committee under Log 14-111 stated that some language in a Product Standard belongs in a product standard and not an installation code, like the NEC. Claiming that product standards include a marking of the dust group, does not provide substantiation to reflect the basis for these specific defined terms in the NEC.

IEC and ISA use the terms "Group IIIC, IIIB and IIIA". However these terms have different definitions. For example the IEC 60079-0 standard under paragraph 4.3 defines Group IIIC as: "conductive dust" and under 3.18.1.1 defines conductive dust as 'combustible dust with electrical resistivity equal to or less than 103 ohm m.' There also is a note: "Note: IEC 61241-2-2 contains the test method for determining the electrical resistivity of dusts." which suggests that a simple replacement of the term 'metal' for 'conductive' may not reflect the same potential hazards.

The ISA 60079-0 draft standard under paragraph 4.3 contains Note 2, a US deviation from the IEC standard, which states: "The 2011 NEC does not recognize the identification of location or equipment as 'Group IIIA, IIIB, or IIIC', but identifies equipment suitable for Zone 20, 21 and 22 and no separate differentiation is made of combustible dusts or ignitable fibers."

Lastly based upon the NFPA Standards Council, Jan. 1995, 95-6 ruling, it is the responsibility for group classification of materials to the Technical Committee on Electrical Equipment in Chemical Atmospheres (EECA) and not the NEC CMP-14. NFPA 499 which is under the EECA does not include these defined terms.

Panel Meeting Action: Reject

Panel Statement: The submitter's interpretation of the NFPA Standards Council decision is not correct. It is the responsibility of CMP-14 to establish the Group classifications and it is the responsibility of the Technical Committee on Electrical Equipment in Chemical Atmospheres to populate those groups.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13 Negative: 1

Explanation of Negative:

WECHSLER, D.: This issue needs to be addressed by the NEC Correlating Committee and input from the NFPA EECA Committee on the meaning of these new material group terms solicited.

A directive of the NFPA Standards Council relative to this Comment issue was that CMP-14 was responsible only for creating Material Groups; another NFPA Committee, the EECA, was responsible for populating/defining the information in the Material Groups.

Here the Committee proposal action created Materials Groups. The Committee proposed action also populated these Material Groups. The Committee proposed action also generated informational notes supplementing the populated material group materials.

Clearly, the aspect involved with population/defining information within the created Material Groups exceeds the directional authority provided by the Standards Council. The Panel statement supports the knowledge of this Standard Council directive. The Panel Action should have been to accept this comment and not proceed with the publishing of this Group information.

14-57 Log #894 NEC-P14 **Final Action: Reject**

(506.9(C)(1))

Submitter: David Wechsler, American Chemical Council

Comment on Proposal No: 14-204a

Recommendation: Delete 506.9(C)(1) and renumber accordingly.

Substantiation: First the Committee under Log 14-111 stated that some language in a Product Standard belongs in a product standard and not an installation code, like the NEC. Claiming that product standards include a marking of the dust group, does not provide substantiation to reflect the basis for these specific defined terms in the NEC.

Second, the NFPA Standards Council, Jan. 1995, 95-6 ruling, stated it is the responsibility for group classification of materials to the Technical Committee on Electrical Equipment in Chemical Atmospheres (EECA) and not the NEC CMP-14. NFPA 499 which is under the EECA does not include these defined terms.

Panel Meeting Action: Reject

Panel Statement: See panel statement in Comment 14-56.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13 Negative: 1

Explanation of Negative:

WECHSLER, D.: See my explanation of negative vote on Comment 14-56.

14-58 Log #895 NEC-P14 **Final Action: Reject**

(506.9(C)(2))

Submitter: David Wechsler, American Chemical Council

Comment on Proposal No: 14-205a

Recommendation: Delete 506.9(C) (2) and renumber accordingly.

Substantiation: First the Committee under Log 14-111 stated that some language in a Product Standard belongs in a product standard and not an installation code, like the NEC. Claiming that product standards include a marking of the dust group, does not provide substantiation to reflect the basis for these specific defined terms in the NEC.

Second, the NFPA Standards Council, Jan. 1995, 95-6 ruling, stated it is the responsibility for group classification of materials to the Technical Committee on Electrical Equipment in Chemical Atmospheres (EECA) and not the NEC CMP-14. NFPA 499 which is under the EECA does not include these defined terms.

Panel Meeting Action: Reject
Panel Statement: See panel statement in Comment 14-56.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
WECHSLER, D.: See my explanation of negative vote on Comment 14-56.

14-59 Log #319 NEC-P14 **Final Action: Accept**
(506.15(A)(7))

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 14-219
Recommendation: Revise text to read as follows:
(e) ~~Fiber~~ Optical fiber cable~~s of the~~ types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in raceways as stated in 506.15(A). These ~~Fiber Optic~~ optical fiber cables shall be sealed in accordance with 506.16.
Substantiation: This is an editorial comment. Terminology should be consistent throughout the code. Article 770 covers optical fiber cables not fiber optic cables. There are many places this change needs to be made to correlate with Article 770.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

14-60 Log #320 NEC-P14 **Final Action: Accept**
(506.15(C)(9))

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 14-223
Recommendation: Revise text to read as follows:
~~Fiber~~ Optical fiber cable~~s of the~~ types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in cable trays or any raceway as stated in 506.15(C). ~~Fiber~~ Optical fiber cables shall be sealed in accordance with 506.16.
Substantiation: This is an editorial comment. Terminology should be consistent throughout the code. Article 770 covers optical fiber cables not fiber optic cables. There are many places this change needs to be made to correlate with Article 770.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

14-61 Log #896 NEC-P14 **Final Action: Reject**
(506.20(D))

Submitter: David Wechsler, American Chemical Council
Comment on Proposal No: 14-225
Recommendation: Delete new 520.6 (D) and renumber accordingly.
Substantiation: Again if the prior action to delete the Article 506 Groups is accepted because based upon the NFPA Standards Council, Jan. 1995, 95-6 ruling, it is the responsibility for group classification of materials to the Technical Committee on Electrical Equipment in Chemical Atmospheres (EECA) and not the NEC CMP-14. NFPA 499 which is under the EECA does not include these defined terms, then this action as stated in this proposal serves no purpose.

Also it was stated in the Panel Statement, Product Standard belongs in a product standard and not an installation code, like the NEC. Claiming that product standards include a marking of the dust group, does not provide substantiation to reflect the basis for these specific defined terms in the NEC.

IEC and ISA use the terms "Group IIIC, IIIB and IIIA". However these terms have different definitions. For example the IEC 60079-0 standard under paragraph 4.3 defines Group IIIC as: "conductive dust" and under 3.18.1.1 defines conductive dust as 'combustible dust with electrical resistivity equal to or less than 103 ohm m.' There also is a note: "Note: IEC 61241-2-2 contains the test method for determining the electrical resistivity of dusts." which suggests that a simple replacement of the term 'metal' for 'conductive' may not reflect the same potential hazards.

The ISA 60079-0 draft standard under paragraph 4.3 contains Note 2, a US deviation from the IEC standard, which states: "The 2011 NEC does not recognize the identification of location or equipment as 'Group IIIA, IIIB, or IIIC', but identifies equipment suitable for Zone 20, 21 and 22 and no separate differentiation is made of combustible dusts or ignitable fibers."

Lastly based upon the NFPA Standards Council, Jan. 1995, 95-6 ruling, it is the responsibility for group classification of materials to the Technical Committee on Electrical Equipment in Chemical Atmospheres (EECA) and not the NEC CMP-14. NFPA 499 which is under the EECA does not include these defined terms.
Panel Meeting Action: Reject
Panel Statement: See panel statement in Comment 14-56.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
WECHSLER, D.: See my explanation of negative vote on Comment 14-56.

14-62 Log #378 NEC-P14 **Final Action: Accept**
(506.25)

Submitter: Robert A. Jones, Independent Electrical Contractors, Inc.
Comment on Proposal No: 14-56a
Recommendation: Revise text to read as follows:
Regardless of the voltage of the electrical system, grounding and bonding shall comply with Article 250 and the requirements in 506.25(A) and (B).
Substantiation: CMP 14 had a long discussion about deleting the informational note about referring to 250.100. During the discussion the phrase "regardless of the voltage of the electrical system" was considered important to minimize the possibility of an ignition; however Proposal 14-56a did not insert these words in the sections affected.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

ARTICLE 513 — AIRCRAFT HANGARS

14-63 Log #199 NEC-P14 **Final Action: Accept**
(513.7(F))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 14-234
Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action taken on Proposal 1-114.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-14 has taken the direction of the Correlating Committee and reconsidered the action taken on Proposal 14-234. CMP-14 continues to reject Proposal 14-234 because the additional text is not necessary. Since Articles 500 through 516 do not amend the requirements of 110.21, these requirements already apply.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

14-64 Log #200 NEC-P14 **Final Action: Accept**
(513.10(B))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 14-235
Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action taken on Proposal 1-114.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-14 has taken the direction of the Correlating Committee and reconsidered the action taken on Proposal 14-235. CMP-14 continues to reject Proposal 14-235 because the additional text is not necessary. Since Articles 500 through 516 do not amend the requirements of 110.21, these requirements already apply.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

14-65 Log #201 NEC-P14 **Final Action: Accept**
(513.10(D)(1))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 14-236
Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 1-114.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept

Panel Statement: CMP-14 has taken the direction of the Correlating Committee and reconsidered the action taken on Proposal 14-236. CMP-14 continues to reject Proposal 14-236 because the additional text is not necessary. Since Articles 500 through 516 do not amend the requirements of 110.21, these requirements already apply.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

ARTICLE 516 — SPRAY APPLICATION, DIPPING, AND COATING PROCESSES

14-66 Log #202 NEC-P14 **Final Action: Accept**
(516, Informational Note)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 14-243
Recommendation: The Correlating Committee directs Code-Making Panel 14 to resolve correlation issues/conflicts with NFPA 33 and NFPA 34 rather than refer to an outdated version of these two documents.

The Correlating Committee advises that using outdated NFPA references is not permitted.

See the Correlating Committee Note on Proposal 14-244.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-14 has resolved the conflicts as directed by the NEC Correlating Committee. See Comments 14-67, 14-68, and 14-69.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

14-67 Log #1268 NEC-P14 **Final Action: Accept**
(516.2)

TCC Action: (1) The Correlating Committee directs that the extract references to the NEC be deleted.
(2) The Correlating Committee directs that the text of 516.3(D)(7)(1) become part of 516.3(D)(7) to comply with the NEC Style Manual.
(3) The Correlating Committee directs that the last sentence of 516.4(B) be revised to read as follows: "All electrical wiring shall comply with 516.4(A)."
(4) The Correlating Committee directs that the following text be deleted from 516.10(A): "except as permitted by 11.5 of NFPA 33" and add an extract reference at the end 516.10(A): "[33:11.5]"

The NEC Style Manual does not permit mandatory references to requirements in other standards.
Submitter: Donald W. Ankele, UL LLC
Comment on Proposal No: 14-244
Recommendation: The Panel Action should be Accept in Principle. CMP-14 Finishing Processes Committee Task Group on 14-244 proposes a revised Article 516 as follows:

ARTICLE 516
Spray Application, Dipping, ~~and~~ Coating, and Printing Processes Using Flammable or Combustible Materials

Informational Note: Text that is followed by a reference in brackets has been extracted from NFPA 33-2011, *Standard for Spray Application Using Flammable and Combustible Materials*, or NFPA 34-2011, *Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids*. Only editorial changes were made to the extracted text to make it consistent with this *Code*.
516.1 Scope. This article covers the regular or frequent application of flammable liquids, combustible liquids, and combustible powders by spray operations and the application of flammable liquids, or combustible liquids at temperatures above their flashpoint, by dipping, coating, printing or other means.
Informational Note: For further information regarding safeguards for these processes, such as fire protection, posting of warning signs, and maintenance, see NFPA 33-2011, *Standard for Spray Application Using Flammable and Combustible Materials*, and NFPA 34-2011, *Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids*. For additional information regarding ventilation, see NFPA 91-2010, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids*.
516.2 Definitions. For the purpose of this article, the following definitions shall apply.
Flash-Off Area. An open or enclosed area after a spray application process where vapors are released due to exposure to ambient air or a heated atmosphere. [33:3.3.1.1]
Limited Finishing Workstation. An apparatus that is capable of confining the vapors, mists, residues, dusts, or deposits that are generated by a spray application process and that meets the requirements of Section 14.3 of NFPA 33, *Standard for Spray Application Using Flammable or Combustible Materials*, but does not meet the requirements of a spray booth or spray room, as herein defined. [**33**:3.3.15.1]
Resin Application Area. Any area in which polyester resins or gelcoats are spray applied. [**33**:3.3.1.2]
Spray Area. Any fully enclosed, partly enclosed, or unenclosed area in which ignitable quantities of flammable or combustible vapors, mists, residues, dusts, or deposits are present due to the operation of spray processes, including (1) any area in the direct path of a spray application process; (2) the interior of a spray booth or spray room or limited finishing workstation, as herein defined; (3) the interior of any exhaust plenum, eliminator section, or scrubber section; (4) the interior of any exhaust duct or exhaust stack leading from a spray application process; (5) the interior of any air recirculation filter house or enclosure, including secondary recirculation particulate filters; (6) any solvent concentrator (pollution abatement) unit or solvent recovery (distillation) unit. The following are not considered to be a part of the spray area: (1) fresh air make-up units; (2) air supply ducts and air supply plenums; (3) recirculation air supply ducts downstream of secondary filters; (4) exhaust ducts from solvent concentrator (pollution abatement) units. [**33**: 3.3.2.3]
Informational Note: Unenclosed spray areas are ~~normally~~ locations outside of buildings or are localized operations within a larger room or space. Such are normally provided with some local vapor extraction/ventilation system. In automated operations, the area limits are ~~shall be~~ the maximum area in the direct path of spray operations. In manual operations, the area limits are the maximum area of spray when aimed at ~~180~~ 90 degrees to the application surface.
Spray Booth. A power-ventilated enclosure for a spray application operation or process that confines and limits the escape of the material being sprayed, including vapors, mists, dusts, and residues that are produced by the spraying operation and conducts or directs these materials to an exhaust system. [**33**:3.3.14]
Informational Note: A spray booth is an enclosure or insert within a larger room used for spray/coating/dipping applications. A spray booth may be fully enclosed or have open front or face and may include separate conveyor entrance and exit. The spray booth is provided with a dedicated ventilation exhaust but may draw supply air from the larger room or have a dedicated air supply.
Spray Room. A power-ventilated fully enclosed room used exclusively for open spraying of flammable or combustible materials. A spray room is a purposefully enclosed room built for spray/coating/dipping applications provided with dedicated ventilation supply and exhaust. Normally the room is configured to house the item to be painted, providing reasonable access around the item/process. Depending on the size of the item being painted, such rooms may actually be the entire building or the major portion thereof. [**33**:3.3.15]
Unenclosed Spray Area. Any spray area that is not confined by a limited finishing workstation, spray booth, or spray room, as herein defined. [**33**:3.3.2.3.2]

516.3 Classification of Locations. Classification is based on ~~dangerous~~ quantities of flammable vapors, combustible mists, residues, dusts, or deposits that are present or might be present in quantities sufficient to produce ignitable or explosive mixtures with air.

(A) Zone Classification of Locations.

(1) For the purposes of this Article, the Zone system of electrical area classification shall be applied as follows:

~~(a) The inside of open or closed containers or vessels shall be considered a Class I, Zone 0 location.~~

(a) A Class I, Division 1 location shall be permitted to be alternatively classified as a Class I, Zone 1 location.

(b) A Class I, Division 2 location shall be permitted to be alternatively classified as a Class I, Zone 2 location.

(c) A Class II, Division 1 location shall be permitted to be alternatively classified as a Zone 21 location.

(d) A Class II, Division 2 location shall be permitted to be alternatively classified as a Zone 22 location. [**33:** 6.2.2]

(2) For the purposes of electrical area classification, the Division system and the Zone system shall not be intermixed for any given source of release. [**33:**6.2.3]

(3) In instances of areas within the same facility classified separately, Class I, Zone 2 locations shall be permitted to abut, but not overlap, Class I, Division 2 locations. Class I, Zone 0 or Zone 1 locations shall not abut Class I, Division 1 or Division 2 locations. [**70:**505.7(B)] [**33:**6.2.4]

(4) Open flames, spark-producing equipment or processes, and equipment whose exposed surfaces exceed the autoignition temperature of the material being sprayed shall not be located in a spray area or in any surrounding area that is classified as Division 2, Zone 2, or Zone 22.

Exception: This requirement shall not apply to drying, curing, or fusing apparatus. [**33:**6.2.5]

(5) Any utilization equipment or apparatus that is capable of producing sparks or particles of hot metal and that is located above or adjacent to either the spray area or the surrounding Division 2, Zone 2, or Zone 22 areas shall be of the totally enclosed type or shall be constructed to prevent the escape of sparks or particles of hot metal. [**33:** 6.2.6]

(B) (A) Class I, Division 1 or Class I, Zone 0 Locations. The following spaces shall be considered Class I, Division 1, or Class I, Zone 0, as applicable:

(1) The interior of any open or closed container or vessel of a flammable liquid

(2) The interior of any dip tank or coating tank

(3) The interior of any ink fountain, ink reservoir, or ink tank

Informational Note: For additional guidance ~~and explanatory diagrams~~, see Chapter 6 ~~4.3.5~~ of NFPA 33-2011, *Standard for Spray Application Using Flammable or Combustible Materials*, and Chapter 6 ~~Sections 4.2, 4.3, and 4.4~~ of NFPA 34-2011, *Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids*.

(C) ~~(B)~~ Class I, Division 1; Class I, Zone 1; ~~or~~ Class II, Division 1; or Zone 21 Locations. The following spaces shall be considered Class I, Division 1, or Class I, Zone 1, ~~or~~ Class II, Division 1, or Zone 21 locations, as applicable:

(1) The interior of spray booths and rooms except as specifically provided in 516.3(D).

(2) The interior of exhaust ducts.

(3) Any area in the direct path of spray operations.

(4) For open dipping and coating operations, all spaces within a 1.5-m (5-ft) radial distance from the vapor sources extending from these surfaces to the floor. The vapor source shall be the liquid exposed in the process and the drainboard, and any dipped or coated object from which it is possible to measure vapor concentrations exceeding 25 percent of the lower flammable limit at a distance of 300 mm (1 ft), in any direction, from the object as in Figure 516.3(D)(6)(a).

(5) Sumps, pits, or belowgrade channels within 7.5 m (25 ft) horizontally of a vapor source. If the sump, pit, or channel extends beyond 7.5 m (25 ft) from the vapor source, it shall be provided with a vapor stop or it shall be classified as Class I, Division 1 for its entire length.

(6) All space in all directions outside of but within 900 mm (3 ft) of open containers, supply containers, spray gun cleaners, and solvent distillation units containing flammable liquids.

(7) For limited finishing workstations, the area inside the curtains or partitions. (See Figure 516.3(D)(5).)

(D) ~~(C)~~ Class I, Division 2; Class I, Zone 2; ~~or~~ Class II, Division 2; or Zone 22 Locations. The following spaces shall be considered Class I, Division 2; ~~or~~ Class I, Zone 2; ~~or~~ Class II, Division 2; or Zone 22 as applicable.

(1) Unenclosed Spray Processes ~~Open Spraying~~. For unenclosed ~~open~~ spraying, all space outside of but within 6 m (20 ft) horizontally and 3 m (10 ft) vertically of the Class I, Division 1 or Class I, Zone 1 location as defined in 516.3(A) and not separated from it by partitions. See Figure 516.3(D)~~(C)~~(1) . [**33:**6.5.1]

(2) Closed-Top, Open-Face, and Open-Front Spray~~ing~~ Booths and Spray Rooms. If spray application operations are conducted within a closed-top, open-face, or open-front booth or room, as shown in Figure 516.3(D)(2), any electrical wiring or utilization equipment located outside of the booth or room but within 915mm (3 ft) of any opening ~~the boundaries designated as Division 2 or Zone 2 in Figure 516.3(C)(2)~~ shall be suitable for Class I, Division 2; Class I, Zone 2; ~~or~~ Class II, Division 2; or Zone 22 locations, whichever is applicable. The Class I, Division 2; Class I, Zone 2; ~~or~~ Class II, Division 2; or Zone 22 locations shown in Figure 516.3(D)~~(C)~~(2) shall extend from the edges of the open face or open front of the booth or room in accordance with the following:

Informational Note: For both interlocked and non-interlocked exhaust ventilation systems, the Division 2, Zone 2 or Zone 22 location extends 915 mm (3 ft) horizontally and 915 mm (3 ft) vertically from the open face or open front of the booth or room, as shown in Figure 516.3(D)(2).

******Insert Figure 516.3(D)~~(C)~~(1)***** Electrical Area Classification for Unenclosed ~~Open~~ Spray Areas. [33:Figure 6.5.1] (not shown)**

Insert Figure 516.3(D)~~(C)~~(2)** Class I, Division 2; Class I, Zone 2; ~~or~~ Class II, Division 2; or Zone 22 Locations Adjacent to a Closed Top, Open Face, or Open Front Spray Booth or Room. [33:Figure 6.5.2] (not shown)**

Add “or Zone 21” and “or Zone 22” to respective legends

~~(a) If the exhaust ventilation system is interlocked with the spray application equipment, the Division 2 or Zone 2 location shall extend 1.5 m (5 ft) horizontally and 900 mm (3 ft) vertically from the open face or open front of the booth or room, as shown in Figure 516.3(C)(2), top.~~

~~(b) If the exhaust ventilation system is not interlocked with the spray application equipment, the Division 2 or Zone 2 location shall extend 3 m (10 ft) horizontally and 900 mm (3 ft) vertically from the open face or open front of the booth or room, as shown in Figure 516.3(C)(2), bottom.~~

~~For the purposes of this subsection, *interlocked* shall mean that the spray application equipment cannot be operated unless the exhaust ventilation system is operating and functioning properly and spray application is automatically stopped if the exhaust ventilation system fails. [**33:**6.5.2.2]~~

(3) Open-Top Spray~~ing~~ Booths. For spraying operations conducted within an open top spray booth, the space 915mm ~~900 mm~~ (3 ft) vertically above the booth and within 915mm ~~900 mm~~ (3 ft) of other booth openings shall be considered Class I, Division 2; Class I, Zone 2; ~~or~~ Class II, Division 2; or Zone 22. [**33:**6.5.3]

(4) Enclosed Spray Booths and Spray Rooms. For spraying operations confined to an enclosed spray booth or room, electrical area classification shall be as follows: ~~the space within 900 mm (3 ft) in all directions from any openings shall be considered Class I, Division 2; or Class I, Zone 2; or Class II, Division 2 as shown in Figure 516.3(C)(4)~~. [**33:**6.5.4]

(A) The area within 915 mm (3 ft) of any opening shall be classified as Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 locations, whichever is applicable, as shown in Figure 516.3(D)(4) .

(B) Where exhaust air is recirculated both of the following shall apply:

(1) The interior of any recirculation path from the secondary particulate filters up to and including the air supply plenum shall be classified as Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 locations, whichever is applicable.

(2) The interior of fresh air supply ducts shall be unclassified.

(C) Where exhaust air is not recirculated, the interior of fresh air supply ducts and fresh air supply plenums shall be unclassified.

Figure 516.3(D)(~~C~~)(4)** Class I, Division 2; Class I, Zone 2; ~~or~~ Class II, Division 2; or Zone 22 Locations Adjacent to an Enclosed Spray Booth or Spray Room. [33:Figure 6.5.4] (not shown)**

(5) Limited Finishing Workstations. For limited finishing workstations, the area inside the 915 mm (3-ft) space horizontally and vertically beyond the volume enclosed by the outside surface of the curtains or partitions shall be classified as Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22, as shown in Figure 516.3(D)(5)

Figure 516.3(D)(5).** Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 Locations Adjacent to a Limited Finishing Workstation. [33:Figure 14.3.5.1] (not shown)**

(not shown)

~~**(5) Tanks and Drain Boards — Surrounding Space.** For dip tanks and drain boards, the 914-mm (3-ft) space surrounding the Class I, Division 1 or Class I, Zone 1 location shall be as defined in 516.3(A)(4) and as shown in Figure 516.3(D)(C)(5). [**34:**6.4.4]~~

~~**(6) Dip Tanks, and Drain Boards — Space Above Floor.** For dip tanks, and drain boards, the space 900 mm (3 ft) above the floor and extending 6 m (20 ft) horizontally in all directions from the Class I, Division 1 or Class I, Zone 1 location.~~

~~*Exception: This space shall not be required to be considered a hazardous (classified) location where the vapor source area is 0.46 m^2 (5 ft^2) or less and where the contents of the open tank trough or container do not exceed 19 L (5 gal). In addition, the vapor concentration during operation and shutdown periods shall not exceed 25 percent of the lower flammable limit outside the Class I location specified in 516.3(B)(4). [**34:**6.4.4 Exception]*~~

(6) Areas Adjacent to Open Dipping and Coating Processes. Electrical wiring and electrical utilization equipment located adjacent to open processes shall meet the requirements of (a) through (c) and Figures 516.3(D)(6)(a), 516.3(D)(6)(b), 516.3(D)(6)(c), 516.3(D)(6)(d), or 516.3(D)(6)(e), whichever is applicable. [34:6.4]

(a) Electrical wiring and electrical utilization equipment located in any sump, pit, or below grade channel that is within 7620 mm (25 ft) horizontally of a vapor source, as defined by this standard, shall be suitable for Class I, Division 1 or Class I, Zone 1 locations. If the sump, pit, or channel extends beyond 7620 mm (25 ft) of the vapor source, it shall be provided with a vapor stop, or it shall be classified as Class I, Division 1 or Class I, Zone 1 for its entire length. [34:6.4.1]

(b) Electrical wiring and electrical utilization equipment located within 1525 mm (5 ft) of a vapor source shall be suitable for Class I, Division 1 or Class I, Zone 1 locations. The space inside a dip tank, ink fountain, ink reservoir, or ink tank shall be classified as Class I, Division 1 or Class I, Zone 0, whichever is applicable. [34:6.4.2]

(c) Electrical wiring and electrical utilization equipment located within 915 mm (3 ft) of the Class I, Division 1 or Class I, Zone 1 location described in 6.4.2 shall be suitable for Class I, Division 2 or Class I, Zone 2 locations, whichever is applicable. [34:6.4.3]

(d) The space 915 mm (3 ft) above the floor and extending 6100 mm (20 ft) horizontally in all directions from the Class I, Division 1 or Class I, Zone 1 location described in 6.4.3 shall be classified as Class I, Division 2 or Class I, Zone 2, and electrical wiring and electrical utilization equipment located within this space shall be suitable for Class I, Division 2 or Class I, Zone 2 locations, whichever is applicable. [34:6.4.4]

Exception: This space shall be permitted to be unclassified for purposes of electrical installations if the surface area of the vapor source does not exceed 0.5 m2 (5 ft2), the contents of the dip tank, ink fountain, ink reservoir, or ink tank do not exceed 19 L (5 gal), and the vapor concentration during operating and shutdown periods does not exceed 25 percent of the lower flammable limit.

Figure 516.3(D)(6)(a)(~~C~~)(~~5~~)** Electrical Area Classification for Open Dipping and Coating Processes Without Vapor Containment or Ventilation. [34:Figure 6.4(a)] (not shown)**

Figure 516.3(D)(6)(b)(~~C~~)(~~5~~)** Electrical Area Classification for Open Dipping and Coating Processes With Peripheral Vapor Containment and Ventilation – Vapors Confined to Process Equipment. [34:Figure 6.4(b)] (not shown)**

Figure 516.3(D)(6)(c)(~~C~~)(~~5~~)** Electrical Area Classification for Open Dipping and Coating Processes With Partial Peripheral Vapor Containment and Ventilation – Vapors NOT Confined to Process Equipment. [34:Figure 6.4(c)] (not shown)**

Figure 516.3(D)(6)(d)(~~C~~)(~~5~~)** Electrical Area Classification for Open Dipping and Coating Processes With Partial Peripheral Vapor Containment and Ventilation – Vapors Confined to Process Equipment. [34:Figure 6.4(d)] (not shown)**

Figure 516.3(D)(6)(e)(~~C~~)(~~5~~)** Electrical Area Classification for a Typical Printing Process. [34:Figure 6.4(e)] (not shown)**

(7)(~~D~~) Enclosed Dipping and Coating Operations. Areas adjacent to enclosed dipping and coating processes shall be classified in accordance with 516.3(D)(1) and Figure 516.3(D)(7). The space adjacent to an enclosed dipping or coating process or apparatus shall be considered unclassified. [**34:**6.5.3]

*Exception: The space within 915 mm (3 ft) in all directions from any opening in the enclosures shall be classified as Class I, Division 2 or Class I, Zone 2, as applicable. [**34:**6.5.2]*

(1) The interior of any enclosed dipping or coating process or apparatus shall be a Class I, Division 1 or Class I, Zone 1 location, and electrical wiring and electrical utilization equipment located within this space shall be suitable for Class I, Division 1 or Class I, Zone 1 locations, whichever is applicable. The area inside the dip tank shall be classified as Class I, Division 1 or Class I, Zone 0, whichever is applicable. [34:6.5.1]

Figure 516.3(D)(7)** Electrical Area Classification Around an Enclosed Dipping or Coating Process [34:Figure 6.5] (not shown)**

(8) Open Containers. All space in all directions within 600 mm (2 ft) of the Division 1 or Zone 1 area surrounding open containers, supply containers, spray gun cleaners, and solvent distillation units containing flammable liquids, as well as the area extending 1.5 m (5 ft) beyond the Division 1 or Zone 1 area up to a height of 460 mm (18 in.) above the floor or grade level. [**33:**<u>**6.5.5**</u> ~~6.6.2~~]

(E) Adjacent Locations. Adjacent locations that are cut off from the defined Class I or Class II locations by tight partitions without communicating openings, and within which flammable vapors or combustible powders are not likely to be released, shall be unclassified.

(F) Unclassified Locations. Locations using drying, curing, or fusion apparatus and provided with positive mechanical ventilation adequate to prevent accumulation of flammable concentrations of vapors, and provided with effective interlocks to de-energize all electrical equipment (other than equipment identified for Class I locations) in case the ventilating equipment is inoperative, shall be permitted to be unclassified where the authority having jurisdiction so judges.

Informational Note: For further information regarding safeguards, see NFPA 86-2011, *Standard for Ovens and Furnaces*.

516.4 Wiring and Equipment in Class I Locations.

(A) Wiring and Equipment — Vapors. All electrical wiring and equipment within the Class I location (containing vapor only — not residues) defined in 516.3 shall comply with the applicable provisions of Article 501 or Article 505, as applicable.

(B) Wiring and Equipment — Vapors and Residues. Unless specifically listed for locations containing deposits of dangerous quantities of flammable or combustible vapors, mists, residues, dusts, or deposits (as applicable), there shall be no electrical equipment in any spray area as herein defined whereon deposits of combustible residue may readily accumulate<u>. All electrical wiring shall be per 516.4(A).</u>~~, except wiring in rigid metal conduit, intermediate metal conduit, Type MI cable, or in metal boxes or fittings containing no taps, splices, or terminal connections. [**33:**6.4.2]~~

<u>**(C) Illumination.**</u>

(1) <u>Luminaires, like that shown in Figure 516.4(C)(1), that are attached to the walls or ceiling of a spray area but that are outside any classified area and are separated from the spray area by glass panels shall be suitable for use in unclassified locations. Such fixtures shall be serviced from outside the spray area. [33:6.6.1]</u>

<u>**Figure 516.4(C)(1)**** Example of a Luminaire that is Mounted Outside of the Spray Area and is Serviced from Outside the Spray Area. [33:Figure 6.6.1]**</u> **(not shown)**

(2) <u>Luminaires, like that shown in Figure 516.4(C)(1), that are attached to the walls or ceiling of a spray area; that are separated from the spray area by glass panels and that are located within a Class I, Division 2; a Class I, Zone 2; a Class II, Division 2; or a Zone 22 location shall be suitable for such location. Such fixtures shall be serviced from outside the spray area. [33:6.6.2]</u>

<u>(3) Luminaires, like that shown in Figure 516.4(C)(3), that are an integral part of the walls or ceiling of a spray area shall be permitted to be separated from the spray area by glass panels that are an integral part of the fixture. Such fixtures shall be listed for use in Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 locations, whichever is applicable, and also shall be listed for accumulations of deposits of combustible residues. Such fixtures shall be permitted to be serviced from inside the spray area. [33:6.6.3]</u>

<u>**Figure 516.4(C)(3)**** Example of a Luminaire that is an Integral Part of the Spray Area and is Serviced from Inside the Spray Area. [33:Figure 6.6.3]**</u> **(not shown)**

<u>(4) Glass panels used to separate luminaires from the spray area or that are an integral part of the luminaire shall meet the following requirements.</u>

<u>(a) Panels for light fixtures or for observation shall be of heat-treated glass, laminated glass, wired glass, or hammered-wired glass and shall be sealed to confine vapors, mists, residues, dusts, and deposits to the spray area. [33:5.5.1]</u>

<u>Exception: Listed spray booth assemblies that have vision panels constructed of other materials shall be permitted.</u>

<u>(b) Panels for light fixtures shall be separated from the fixture to prevent the surface temperature of the panel from exceeding 93°C (200°F). [33:5.5.2]</u>

<u>(c) The panel frame and method of attachment shall be designed to not fail under fire exposure before the vision panel fails. [33:5.5.3]</u>

~~**(C) Illumination.** Illumination of readily ignitible areas through panels of glass or other transparent or translucent material shall be permitted only if it complies with the following:~~

~~(1) Fixed lighting units are used as the source of illumination.~~

~~(2) The panel effectively isolates the Class I location from the area in which the lighting unit is located.~~

~~(3) The lighting unit is identified for its specific location.~~

~~(4) The panel is of a material or is protected so that breakage is unlikely.~~

~~(5) The arrangement is such that normal accumulations of hazardous residue on the surface of the panel will not be raised to a dangerous temperature by radiation or conduction from the source of illumination.~~

(D) Portable Equipment. Portable electric luminaires or other utilization equipment shall not be used in a spray area during spray operations.

*Exception No. 1: Where portable electric luminaires are required for operations in spaces not readily illuminated by fixed lighting within the spraying area, they shall be of the type identified for Class I, Division 1 or Class 1, Zone 1 locations where readily ignitible residues may be present. [**33:**6.9 Exception]*

Exception No. 2: Where portable electric drying apparatus is used in spray booths and the following requirements are met:

(a) The apparatus and its electrical connections are not located within the spray enclosure during spray operations.

(b) Electrical equipment within 450 mm (18 in.) of the floor is identified for Class I, Division 2 or Class I, Zone 2 locations.

(c) All metallic parts of the drying apparatus are electrically bonded and grounded.

(d) Interlocks are provided to prevent the operation of spray equipment while drying apparatus is within the spray enclosure, to allow for a 3-minute purge of the enclosure before energizing the drying apparatus and to shut off drying apparatus on failure of ventilation system.

(E) Electrostatic Equipment. Electrostatic spraying or detearing equipment shall be installed and used only as provided in 516.10.

Informational Note: For further information, see NFPA 33-2011, *Standard for Spray Application Using Flammable or Combustible Materials*.

(F) Static Electric Discharges.

(1) All persons and all electrically conductive objects, including any metal parts of the process equipment or apparatus, containers of material, exhaust ducts, and piping systems that convey flammable or combustible liquids, shall be electrically grounded. [34:6.8.1]

(2) Provision shall be made to dissipate static electric charges from all nonconductive substrates in printing processes.

516.7 Wiring and Equipment Not Within Classified ~~I and II~~ Locations.

(A) Wiring. All fixed wiring above the Class I and II locations shall be in metal raceways, Type PVC conduit, Type RTRC conduit, or electrical nonmetallic tubing; where cables are used, they shall be Type MI, Type TC, or Type MC cable. Cellular metal floor raceways shall only be permitted to supply ceiling outlets or as extensions to the area below the floor of a Class I or II location. Where cellular metal raceways, are used, they shall not have connections leading into or passing through the Class I or II location unless suitable seals are provided.

(B) Equipment. Equipment that may produce arcs, sparks, or particles of hot metal, such as lamps and lampholders for fixed lighting, cutouts, switches, receptacles, motors, or other equipment having make-and-break or sliding contacts, where installed above a Classified ~~I or II~~ location or above a location where freshly finished goods are handled, shall be of the totally enclosed type or be constructed so as to prevent the escape of sparks or hot metal particles.

516.10 Special Equipment.

(A) Fixed Electrostatic Equipment. This section shall apply to any equipment using electrostatically charged elements for the atomization, charging, and/or precipitation of hazardous materials for coatings on articles or for other similar purposes in which the charging or atomizing device is attached to a mechanical support or manipulator. This shall include robotic devices. This section shall not apply to devices that are held or manipulated by hand. Where robot or programming procedures involve manual manipulation of the robot arm while spraying with the high voltage on, the provisions of 516.10(B) shall apply. The installation of electrostatic spraying equipment shall comply with 516.10(A)(1) through (A)(10). Spray equipment shall be listed except as permitted by 11.5 of NFPA 33. All automatic electrostatic equipment systems shall comply with 516.4(A)(1) through (A)(9).

(1) Power and Control Equipment. Transformers, high-voltage supplies, control apparatus, and all other electrical portions of the equipment shall be installed outside of the Class I location as defined in 516.3 or be of a type identified for the location.

Exception: High-voltage grids, electrodes, electrostatic atomizing heads, and their connections shall be permitted within the Class I location.

(2) Electrostatic Equipment. Electrodes and electrostatic atomizing heads shall be adequately supported in permanent locations and shall be effectively insulated from ground. Electrodes and electrostatic atomizing heads that are permanently attached to their bases, supports, reciprocators, or robots shall be deemed to comply with this section.

(3) High-Voltage Leads. High-voltage leads shall be properly insulated and protected from mechanical damage or exposure to destructive chemicals. Any exposed element at high voltage shall be effectively and permanently supported on suitable insulators and shall be effectively guarded against accidental contact or grounding.

(4) Support of Goods. Goods being coated using this process shall be supported on conveyors or hangers. The conveyors or hangers shall be arranged (1) to ensure that the parts being coated are electrically connected to ground with a resistance of 1 megohm or less and (2) to prevent parts from swinging.

(5) Automatic Controls. Electrostatic apparatus shall be equipped with automatic means that will rapidly de-energize the high-voltage elements under any of the following conditions:

(1) Stoppage of ventilating fans or failure of ventilating equipment from any cause

(2) Stoppage of the conveyor carrying goods through the high-voltage field unless stoppage is required by the spray process

(3) Occurrence of excessive current leakage at any point in the high-voltage system

(4) De-energizing the primary voltage input to the power supply

(6) Grounding. All electrically conductive objects in the spray area, except those objects required by the process to be at high voltage, shall be adequately grounded. This requirement shall apply to paint containers, wash cans, guards, hose connectors, brackets, and any other electrically conductive objects or devices in the area.

Informational Note: For more information on grounding and bonding for static electricity purposes, see NFPA 33-2011, *Standard for Spray Application Using Flammable or Combustible Materials*; NFPA 34-2011, *Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids*; and NFPA 77-2007, *Recommended Practice on Static Electricity*.

(7) Isolation. Safeguards such as adequate booths, fencing, railings, interlocks, or other means shall be placed about the equipment or incorporated therein so that they, either by their location, character, or both, ensure that a safe separation of the process is maintained.

(8) Signs. Signs shall be conspicuously posted to convey the following:

(1) Designate the process zone as dangerous with regard to fire and accident

(2) Identify the grounding requirements for all electrically conductive objects in the spray area

(3) Restrict access to qualified personnel only

(9) Insulators. All insulators shall be kept clean and dry.

(10) Other Than Nonincendive Equipment. Spray equipment that cannot be classified as nonincendive shall comply with (A)(10)(a) and (A)(10)(b).

(a) Conveyors, ~~or~~ hangers, and application equipment shall be arranged so ~~as to maintain a safe~~ that a minimum separation ~~distance~~ of at least twice the sparking distance is maintained between the workpiece or material being sprayed ~~between goods being painted~~ and electrodes, electrostatic atomizing heads, or charged conductors. Warnings defining this safe distance shall be posted. [**33:**11.4.1]

(b) The equipment shall provide an automatic means of rapidly de-energizing the high-voltage elements in the event the distance between the goods being painted and the electrodes or electrostatic atomizing heads falls below that specified in (a). [**33:**11.3.8]

(B) Electrostatic Hand-Spraying Equipment. This section shall apply to any equipment using electrostatically charged elements for the atomization, charging, ~~and/~~or precipitation of flammable and combustible materials for coatings on articles, or for other similar purposes in which the charging or atomizing device is hand-held and ~~or~~ manipulated during the spraying operation. Electrostatic hand-spraying equipment and devices used in connection with paint-spraying operations shall be of listed types and shall comply with 516.10(B)(1) through (B)(5).

(1) General. The high-voltage circuits shall be designed so as not to produce a spark of sufficient intensity to ignite the most readily ignitible of those vapor–air mixtures likely to be encountered, or result in appreciable shock hazard upon coming in contact with a grounded object under all normal operating conditions. The electrostatically charged exposed elements of the handgun shall be capable of being energized only by an actuator that also controls the coating material supply.

(2) Power Equipment. Transformers, power packs, control apparatus, and all other electrical portions of the equipment shall be located outside of the Class I location or be identified for the location.

Exception: The handgun itself and its connections to the power supply shall be permitted within the Class I location.

(3) Handle. The handle of the spraying gun shall be electrically connected to ground by a conductive material ~~metallic connection~~ and be constructed so that the operator in normal operating position is in direct ~~intimate~~ electrical contact with the grounded handle with a resistance of not more than 1 megohm to prevent buildup of a static charge on the operator's body. Signs indicating the necessity for grounding other persons entering the spray area shall be conspicuously posted.

(4) Electrostatic Equipment. All electrically conductive objects in the spraying area, except those objects required by the process to be at high voltage shall be electrically connected to ground with a resistance of not more than 1 megohm ~~adequately grounded~~. This requirement shall apply to paint containers, wash cans, and any other electrical conductive objects or devices in the area. The equipment shall carry a prominent, permanently installed warning regarding the necessity for this grounding feature.

Informational Note: For more information on grounding and bonding for static electricity purposes, see NFPA 33-2011, *Standard for Spray Application Using Flammable or Combustible Materials*; NFPA 34-2011, *Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids*; and NFPA 77-2007, *Recommended Practice on Static Electricity*.

(5) Support of Objects. Objects being painted shall be maintained in electrical ~~metallic~~ contact with the conveyor or other grounded support. Hooks shall be regularly cleaned to ensure adequate grounding of 1 megohm or less. Areas of contact shall be sharp points or knife edges where possible. Points of support of the object shall be concealed from random spray where feasible; and, where the objects being sprayed are supported from a conveyor, the point of attachment to the conveyor shall be located so as to not collect spray material during normal operation. [**33:** Chapter 12]

(C) Powder Coating. This section shall apply to processes in which combustible dry powders are applied. The hazards associated with combustible dusts are present in such a process to a degree, depending on the chemical composition of the material, particle size, shape, and distribution.

(1) Electrical Equipment and Sources of Ignition. Electrical equipment and other sources of ignition shall comply with the requirements of Article 502. Portable electric luminaires and other utilization equipment shall not be used within a Class II location during operation of the finishing processes. Where such luminaires or utilization equipment are used during cleaning or repairing operations, they shall be of a type identified for Class II, Division 1 locations, and all exposed metal parts shall be connected to an equipment grounding conductor.

Exception: Where portable electric luminaires are required for operations in spaces not readily illuminated by fixed lighting within the spraying area, they shall be of the type listed for Class II, Division 1 locations where readily ignitible residues may be present.

(2) Fixed Electrostatic Spraying Equipment. The provisions of 516.10(A) and 516.10(C)(1) shall apply to fixed electrostatic spraying equipment.

(3) Electrostatic Hand-Spraying Equipment. The provisions of 516.10(B) and 516.10(C)(1) shall apply to electrostatic hand-spraying equipment.

(4) Electrostatic Fluidized Beds. Electrostatic fluidized beds and associated equipment shall be of identified types. The high-voltage circuits shall be designed such that any discharge produced when the charging electrodes of the bed are approached or contacted by a grounded object shall not be of sufficient intensity to ignite any powder–air mixture likely to be encountered or to result in an appreciable shock hazard.

(a) Transformers, power packs, control apparatus, and all other electrical portions of the equipment shall be located outside the powder-coating area or shall otherwise comply with the requirements of 516.10(C)(1).

Exception: The charging electrodes and their connections to the power supply shall be permitted within the powder-coating area.

(b) All electrically conductive objects within the powder-coating area shall be adequately grounded. The powder-coating equipment shall carry a prominent, permanently installed warning regarding the necessity for grounding these objects.

Informational Note: For more information on grounding and bonding for static electricity purposes, see NFPA 33-2011, *Standard for Spray Application Using Flammable or Combustible Materials*; NFPA 34-2011, *Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids*; and NFPA 77-2007, *Recommended Practice on Static Electricity*.

(c) Objects being coated shall be maintained in electrical contact (less than 1 megohm) with the conveyor or other support in order to ensure proper grounding. Hangers shall be regularly cleaned to ensure effective electrical contact. Areas of electrical contact shall be sharp points or knife edges where possible.

(d) The electrical equipment and compressed air supplies shall be interlocked with a ventilation system so that the equipment cannot be operated unless the ventilating fans are in operation. [**33:** Chapter 15]

516.16 Grounding. All metal raceways, the metal armors or metallic sheath on cables, and all non–current-carrying metal parts of fixed or portable electrical equipment, regardless of voltage, shall be grounded and bonded. Grounding and bonding shall comply with 501.30, 502.30, or 505.25, as applicable.

Substantiation: For the 2011 NEC, the Informational Notes in Article 516 were revised to the 2011 editions of NFPA 33 and NFPA 34. The actual text in Article 516, however, remained the extracted text from 2007.
Proposal 14-244 and others proposed partial revisions to 516, but no proposal addressed all of the parts of 516 that were 2007 extracted text.
The TCC directed that a task group be formed consisting of members of CMP14 and the Committee on Finishing Processes.
This comment was prepared by a Task Group consisting of the following members:
CMP14
Don Ankele, UL, Task Group Chair
Bill Lawrence, FM Global
Jeremy Neagle, US Bureau of ATF
Ed Briesch, UL LLC
Fred Walker, US Department of the Air Force
Panel Meeting Action: Accept

Panel Statement: CMP-14 notes that this rewrite of Article 516 has the full concurrence of the Technical Committee on Finishing Processes, who is responsible for NFPA 33, *Standard for Spray Application Using Flammable or Combustible Materials*.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

14-68 Log #492 NEC-P14 **Final Action: Reject**
(516.2.Spray Area and 516.3 (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 14-245
Recommendation: Revise text to read as follows:
Spray Area. Normally, locations outside of buildings or localized operations within a larger room or space. Such <u>locations</u> are normally provided with some local vapor extraction/ventilation system. ~~In automated operations, the area limits shall be the maximum area in the direct path of spray operations. In manual operations, the area limits shall be the maximum area of spray when aimed at 180 degrees to the application surface.~~
<u>**516.3 Maximum spray areas.**</u>
<u>**516.3.1** In automated operations, the spray area limits shall be the maximum area in the direct path of spray operations.</u>
<u>**516.3.2** In manual operations, the spray area limits shall be the maximum area of spray when aimed at 180 degrees to the application surface.</u>
This would require renumbering of sections 516.3 and 516.4.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However, on rereading it appears that a subject is needed for the second sentence. I also feel that CMP 14 might want to consider whether to place the third and fourth sentences, which are requirements, in an alternate location within Article 516, since definitions are not allowed to contain requirements. The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Another approach would be to simply make the third and last sentences into an informational note, for example as follows:
<u>**Informational Note:** In automated operations, the spray area limits should be the maximum area in the direct path of spray operations. In manual operations, the spray area limits should be the maximum area of spray when aimed at 180 degrees to the application surface.</u>
Similar approaches to what is being suggested above for spray areas might be done also for spray booths and spray rooms but spray area is the term with the clearest problems because of the requirements and the missing subject.
Panel Meeting Action: Reject
Panel Statement: The comment in effect creates a new definition of "spray area" and a new concept of determining its extent, neither of which have been reviewed by the Technical Committee on Finishing Processes, who is responsible for NFPA 33, *Standard for Spray Application Using Flammable or Combustible Materials*. CMP-14 points out that the definition of "spray area" in Article 516 (of the 2011 edition of the Code) is being replaced with one extracted without alteration from the 2011 edition of NFPA 33, as indicated in Comment 14-67.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

14-69 Log #493 NEC-P14 **Final Action: Reject**
(516.2.Spray Area)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 14-245
Recommendation: Revise text to read as follows:
Spray Area. Normally, locations outside of buildings or localized operations within a larger room or space. Such <u>locations</u> are normally provided with some local vapor extraction/ventilation system. In automated operations, the area limits shall be the maximum area in the direct path of spray operations. In manual operations, the area limits shall be the maximum area of spray when aimed at 180 degrees to the application surface.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However, on rereading it appears that a subject is needed for the second sentence. I also feel that CMP 14 might want to consider whether to place the third and fourth sentences, which are requirements, in an alternate location within Article 516, since definitions are not allowed to contain requirements. This is proposed in an additional comment. The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Another approach would be to simply make the third and last sentences into an informational note, for example as follows:
<u>**Informational Note:** In automated operations, the spray area limits should be the maximum area in the direct path of spray operations. In manual operations, the spray area limits should be the maximum area of spray when aimed at 180 degrees to the application surface.</u>
Similar approaches to what is being suggested above for spray areas might be done also for spray booths and spray rooms but spray area is the term with the clearest problems because of the requirements and the missing subject.
Panel Meeting Action: Reject
Panel Statement: See panel statement on Comment 14-68.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

14-70 Log #203 NEC-P14 **Final Action: Accept**
(516.10(B)(4))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 14-254
Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on taken on Proposal 1-114.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-14 has taken the direction of the Correlating Committee and reconsidered the action taken on Proposal 14-254. CMP-14 affirms its decision to reject Proposal 14-254 because the additional text is not necessary. Since Articles 500 through 516 do not amend the requirements of Section 110.21, the requirements therein already apply.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

ARTICLE 517 — HEALTH CARE FACILITIES

15-4 Log #1296 NEC-P15 **Final Action: Reject**
(517.1, Informational Note (New))

TCC Action: The Correlating Committee directs that this comment be reported as Reject. The format and language used in this Code follows guidelines established by NFPA and published in the NEC Style Manual.
Submitter: Stephen M. Lipster, The Electrical Trades Center
Comment on Proposal No: 15-46
Recommendation: Add a new informational note to 517.1:
Informational Note: NFPA 99 Health Care Facilities Code extracted material found in the design elements of this Article cannot be revised by the standard National Electrical Code making process. Revisions to these elements must be submitted to the Electrical Systems Technical Committee of the NFPA 99 Health Care Code.
Substantiation: Understandably code users believe the NEC can be revised under the normal NEC code making process. Recent Standards Council decisions have given jurisdiction to large portions of Article 517 to the NFPA 99 ELS. Code users should be made aware of this change so code users participating in the code making process can submit revisions to the proper entity.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 12 Negative: 2
Explanation of Negative:
ROCK, B.: Per 2.2.1 of the *2011 National Electrical Code® Style Manual*, Article Scope statements are the responsibility of the Correlating Committee. Furthermore, the content of the proposed added Informational Note is redundant to *NEC*® 90.5(C) and 90.9(C)(2) regarding content extracted from other NFPA documents, in this case *NFPA 99*.
TALKA, D.: This should be rejected for two reasons. (1) This is new material that has not had public review and comment. (2) This Informational Note is basically an instruction to the CMP on how to approach changes to Article 517. The Informational Note does nothing to assist the NEC reader to apply or interpret the code. It does not belong in the NEC.

15-4a Log #CC1500 NEC-P15 **Final Action: Accept**
(517.2)

Submitter: Code-Making Panel 15,
Comment on Proposal No: N/A
Recommendation: Add extraction reference to definition as follows:
Alternate Power Source. One or more generator sets, or battery systems where permitted, intended to provide power during the interruption of the normal electrical service; or the public utility electrical service intended to provide power during interruption of service normally provided by the generating facilities on the premises. <u>[**99:** 3.3.5]</u>
Substantiation: The Panel notes that this is extracted material from NFPA 99 and should be referenced as such. [99: 3.3.5]. The panel action adds the NFPA 99 reference.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-5 Log #435 NEC-P15 **Final Action: Accept in Principle**
(517.2.Critical Branch)

Submitter: Neil F. LaBrake, Jr., National Grid USA
Comment on Proposal No: 15-12
Recommendation: The Panel action should be "accept-in-principle" and the recommended text for "517.2 Critical Branch" should read as follows:

"**Critical Branch.** A system of feeders and branch circuits supplying power for task illumination, fixed equipment, select receptacles, and select power circuits serving areas and functions related to patient care that are automatically connected to alternate power sources by one or more transfer switches during interruption of the normal power source. [99: 3.3.30]"

Also, the NFPA 99 extract note shall be identified in the NEC for this section.
Substantiation: This comment is the work of the Task Group on 2014 NEC/2012 NFPA 99 Correlation with the following representation: Larry Todd, CMP-15; Don Talka, CMP-15; Jim Duncan, CMP-15; Sam Friedman, CMP-15; Walt Vernon, NFPA 99; Dave Dagenais, NFPA 99; James Costley, NFPA 99; Chad Beebe, NFPA 99; Jim Dollard, NEC Correlating Committee; and Neil LaBrake, Jr., NEC Correlating Committee (Chair). As directed by Mr. Michael J. Johnston, NEC Correlating Committee Chair on June 8th, 2012, the Task Group acted on correlation matters and conformance with the Standard Council direction on "Installation vs. Performance" to resolve any conflicts or inconsistencies resulting from proposed revisions in the A2013NEC Report on Proposals (ROP) related to the 2012 NFPA 99.

This definition is under the jurisdiction of the NFPA 99 Technical Committee. This action results in correlation of NFPA 99-2012 Section 3.3.30 with A2013NEC ROP.
Panel Meeting Action: Accept in Principle
Revise the following definition in 517.2 to agree with NFPA 99:
Critical Branch. A system of feeders and branch circuits supplying power for task illumination, fixed equipment, select receptacles, and select power circuits serving areas and functions related to patient care that are is automatically connected to alternate power sources by one or more transfer switches during interruption of the normal power source. [99: 3.3.30]
Panel Statement: The word "are" should be changed to "is" because it is grammatically matching and does not change the intent. It is consistent with NEC Style Manual 4.3.2.2. The definition is an extraction from NFPA 99, *Health Care Facilities Code,* 3.3.30. This information should be forwarded to NFPA 99 ELS Committee.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-6 Log #1187 NEC-P15 **Final Action: Accept in Principle**
(517.2, Critical Branch)

Submitter: Technical Committee on Electrical Systems,
Comment on Proposal No: 15-12
Recommendation: Revise text to read as follows:

Critical Branch. A system of feeders and branch circuits supplying power for task illumination, fixed equipment, select receptacles, and power circuits serving areas and functions related to patient care ~~and~~ that are automatically connected to alternate power sources by one or more transfer switches during interruption of normal power source. [**99:** 3.3.30]
Substantiation: The ELS committee requests this revision to what was accepted at the ROP stage to completely correlate with Section 3.3.30 of NFPA 99-2012.

This comment was balloted through the Technical Committee on Electrical Systems with the following results:

25 Members Eligible to Vote
2 Not Returned (T. Easty, H. Nash)
23 Affirmative
0 Negatives
0 Abstentions

Panel Meeting Action: Accept in Principle
Panel Statement: See the panel action and statement on Comment 15-5.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-7 Log #1484 NEC-P15 **Final Action: Reject**
(517.2.Critical Branch)

Submitter: Randy Hunter, Las Vegas, NV
Comment on Proposal No: 15-12
Recommendation: Reject the proposal.
Substantiation: The text for 517.2 for the definition of a "critical branch" should not be revised as indicated in Proposal 15-12, just as the text in 517.26 should revert to the 2011 NEC and previous editions of the NEC involved the requirement of the essential electrical system, such as the life safety and the critical branch, to use Article 700, except as amended by Article 517. For the 2014 NEC, Proposal 15-48 was submitted by the NFPA 99 Technical Committee on Electrical Systems to revise 517.26 as follows: "Application of Other Articles. The life safety branch of the essential electrical system shall meet the requirements of Article 700, except as amended by Article 517." What the NFPA 99 Electrical Committee did not take into consideration is the existing text in 517.30(D) stating the following: "The sizing requirements in 700.4 and 701.4 shall not apply to hospital generator set(s)." Both the NFPA 99 Electrical Committee and CMP-15 may have overlooked NEC 517.30(D) as a solution to their concerns and negating any reason for deleting the critical branch from 517.26. Deleting the critical branch from compliance with Article 700 will also delete safety features covered by Article 700, such as 700.5 for transfer switches where the transfer switches are required to be electrically-operated and mechanically-held. Similar action should be made for Proposal 15-12 making changes to the definition of a "critical branch." Making the necessary changes in Article 517 for critical branch circuits at this point in the process would constitute new material and would not be permitted at the comment stage, however, rejecting the proposal would leave Article 700 as a requirement with a rewrite possible for the 2017 NEC.
Panel Meeting Action: Reject
Panel Statement: Panel 15 has been directed by the correlating committee to achieve correlation with NFPA 99, *Health Care Facilities Code*. The panel actions on Comments 15-5 and 15-6 achieves this. The arrangement of the various systems and branches is a performance concern under the purview of the NFPA 99 Electrical Systems committee. Requests for changes to performance requirements should be processed through that committee.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-8 Log #918 NEC-P15 **Final Action: Reject**
(517.2.Equipment Branch)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 15-14
Recommendation: Revise text to read as follows:
517.2 Definitions.
Equipment Branch. A system of feeders and branch circuits arranged for delayed, automatic, or manual connection to the alternate power source ~~and that serves primarily 3-phase power equipment~~. [**99:**3.3.46].
Substantiation: Three branches are defined in 517: Critical, Equipment, and Life Safety. These branches are defined by what they serve. Only e*quipment* is identified by the type of electrical circuit. This unnecessary and perhaps misleading.
The definition is copied from NFPA 99, but the NEC should be as precise as possible when it comes to electrical descriptions.
Panel Meeting Action: Reject
Panel Statement: This is extracted material and Panel 15 has been directed by the correlating committee to maintain correlation with NFPA 99, *Health Care Facilities Code*. The arrangement of the various systems and branches is a performance concern under the purview of the NFPA 99 ELS Committee. Requests for changes to performance requirements should be processed through that committee.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-9 Log #494 NEC-P15 **Final Action: Reject**
(517.2.Health Care Facilities and Informational Note (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 15-15
Recommendation: Revise text to read as follows:
Health Care Facilities. Buildings or portions of buildings in which medical, dental, psychiatric, nursing, obstetrical, or surgical care are provided. ~~Health care facilities include, but are not limited to, hospitals, nursing homes, limited care facilities, clinics, medical and dental offices, and ambulatory care centers, whether permanent or movable.~~
Informational Note: Health care facilities include, but are not limited to, hospitals, nursing homes, limited care facilities, clinics, medical and dental offices, and ambulatory care centers, whether permanent or movable.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains a list of examples and such examples are not usually contained in definitions but as information. If, on the other hand, the CMP believes that this list is a requirement it should place it somewhere else in Article 517, for example as a section 517.3 or a similar new location, since NEC definitions shall not contain requirements. Moreover, the NEC manual of style does not permit the definition to contain the defined term and the second sentence contains the defined term "health care facilities".
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Panel Meeting Action: Reject
Panel Statement: The glossary of terms gives the definition for "Health Care Facilities" to NFPA 5000. The panel suggests that the submitter make the proposal to the appropriate document.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-10 Log #436 NEC-P15 **Final Action: Accept in Principle**
(517.2.Life Safety Branch)

Submitter: Neil F. LaBrake, Jr., National Grid USA
Comment on Proposal No: 15-16
Recommendation: The Panel action should be "accept-in-principle" and the recommended text for "517.2 Life Safety Branch" should read as follows:
Life Safety Branch. A system of feeders and branch circuits supplying power for lighting, receptacles, and equipment essential for life safety that are automatically connected to alternate power sources by one or more transfer switches during interruption of the normal power source. [99: 3.3.94]
Also, the NFPA 99 extract note shall be identified in the NEC for this section.
Substantiation: This comment is the work of the Task Group on 2014 NEC/2012 NFPA 99 Correlation with the following representation: Larry Todd, CMP-15; Don Talka, CMP-15; Jim Duncan, CMP-15; Sam Friedman, CMP-15; Walt Vernon, NFPA 99; Dave Dagenais, NFPA 99; James Costley, NFPA 99; Chad Beebe, NFPA 99; Jim Dollard, NEC Correlating Committee; and Neil LaBrake, Jr., NEC Correlating Committee (Chair). As directed by Mr. Michael J. Johnston, NEC Correlating Committee Chair on June 8th, 2012, the Task Group acted on correlation matters and conformance with the Standard Council direction on "Installation vs. Performance" to resolve any conflicts or inconsistencies resulting from proposed revisions in the A2013NEC Report on Proposals (ROP) related to the 2012 NFPA 99.
This definition is under the jurisdiction of the NFPA 99 Technical Committee. This action results in correlation of NFPA 99-2012 Section 3.3.94 with A2013NEC ROP.
Panel Meeting Action: Accept in Principle
Revise the following definition in 517.2 to agree with NFPA 99:
Life Safety Branch. A system of feeders and branch circuits supplying power for lighting, receptacles, and equipment essential for life safety that is ~~are~~ automatically connected to alternate power sources by one or more transfer switches during interruption of the normal power source. [99: 3.3.94]
Panel Statement: The word "are" should be changed to "is" because it is grammatically matching and does not change the intent. It is consistent with NEC Style Manual 4.3.2.2. The definition is an extraction from NFPA 99, *Health Care Facilities Code*, 3.3.94. This information should be forwarded to NFPA 99 ELS Committee.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-11 Log #1188 NEC-P15 **Final Action: Accept in Principle**
(517.2, Life Safety Branch)

Submitter: Technical Committee on Electrical Systems,
Comment on Proposal No: 15-16
Recommendation: Revise text to read as follows:
Life Safety Branch. A system of feeders and branch circuits supplying power for lighting, receptacles, and equipment essential for life safety, ~~and~~ that are automatically connected to alternate power sources by one or more transfer switches during interruption of the normal power source. [**99**:3.3.94]
Substantiation: The ELS committee requests this revision to what was accepted at the ROP stage to completely correlate with Section 3.3.94 of NFPA 99-2012.
This comment was balloted through the Technical Committee on Electrical Systems with the following results:
25 Members Eligible to Vote
2 Not Returned (T. Easty, H. Nash)
23 Affirmative
0 Negatives
0 Abstentions
Panel Meeting Action: Accept in Principle
Panel Statement: The panel action on Comment 15-10 addresses the intent of the recommendation. See the panel statement on Comment 15-10.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-12 Log #204 NEC-P15 **Final Action: Accept**
(517.2.Patient Care Area)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 15-19
Recommendation: The Correlating Committee directs the panel to reconsider this proposal with respect to the accuracy of the extracted material and the use of permissive language in the Informational Notes. Defined terms in this proposal shall be extracted from NFPA 99.
The Correlating Committee further directs that the panel ensure that where text is extracted from NFPA 99 it meets the requirements of 4.3.2.2 of the NEC Style Manual.
In addition, it was the action of the Correlating Committee that further consideration be given to the comments expressed in the voting.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Change the following as shown in the 2014 NEC ROP Version:
Patient Care Space. Space within a health care facility wherein patients are intended to be examined or treated.
Basic Care Space. Space in which failure of equipment or a system is not likely to cause injury to the patients or caregivers but may cause patient discomfort.
Critical Care Space. Space in which failure of equipment or a system is likely to cause major injury or death to patients or caregivers.
General Care Space. Space in which failure of equipment or a system is likely to cause minor injury to patients or caregivers.
Support Space. Space in which failure of equipment or a system is not likely to have a physical impact on patients or caregivers.
Informational Note No. 1: The governing body of the facility designates patient care space in accordance with the type of patient care anticipated and with the definitions of the area classification. Business offices, corridors, lounges, day rooms, dining rooms, or similar areas typically are not classified as patient care ~~rooms~~ space.
Informational Note No. 2: Basic Care SpaceRoom. This spacerooms is typically where basic medical or dental care, treatment, or examinations are performed. Examples include but are not limited to, examination or treatment rooms in clinics, medical and dental offices, nursing homes and limited care facilities.
Informational Note No. ~~2~~ 3: General care space ~~may~~ includes areas such as patient bedrooms, examining rooms, treatment rooms, clinics, and similar areas ~~in~~ where the patient may come in contact with electromedical devices or ordinary appliances such as a nurse call system, electric beds, examining lamps, telephones, and entertainment devices.
Informational Note No. ~~3~~ 4: Critical care space ~~rooms may~~ includes special care units, intensive care units, coronary care units, angiography laboratories, cardiac catheterization laboratories, delivery rooms, operating rooms, and similar areas in which patients are intended to be subjected to invasive procedures and connected to line-operated, electromedical devices.
Informational Note No. ~~4~~ 5: Space~~Rooms within a patient care room~~ where a procedure is performed that subjects patients or staff to wet conditions ~~may be~~ are considered as wet procedure areas. This includes standing fluids on the floor or drenching of the work area. Procedures and incidental spillage of liquids do not define wet procedure areas. It is the responsibility of the governing body of the health care facility to designate the wet procedure areas.
Panel Statement: The panel reconsiders its action and agrees with action taken on Proposal 15-19 and Proposal 15-20 to change to the word "space" instead of "room" or "area". As directed, the panel has corrected the permissive language in the informational notes and made other grammatical and editorial corrections. The panel recognizes the following statement from the NEC Correlating Committee Task Group on 2014 NEC/2012 NFPA 99 Correlation: "The TG recognizes in Proposals 15-20, 15-26, 15-33, 15-42, and 15-62 that these definitions as revised with the term change from "areas" to "spaces" do not correlate with NFPA 99, *Health Care Facilities Code*, 2012. However, NFPA 99 members of this Task Group are submitting a TIA to NFPA 99-2012 to have correlation when the 2014 NEC is issued based on the A2014 NFPA 99 ROP meeting. The 2015 revision of NFPA 99 can then process the change during its comment stage to ensure its correlation with the 2014 NEC."
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-13 Log #495 NEC-P15 **Final Action: Reject**
(517.2.Patient Care Area)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 15-19
Recommendation: Please accept the proposal as submitted and do not modify it.
Substantiation: The NFPA Standards Council has set up an Advisory Committee on the Glossary on Terminology to obtain consistency in definitions with the NFPA set of documents. The NFPA 99 set of definitions are reasonable and the small differences between what was proposed and what was accepted will simply lead to new confusion when users of both codes find similar terms and similar definitions but a lack of consistency. Accepting extracted definitions will create consistency.
Panel Meeting Action: Reject
Panel Statement: See the panel action and statement on Comment 15-12.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-14 Log #205 NEC-P15 **Final Action: Accept**
(517.2.Patient Care Areas)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 15-20
Recommendation: The Correlating Committee directs the panel to reconsider this proposal with respect to the accuracy of the extracted material. Defined terms in this proposal shall be extracted from NFPA 99.
The Correlating Committee further directs that the panel ensure that where text is extracted from NFPA 99 it meets the requirements of 4.3.2.2 of the NEC Style Manual.

In addition, it was the action of the Correlating Committee that further consideration be given to the comments expressed in the voting.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: See the panel action and statement on Comment 15-12.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-15 Log #496 NEC-P15 **Final Action: Reject**
(517.2.Patient Care Facility)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 15-21
Recommendation: Please accept the proposal as submitted and do not modify it.
Substantiation: The NFPA Standards Council has set up an Advisory Committee on the Glossary on Terminology to obtain consistency in definitions with the NFPA set of documents. The NFPA 99 definition is reasonable. Accepting extracted definitions will create consistency.
Panel Meeting Action: Reject
Panel Statement: The definition for "Patient Care Vicinity" is extracted material from NFPA 99.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-16 Log #1400 NEC-P15 **Final Action: Reject**
(517.2.Patient Care Room)

Submitter: Timothy Crnko, St. Louis, MO
Comment on Proposal No: 15-19
Recommendation: Revise text to read as follows:
Patient Care ~~Area~~ Room. Any ~~portion~~ room ~~space~~ of a health care facility wherein patients are intended to be examined or treated. [99:3.3.138]
Basic Care Room ~~Space~~: Room ~~Space~~ in which failure of equipment or a system is not likely to cause injury to the patients or caregivers but may cause patient discomfort, Category 3. [99:3.3.138.1]
Critical Care Room ~~Space~~. ~~Space~~ Room in which failure of equipment or a system is likely to cause major injury or death to patients or caregivers. Category 1.
[99:3.3.138.2]
General Care Room ~~Space~~. ~~Space~~ Room in which failure of equipment or a system is likely to cause minor injury to patients or caregivers. Category 2
[99:3.3.138.3]
Support ~~Space~~ Room: ~~Space~~ Room in which failure of equipment or a system is not likely to have a physical impact on patients or caregivers. Category 4
[99:3.3.138.4]
Informational Note No. I: This Article reflects the NFPA 99 requirements where the risk to the patient is defined by categories of risk in a specific location or space and the various systems to support. It is important to note these requirements are no longer occupancy-based. The risk to the patient does not change for a given procedure. If the procedure is performed in a doctor's office versus a hospital the risk remains the same. The different essentially electrical systems Type 1, 2, and 3 are designed to meet the designated Category for the specific room usage, intended use of receptacles, etc.
Four levels of systems categories are defined in NFPA 99, based on the risks to patients and caregivers in the facilities. See NFPA 99:4.1. The categories are as follows:
(1) Category 1: Systems are expected to work or be available at all times to support patient needs. [99:A.4.1.1]
(2) Category 2: Systems are expected to provide a high level of reliability; however limited short durations of equipment downtime can be tolerated without significant impact on patient care. Category 2 systems support patient needs but are not critical for life support. [99:A.4.1.2]
(3) Category 3: Normal building system reliabilities are expected. Such systems support patient needs. but failure of such equipment would not immediately affect patient care. Such equipment is not critical for life support. [99:A.4.1.3]
(4) Category 4: Such systems have no impact on patient care and would not be noticeable to patients in the event of failure. [99:A.4.1.4]
Informational Note No. ~~1~~2: The governing body of the facility designates patient care ~~spaces~~ rooms in accordance with the type of patient care anticipated and with the definitions of the area classification. Business offices, corridors, lounges, day rooms, dining rooms, or similar areas typically are not classified as patient care rooms. [99:1.3.4.1]
lnformational Note No. 3: Patient Care Room, business offices, corridors, lounges, day rooms. dining rooms or similar areas typically are not classified as patient care rooms. [99:A.3.3.l38]
Basic Care Room. These rooms are typically where basic medical or dental care. treatment. or examinations are performed.
Examples include but are not limited to, examination or treatment rooms in clinics, medical and dental offices, nursing homes and limited care facilities. [99:A.3.3.138.1]
Critical Care Room. These rooms are typically where patients are intended to be subjected to invasive procedures and connected to line-operated patient care-related appliances. Examples include but are not limited to special care patient rooms used for critical care, intensive care, and special care treatment rooms such as angiography laboratories,cardiac catheterization laboratories, delivery rooms, operating rooms, post-anesthesia care units, trauma rooms and other similar rooms. [99: A.3.3.138.2]
General Care Room. Examples include but are not limited to, inpatient bedrooms dialysis rooms in vitro fertilization rooms procedural rooms and similar rooms. [99:A.3.3.138.3]
Support Room. Examples of support rooms include. but are not limited to anesthesia work rooms, sterile supply, laboratories, morgues, waiting rooms, utility rooms and lounges. [99:A.3.3.138.4]
Informational Note No. 4. Spaces within a patient care room where a procedure is performed that subjects patients or staff to wet conditions may be considered as wet procedure areas. These include standing fluids on the floor or drenching of the work area. Routine housekeeping procedures and incidental spillage of liquids do not define wet procedure areas. It is the responsibility of the governing body of the health care facility to designate the wet procedure areas. [99:1.3.4.3]
~~Informational Note No. 2: General care spacesrooms may include areas such as patient bedrooms, examining rooms, treatment rooms, clinics, and similar areas in where the patient may come in contact with electromedical devices or ordinary appliances such as a nurse call system, electric beds, examining lamps, telephones, and entertainment devices.~~
~~Informational Note 3: Critical care spacerooms may include special care units, intensive care units, coronary care units, angiography laboratories, cardiac catheterization laboratories, delivery rooms, operating rooms, and similar areas in which patients are intended to be subjected to invasive procedures and connected to line operated, electromedical devices.~~
Substantiation: Use "room" rather than "space" as used in NFPA 99. Include NFPA 99 designated Category for each room since this is the guide post as to designated risk and this then makes an extract reference possible which is more transparent. Informational Note No. 1 is needed to inform reader of the major change from occupancy-based to risk-based. The last two paragraphs from 2012 NFPA 99 Origins and Development of NFPA 99 on page 99-3 in part:
"The 2012 edition went through a major overhaul, The premise of an occupancy-based document was modified to become a risk-based document.... The
administration of health care continues to change. NFPA 99 has changed to reflect how health care is delivered.
The risk to the patient does not change for a given procedure. If the procedure is performed in a doctor's office versus a hospital, the risk remains the same.
Therefore, NFPA 99 eliminated the occupancy chapters and has gone to a risk-based approach. New Chapter 4 outlines the parameters for this approach The Code now reflects the risk to the patient in defined categories of risk."
The 2012 NFPA 99 Chapter 4 is the foundation for the change to a risked-based approach rather than an occupancy-based:
"**4.1*** ***Building System Categories***. *Building systems in health care facilities shall be designed to meet system Category 1 through Category 4 requirements as detailed in this code.*"
4.1.1 to 4,1.3 details four different categories of facility systems that should be applied to Chapter 6 Electrical Systems, For instance, Category 1 systems are intended to supply loads where failure could result in "major injury or death of patients or caregivers".
The 2012 NFPA 99 in Chapter 3 section 3.3.138 ties the patient care rooms to categories. Examples: critical care room would be Category 1, general care room would be Category 2, and basic care room would be Category 3.
The 2012 NFPA 99 has three types of essential electrical systems: Type 1, Type 2, and Type 3. NFPA 99:6.3.2.2.10 specifies which type of essential electrical system is required to serve various categories of rooms, Examples: "critical care rooms (Category 1 Room) shall be served only by a Type 1 essential electrical system and "general care rooms (Category 2 Room) shall be served only by a Type l or Type II "essential electrical system. (Note the 2012 NFPA is inconsistent in its nomenclature in denoting Types: such as sometime it denotes Type 2 and sometime it denotes Type II.)
Other examples of where the type of essential electrical system is designated is NFPA 99 6.3.2.2.6.2: "Receptacles for Patient Bed Locations in Critical Care Areas (Category 1)" means these receptacles need to be served by an essential electrical system Type 1 and "Receptacles for Patient Bed Locations in General Care Areas (Category 2)" means these receptacles need to be served by an essential electrical system Type 2.
Informational Note No. 3 is extracted material from NFPA 99 Annex to help readers understand the information.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 15-12. NFPA 99, *Health Care Facilities Code*, ELS has jurisdiction over the design criteria for health care facilities. The submitter is advised to send his comment to NFPA 99 Electrical Systems committee for correlation.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-17 Log #497 NEC-P15 **Final Action: Reject**
(517.2.Wet Procedure Area (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 15-24
Recommendation: Please accept the proposal as submitted and do not modify it.
Substantiation: The NFPA Standards Council has set up an Advisory Committee on the Glossary on Terminology to obtain consistency in definitions with the NFPA set of documents. The NFPA 99 definition is reasonable. Accepting extracted definitions will create consistency.
Panel Meeting Action: Reject
Panel Statement: The panel reaffirms its intention to use the word "space" as evidenced by the panel action and statement on Comment 15-12. The panel also reaffirms its intention to use the word "location" instead of the word "area" in the definition title. The panel believes that the informational note provides clarity.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-18 Log #498 NEC-P15 **Final Action: Reject**
(517.2.Wet Procedure Locations, Wet Procedure Area (New) and Informational Note (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 15-25
Recommendation: Revise text to read as follows:
~~**Wet Procedure Locations.** Those spaces within patient care areas where a procedure is performed and that are normally subject to wet conditions while patients are present. These include standing fluids on the floor or drenching of the work area, either of which condition is intimate to the patient or staff. Routine housekeeping procedures and incidental spillage of liquids do not define a wet procedure location.~~
Wet Procedure Area. The area in a patient care room where a procedure is performed that is normally subject to wet conditions while patients are present, including standing fluids on the floor or drenching of the work area, either of which condition is intimate to the patient or staff. [**99:**3.3.184]
Informational Note: Routine housekeeping procedures and incidental spillage of liquid do not define a wet procedure area or location.
Substantiation: The action by CMP 15 is unclear. No proposal was accepted to delete the definition of "wet procedure locations" in spite of the acceptance in 15-24 of a definition for "wet procedure location area". In order to clarify the action of CMP 15 this comment asks that the existing definition of "wet procedure locations" be deleted and the definition of "wet procedure area" be extracted from NFPA 99.
This comment also recommends that the informational note proposed by CMP 15 in 15-24 be added to the extracted definition because it definitely gives useful information to the user of the NEC.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 15-17.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-19 Log #206 NEC-P15 **Final Action: Accept**
(517.10)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 15-26
Recommendation: The Correlating Committee directs that the panel reconsider this proposal with respect to the Correlating Committee Action on Proposals 15-19 and 15-20.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Change the following as shown in the 2014 NEC ROP Version to read as follows:
(A) Applicability. Part II shall apply to patient care space~~s~~ of all health care facilities.
Panel Statement: See panel action and statement on Comment 15-12. The panel made an editorial change.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-20 Log #387 NEC-P15 **Final Action: Reject**
(517.15)

Submitter: Dan Ordahl, Apple Valley, MN
Comment on Proposal No: 15-28
Recommendation: Add new text to read as follows:
517.15 All 125 volt, single-phase 15 and 20 amp receptacles that are installed in patient care areas, shall be listed hospital grade type.
Substantiation: With increasing complex procedures being performed in the clinic exam room and dentist office. The equipment being utilized for those procedures is listed for use only with a hospital grade receptacle. But that equipment will still fit directly into a nonhospital grade receptacle.
It would only seem prudent that hospital grade receptacles be installed in those areas requiring the special wiring methods in 517.13(A). The special wiring methods in 517.13(A) shall be provided for branch circuits for All patient care areas. This requirement of the wiring method is not limited to patient bed locations.
A hospital grade receptacle is designed to a higher standard than a standard receptacle for use and grounding. This would work in harmony with the higher standard for wiring methods serving all patient care areas required in 517.13(A). Use of standard receptacle is a weak-link between the 517.13(A) wiring method and the hospital grade equipment to patient safety.
Panel Meeting Action: Reject
Panel Statement: This change would eliminate the use of existing locking type receptacles and receptacles listed for "Hospital Use Only".
Patient bed locations in patient care space require hospital grade receptacles as addressed in 517.18(B) and 517.19(C)(2). This section addresses grounding of receptacles and fixed equipment in Patient Care Space.
Equipment in dental offices often uses Midget Locking receptacles "NEMA configuration ML-2".
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
SAMPSON, M.: The panel should take another closer look at this proposal. If patient care areas are required to be supplied by a robust wiring method listed as an equipment grounding conductor as well as an insulated equipment grounding conductor, and then - in other than inpatient sleeping rooms - why is it terminated at a general purpose receptacle, not a hospital grade device. Listed medical equipment such as dental chairs and exam tables often have this marking "Grounding reliability can only be achieved with the use of a hospital grade receptacle" and have hospital grade supply cords. By not requiring all receptacles in patient care areas, a weak link is created in the equipment grounding chain.

15-21 Log #367 NEC-P15 **Final Action: Accept**
(517.16)

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 15-31
Recommendation: Revise text and add the 2012 *NFPA 99* references to read as follows:
517.16 **Use of Isolated Ground Receptacles** ~~**with Insulated Grounding Terminals.**~~ ~~Receptacles with insulated grounding terminals, as permitted in 250.146(D), shall not be permitted.~~ An isolated ground receptacle shall not be installed within a patient care vicinity. [**99:**6.3.2.2.7.1(B)]
Substantiation: The Panel Action on this proposal should have been Accept In Part.
The first part of Proposal 15-31 that would not permit isolated ground receptacles in patient care vicinity should have been accepted. The panel's concern is that redundant grounding is needed for the patient's safety. However, if isolated ground receptacles are not permitted in the patient care vicinity, this concern would be addressed. Away from this space the use of isolated ground receptacles would mitigate against equipment interference due to electrical noise without affecting patient safety. Furthermore, acceptance of the proposal's first part would correlate *NEC*® 517.16 with the requirements of *NFPA99* 6.3.2.2.7.1. Therefore, a Panel Action of Accept In Part would have been more appropriate.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-22 Log #1542 NEC-P15 **Final Action: Accept**
(517.16)

Submitter: Brian E. Rock, Hubbell Incorporated
Comment on Proposal No: 15-31
Recommendation: *Proposal 15-31 should have been Accepted In Part, and 517.16 should be revised to read as follows:*
517.16 **Use of Isolated Ground Receptacles** ~~**with Insulated Grounding Terminals.**~~ ~~Receptacles with insulated grounding terminals, as permitted in 250.146(D), shall not be permitted.~~ An isolated ground receptacle shall not be installed within a patient care vicinity. [**99:**6.3.2.2.7.1(B)]
Substantiation: The first part of Proposal 15-31 that would not permit isolated ground receptacles in patient care vicinity should have been accepted. The panel's concern is that redundant grounding is needed for the patient's safety. However, if isolated ground receptacles are not permitted in the patient care vicinity, this concern would be addressed. Away from this space the use of isolated ground receptacles would mitigate against equipment interference due to electrical noise without affecting patient safety. Furthermore, acceptance of the proposal's first part would correlate *NEC*® 517.16 with the requirements of *NFPA99* 6.3.2.2.7.1. Therefore, a Panel Action of Accept In Part would have been more appropriate.

Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-23 Log #207 NEC-P15 **Final Action: Accept**
(517.17(A))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 15-33
Recommendation: The Correlating Committee directs that the panel reconsider this proposal with respect to the Correlating Committee Action on Proposals 15-19 and 15-20.
The Correlating Committee notes that the term "space" is not used in NFPA 99.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Change the following as shown in the 2014 NEC ROP Version as follows:
517.17 Ground-Fault Protection.
(A) Applicability. The requirements of 517.17 shall apply to hospitals and other buildings (including multiple occupancy buildings) with critical care space~~s~~ or utilizing electrical life support equipment, and buildings that provide the required essential utilities or services for the operation of critical care space~~s~~ or electrical-life support equipment.
Panel Statement: See panel action and statement on Comment 15-12. The panel made editorial changes.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-24 Log #445 NEC-P15 **Final Action: Reject**
(517.18(B))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 15-35
Recommendation: 517.18 General Care Areas.
(B) Patient Bed Location Receptacles. Each patient bed location shall be provided with a minimum of eight receptacles ~~They shall be permitted to be of the single, duplex, or quadruplex type, or any combination of the three.~~ All receptacles shall be listed "hospital grade" and shall be so identified. The grounding terminal of each receptacle shall be connected to an insulated copper equipment grounding conductor sized in accordance with Table 250.122. **[ROP 15–35, ROP 15–36]**
Substantiation: Why chase the additional receptacle configurations? The important part is "Hospital Grade".
Panel Meeting Action: Reject
Panel Statement: The text in question aids the NEC user and correlates with NFPA 99, *Health Care Facilities Code*.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-25 Log #1407 NEC-P15 **Final Action: Reject**
(517.18(B))

Submitter: Timothy Crnko, St. Louis, MO
Comment on Proposal No: 15-36
Recommendation: Revise text to read as follows:
(B) Patient Bed Location Receptacles. Each patient bed location shall be provided with a minimum of eight receptacles. <u>Category 2. [99:6.3.2.2.6.2(A)]</u>
Substantiation: Include the NFPA 99 designated Category since this is the guide post as to designated risk and this then makes an extract reference possible which is more transparent.
99:6.3.2.2.6.2 provides the *Minimum Number of Receptacles* for various locations and each is designated Category where appropriate. This then ties to 99: 6.3.2.2.10 *Essential Electrical Systems* which provides the requirements for the Type essential electrical system (Type I, 2, or 3) that must serve various types of patient care rooms which are designated with a Category where appropriate.
The last two paragraphs from 2012 NFPA 99 *Origins and Development of NFPA 99* on page 99-3 in part:
"The 2012 edition went through a major overhaul. The premise of an occupancy-based document was modified to become a risk-based document... The administration of health care continues to change. NFPA 99 has changed to reflect how health care is delivered.
The risk to the patient does not change for a given procedure. The procedure is performed in a doctor's office versus a hospital, the risk remains the same.
Therefore, NFPA 99 eliminated the occupancy chapters and has gone to a risk-based approach. New Chapter 4 outlines the parameters or this approach. The Code now reflects the risk to the patient in defined categories at risk." The 2012 NFPA 99 Chapter 4 is the foundation for the change to a risked-based approach rather than an occupancy-based:
*"**4.1* Building System Categories**. Building systems in health care facilities shall be designed to meet system Category I through Category 4 requirements as detailed in this code."*
4.1.1 to 4.1.3 details four different categories of facility systems that should be applied to Chapter 6 *Electrical Systems*. For instance, Category I systems are intended to supply loads where failure could result in *"major injury or death of patients or caregivers"*.
The 2012 NFPA 99 in Chapter 399:3.3.138 ties the patient care rooms to categories, Examples: critical care room would be Category 1, general care room would be Category 2, and basic care room would be Category 3.
The 2012 NFPA 99 has three types of essential electrical systems: Type 1, Type 2, and Type 3. NFPA 99 6.3.2.2.10 specifies which type of essential electrical system is required to serve various categories of rooms. Examples: *"critical care rooms (Category I Room) shall be served only by a Type 1"* essential electrical system and *"general care rooms (Category 2 Room) shall be served only by a Type I or Type II"* essential electrical system. (Note the 2012 NFPA is inconsistent in its nomenclature in denoting Types: such as sometime it denotes Type 2 and sometime it denotes Type II.)
Other examples of where the type of essential electrical system is designated is 99:6.3.2.2.6.2: *"Receptacles for Patient Bed Locations in Critical Care Areas (Category I)"* means these receptacles need to be served by an essential electrical system Type 1 and *"Receptacles/or Patient Bed Locations in General Care Areas (Category 2)"* means these receptacles need to be served by an essential electrical system Type 2.
Panel Meeting Action: Reject
Panel Statement: The use of the term "Category 2" as described in NFPA 99, *Health Care Facilities Code,* is not necessary in the NEC and would be confusing to NEC users.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-26 Log #437 NEC-P15 **Final Action: Accept**
(517.18(C))

Submitter: Neil F. LaBrake, Jr., National Grid USA
Comment on Proposal No: 15-37
Recommendation: The Panel action should be "accept-in-principle" and the recommended text for 517.18(C) should read as follows:
"<u>**Designated General Care Pediatric Locations.** Receptacles that are located within the patient rooms, bathrooms, playrooms, and activity rooms of pediatric units, other than nurseries, shall be listed tamper-resistant or shall employ a listed tamper-resistant cover. [99: 6.3.2.2.6.2(F)]</u>"
Also, the NFPA 99 extract note shall be identified in the NEC for this section.
Substantiation: This comment is the work of the Task Group on 2014 NEC/2012 NFPA 99 Correlation with the following representation: Larry Todd, CMP-15; Don Talka, CMP-15; Jim Duncan, CMP-15; Sam Friedman, CMP-15; Walt Vernon, NFPA 99; Dave Dagenais, NFPA 99; James Costley, NFPA 99; Chad Beebe, NFPA 99; Jim Dollard, NEC Correlating Committee; and Neil LaBrake, Jr., NEC Correlating Committee (Chair). As directed by Mr. Michael J. Johnston, NEC Correlating Committee Chair on June 8th, 2012, the Task Group acted on correlation matters and conformance with the Standard Council direction on "Installation vs. Performance" to resolve any conflicts or inconsistencies resulting from proposed revisions in the A2013NEC Report on Proposals (ROP) related to the 2012 NFPA 99.
Pediatric locations are under the jurisdiction of the NFPA 99 Technical Committee. This action results in correlation of NFPA 99-2012 Section 6.3.2.2.6.2(F) with A2013NEC ROP.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 12 Negative: 2
Explanation of Negative:
LIPSTER, S.: Mr. Rock's comments are well taken, especially the concerns raised regarding siblings and the "…curiosity factor of a healthcare environment…". This panel and the NFPA 99 Electrical Systems Technical Committee should follow the lead provided by Article 406 and consider expanding the use of tamper-resistant receptacles in appropriate healthcare facilities.
ROCK, B.: The purpose of tamper-resistant receptacles is to reduce injuries to mobile toddlers and young children. This Comment's revision from "rooms … of pediatric units" to "<u>patient</u> rooms … of pediatric units" effectively removes the requirement for tamper-resistant receptacles in public-accessible waiting rooms, hallways and lobbies of pediatric units. Often, visitors to maternity areas are accompanied by toddlers and young children. During such visits, the focus is on the mother and newborn infant, and less so on those accompanying youngster under the presumption that visitor-accessible spaces of healthcare facilities are inherently free from hazards. The curiosity factor of a healthcare environment and of novel medical equipment is in fact quite the opposite.
Furthermore, the new exclusion of UNQUALIFIED "nurseries" from requiring installation of tamper-resistant receptacles aggravates this risk to toddlers and youngsters. Neither the *National Electrical Code®* nor *NFPA 99* defines the term "nursery". Per 3.2.1.2 of the *Manual of Style for NFPA Technical Committee Documents*, definitions of general terms shall follow *Webster's Collegiate Dictionary*. There, "nursery" is broadly defined as "a place where <u>children</u> are temporarily cared for in their parents' absence", NOT as a space for the care of newborn patients. NEMA finds unacceptable both the specific omission of "neonatal" qualification before "nurseries" and the general sophistry of editorially supplanting substantive, <u>un</u>extracted requirements with requirements that reduce broader, essential safety under the pretext of conveniently using a quoted extraction from another NFPA document narrower in scope and purpose.

15-27 Log #1189 NEC-P15 **Final Action: Reject**
(517.18(C))

Submitter: Technical Committee on Electrical Systems,
Comment on Proposal No: 15-37
Recommendation: Revise text to read as follows:
(C) Designated Pediatric Locations. Receptacles that are located within the patient rooms, bathrooms, playrooms, and activity rooms of pediatric units, or spaces with similar risk as determined by the governing body, other than nurseries, ~~and patient care areas of designated pediatric locations~~ shall be listed tamper resistant or shall employ a listed tamper-resistant cover.
Substantiation: This comment is being proposed to change this section to match an accepted proposal at the NFPA 99 ELS committee meeting. The proposed change now references spaces with similar risks to address the concern of limiting this to only patient rooms noted in the reason for the "reject" at the ROP stage. This is a performance requirement which the ELS committee has reviewed the technical nature of.
This comment was balloted through the Technical Committee on Electrical Systems with the following results:
25 Members Eligible to Vote
2 Not Returned (T. Easty, H. Nash)
22 Affirmative
1 Negative (DeHanes)
0 Abstentions
Panel Meeting Action: Reject
Panel Statement: The correlating committee has charged CMP 15 to coordinate with the 2012 edition of NFPA 99, *Health Care Facilities Code,* and this is accomplished by accepting the extracted text from Comment 15-26.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14
Comment on Affirmative:
ROCK, B.: NEMA agrees with the Panel Action to Reject Comment 15-27 but disagrees with the Panel Statement. See the NEMA comment accompanying its Negative vote on Comment 15-26.

15-28 Log #208 NEC-P15 **Final Action: Accept**
(517.19(A))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 15-38
Recommendation: The Correlating Committee directs that the panel reconsider this proposal with respect to the Correlating Committee Action on Proposals 15-19 and 15-20.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: See the panel action and statement on Comment 15-29.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-29 Log #1190 NEC-P15 **Final Action: Accept**
(517.19(A))

Submitter: Technical Committee on Electrical Systems,
Comment on Proposal No: 15-38
Recommendation: Revise text to read as follows:
(A) Patient Bed Location Branch Circuits. Each patient bed location ~~room~~ shall be supplied by at least two branch circuits, one or more from the critical branch and one or more circuits from the normal system. At least one branch circuit from the critical branch shall supply an outlet(s) only at that bed location. All branch circuits from the normal system shall be from a single panelboard. Critical branch receptacles shall be identified and shall also indicate the panelboard and circuit number supplying them. The branch circuit serving patient bed locations shall not be part of a multi-wire branch circuit.
Exception No. 1: Branch circuits serving only special-purpose receptacles or equipment in critical care spaces shall be permitted to be served by other panelboards.
Exception No. 2: Critical care spaces served from two separate critical branch transfer switches ~~on the emergency system~~ shall not be required to have circuits from the normal system.
Substantiation: The NFPA 99 ELS TC is proposing these changes to be consistent with NFPA 99. The term "emergency system" is no longer used in NFPA 99.
This comment was balloted through the Technical Committee on Electrical Systems with the following results:
25 Members Eligible to Vote
2 Not Returned (T. Easty, H. Nash)
22 Affirmative
1 Negative (DeHanes)
0 Abstentions
Panel Meeting Action: Accept
Change the following as shown in the 2014 NEC ROP Version:
517.19 Critical Care Areas.
(A) Patient Bed Location Branch Circuits. Each patient bed location shall be supplied by at least two branch circuits, one or more from the critical branch and one or more circuits from the normal system. At least one branch circuit from the critical branch shall supply an outlet(s) only at that bed location. All branch circuits from the normal system shall be from a single panelboard. Critical branch receptacles shall be identified and shall also indicate the panelboard and circuit number supplying them. The branch circuit serving patient bed locations shall not be part of a multi-wire branch circuit.
Exception No. 1: Branch circuits serving only special purpose receptacles or equipment in critical care space~~s~~ shall be permitted to be served by other panelboards.
Exception No. 2: Critical care space~~s~~ served from two separate critical branch transfer switches ~~on the emergency system~~ shall not be required to have circuits from the normal system.
Panel Statement: The panel made editorial changes.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-30 Log #1399 NEC-P15 **Final Action: Reject**
(517.19(B))

Submitter: Timothy Crnko, St. Louis, MO
Comment on Proposal No: 15-39
Recommendation: Revise text to read as follows:
(B) Patient Bed Location Receptacles.
(1) Minimum Number and Supply. Each patient bed location shall be provided with a minimum of fourteen receptacles. Category 1. [99;6.3.2.2.6.2(B)] At least one ~~of which~~ receptacle shall be connected to either of the following:
(1)The normal system branch circuit required in 517.19(A)
(2) A critical branch circuit supplied by a different transfer switch than the other receptacles at the same patient bed location.
(2) Receptacle Requirements. The receptacles required in 517.19(B)(I) shall be permitted to be single, duplex, or quadruplex type or any combination thereof. AIl receptacles shall be listed "hospital grade" and shall be so identified. The grounding terminal of each receptacle shall be connected to the reference grounding point by means of an insulated copper equipment grounding conductor.
Substantiation: Include NFPA 99 designated Category since this is the guide post as to designated "risk" and this then makes an extract reference possible which is more transparent, 99:6.3.2.2.6.2 provides the *Minimum Number of Receptacles* for various locations and each is designated Category where appropriate. This then ties to 99: 6.3.2.2.10
Essential Electrical Systems which provides the requirements for the Type essential electrical system (Type 1, 2, or 3) that must serve various types of patient care
rooms which are designated with a Category where appropriate.
The last two paragraphs from 2012 NFPA 99 *Origins and Development of NFPA 99* on page 99-3 in part:
"The 2012 edition went through a major overhaul. The premise of an occupancy-based document was modified to become a risk-based document.... The administration of health care continues to change. NFPA 99 has changed to reflect how health care is delivered.
The risk to the patient does not change/or a given procedure. If the procedure is performed in a doctor's office versus a hospital, the risk remains the same. Therefore, NFPA 99 eliminated the occupancy chapters and has gone to a risk-based approach. New Chapter 4 outlines the parameters for this approach. The Code now reflects the risk to the patient in defined categories of risk."
The 2012 NFPA 99 Chapter 4 is the foundation for the change to a risked-based approach rather than an occupancy-based:
"4.1 * *Building System Categories.* *Building systems in health care facilities shall be designed to meet system Category 1 through Category 4 requirements as detailed in this code."*
4.1.1 to 4.1.3 details four different categories of facility systems that should be applied to Chapter 6 *Electrical Systems*. For instance, Category 1 systems are intended to supply loads where failure could result in *"major injury or death a/patients or caregivers."*
The 2012 NFPA 99 in Chapter 3 [99:3.3.138] ties the patient care rooms to categories. Examples: critical care room would be Category 1, general care room would be Category 2, and basic care room would be Category 3.
The 2012 NFPA 99 has three types of essential electrical systems: Type 1, Type 2, and Type 3. NFPA 99 6.3.2.2.10 specifies which type of essential electrical system is required to serve various categories of rooms. Examples: *"critical care rooms (Category 1 Room) shall be served only by a Type I"* essential electrical system and *"general care rooms (Category 2 Room) shall be served only by a Type 1 or Type II"* essential electrical system. (Note the 2012 NFPA is inconsistent in its nomenclature in denoting Types: such as sometime it denotes Type 2 and sometime it denotes Type II.)
Other examples of where the type of essential electrical system is designated is 99:6.3.2.2.6.2: *"Receptacles for Patient Bed Locations in Critical Care Areas (Category 1)"* means these receptacles need to be served by an essential electrical system Type 1 and *"Receptacles/or Patient Bed Locations in General*

Care Areas (Category 2)" means these receptacles need to be served by an essential electrical system Type 2.
Panel Meeting Action: Reject
Panel Statement: The use of the term "Category 1" as described in NFPA 99, *Health Care Facilities Code,* is not necessary in the NEC and would be confusing to NEC users. In addition the removal of the words "of which" reduces clarity as to the receptacles referenced.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-31 Log #446 NEC-P15 **Final Action: Reject**
(517.19(B)(2))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 15-39
Recommendation: Revise text to read as follows:
517.19 Critical Care Areas.
(B) Patient Bed Location Receptacles.
(2) Receptacle Requirements. The receptacles required in 517.19(B)(1) shall ~~be permitted to be single, duplex, or quadruplex type or any combination thereof. All receptacles shall~~ be listed "hospital grade" and shall be so identified. The grounding terminal of each receptacle shall be connected to the reference grounding point by means of an insulated copper equipment grounding conductor.
Substantiation: Why chase the additional receptacle configurations? The important part is "Hospital Grade".
Panel Meeting Action: Reject
Panel Statement: The text in question aids the NEC user and correlates with NFPA 99, *Health Care Facilities Code*.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-32 Log #1405 NEC-P15 **Final Action: Reject**
(517.19(C))

Submitter: Timothy Crnko, St. Louis, MO
Comment on Proposal No: 15-41
Recommendation: Revise text to read as follows:
(C) Operating Room Receptacles.
(1) Minimum Number and Supply. ~~Each o~~Operating room shall be provided with a minimum of thirty six receptacles. Category 1, [99:6.3.2.2.6.2(C)] At least twelve ~~of which~~ receptacles shall be connected to either of the following:
(1) The normal system branch circuit required in 517.19(A).
(2) A critical branch circuit supplied by a different transfer switch than the other receptacles at the same location.
(2) Receptacle Requirements. The receptacles required in 517.19(C)(1) shall be permitted to be of the single or duplex types or a combination of both. All receptacles, whether thirty six or more, shall be listed "hospital grade" and so identified. The grounding terminal of each receptacle shall be connected to the reference grounding point by means of an insulated copper equipment grounding conductor.
Substantiation: Include NFPA 99 designated Category since this is the guide post as to designated risk and this then makes an extract reference possible which is more transparent.

99:6.3.2.2.62 provides the *Minimum Number of Receptacles* for various locations and each is designated with a Category where appropriate. This then ties to 99:

6.3.22.10 *Essential Electrical Systems* which provides the requirements for the Type essential electrical system (Type I, 2, or 3) that must serve various types of patient care rooms which are designated with a Category where appropriate.

The last two paragraphs from 2012 NFPA 99 *Origins and Development of NFPA 99* on page 99-3 in part:

"The 2012 edition went through a major overhaul, The premise of an occupancy-based document was modified to become a risk-based document.... The administration of health care continues to change. NFPA 99 has changed to reflect how health care is delivered.

The risk to the patient does not change for a given procedure. If the procedure is performed in a doctor 's office versus a hospital, the risk remains the same.

Therefore, NFPA 99 eliminated the occupancy chapters and has gone to a risk-based approach. New Chapter 4 outlines the parameters for this approach. The Code now reflects the risk to the patient in defined categories of risk." The 2012 NFPA 99 Chapter 4 is the foundation for the change to a risked-based approach rather than an occupancy-based:

*"**4.1 * Building System Categories.** Building systems in health care facilities shall be designed to meet system Category I through Category 4 requirements as detailed in this code."*

4.1.1 to 4.1.3 details four different categories of facility systems that should be applied to Chapter 6 *Electrical Systems*. For instance, Category I systems are intended to supply loads where failure could result in "major injury or death a/patients or caregivers".

The 2012 NFPA 99 in Chapter 3 99:3.3.138 ties the patient care rooms to categories. Examples: critical care room would be Category 1, general care room would be Category 2, and basic care room would be Category 3.

The 2012 NFPA 99 has three types of essential electrical systems: Type I, Type 2, and Type 3. NFPA 99 6.3.2.2.10 specifies which type of essential electrical system is required to serve various categories of rooms. Examples: *"critical care rooms (Category 1 Room) shall be served only by a Type 1"* essential electrical system and *"general care rooms (Category 2 Room) shall be served only by a Type I or Type II"* essential electrical system. (Note the 2012 NFPA is inconsistent in its nomenclature in denoting Types: such as sometime it denotes Type 2 and sometime it denotes Type II.)

Other examples of where the type of essential electrical system is designated is 99:6.3.22.6.2: *"Receptacles for Patient Bed Locations in Critical Care Areas (Category 1)"* means these receptacles need to be served by an essential electrical system Type I and *"Receptacles for Patient Bed Locations in General Care Areas (Category 2)"* means these receptacles need to be served by an essential electrical system Type 2.
Panel Meeting Action: Reject
Panel Statement: The use of the term "Category 1" as described in NFPA 99, *Health Care Facilities Code,* is not necessary in the NEC and would be confusing to NEC users. In addition the removal of the words "of which" reduces clarity as to the receptacles referenced.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-33 Log #155 NEC-P15 **Final Action: Accept**
(517.19(D))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-181a
Recommendation: It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 15 for action in Article 517.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts Proposal 9-181a.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-34 Log #209 NEC-P15 **Final Action: Accept**
(517.19(E))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 15-42
Recommendation: The Correlating Committee directs that the panel reconsider this proposal with respect to the Correlating Committee Action on Proposals 15-19 and 15-20.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Change the following as shown in the 2014 NEC ROP Version:
(F) Additional Protective Techniques in Critical Care Space~~s~~ (Optional). Isolated power systems shall be permitted to be used for critical care spaces~~rooms~~, and, if used, the isolated power system equipment shall be listed as isolated power equipment. The isolated power system shall be designed and installed in accordance with 517.160.
Panel Statement: See panel action and statement on Comment 15-12. The panel made editorial changes.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-35 Log #385 NEC-P15 **Final Action: Reject**
(517.26)

Submitter: Rocco DeLuca, Jr., City of Phoenix Arizona
Comment on Proposal No: 15-48
Recommendation: Continue to reject this proposal. Text in the 2014 NEC should read as follows:
517.26 Application of Other Articles. The essential electrical system shall meet the requirements of Article 700, except as amended by Article 700.

lnformational Note: The provisions of NFPA 110-2010, Standard for Emergency and Standby Power Systems, should be considered when designing and installing essential electrical power supply systems.
Substantiation: This proposal is unsubstantiated and removes necessary correlation between Article 517 and Article 700. The critical branch of health care facilities is part of the essential electrical system, no matter what you call it. Even though there was an effort to remove the word "emergency" from Article 517, it does not change how the essential (emergency) electrical system must perform to protect occupants and patients. There are essential rules in Article 700 that are necessary for inspectors to apply to the critical branch in addition to the life safety branch and equipment branch (in some instances) of electrical systems. This proposal (15-48) seeks to only correlate the requirements of Article 700 just to the life safety branch, without any technical or practical substantiation. This is an injustice to the inspection community not to mention a disservice to the heath and welfare of patients. Here is one

example of some of what is lost by such a revision.

Transfer switches used on emergency systems are required to be listed and identified as Suitable for use on Emergency Systems (See the UL White Book for information on transfer equipment for emergency use). This requirement is provided in 700.5(A) and found nowhere in Article 517. Transfer equipment is required to be used in the critical branch, equipment branch and life safety branch of health care facilities. If this proposal is accepted, standard transfer equipment would be permitted in the critical branch of a health care facility. This is a serious error and results in inferior installations and designs that will impact a system essential for the health and welfare of patients. The critical branch of a health care facility is part of the "emergency' system, no matter what it is called. Other requirements that are necessary in 700 to apply to the critical branch are 700.10 dealing power source wiring and separation requirements [700.10(B)], and fire ratings for emergency (critical branch) feeders in health care facilities taller than 75 feet [700.10(D)].

Other requirements applicable to emergency system power sources are contained in 700.12. Section 700.26 relaxes the requirements for GFPE on the alternate power source, which is not addressed in Article 517. This would result in GFPE being required for the alternate source in health care facilities.

Panel Meeting Action: Reject

Panel Statement: See the panel action and statement on Comments 15-4 and 15-39.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

15-36 Log #571 NEC-P15 **Final Action: Accept in Principle**
(517.26)

Note: When the ballot result does not confirm the TC action on a Proposal by a two-thirds affirmative vote, the Report on Proposals shall be published with a specific request for public comment on that Proposal. The Proposal is now being reconsidered by the TC as a public comment.

Submitter: Technical Committee on Electrical Systems,

Comment on Proposal No: 15-48

Recommendation: Revise text to read as follows:

517.26 Application of Other Articles. The <u>life safety branch of the</u> essential electrical system shall meet the requirements of Article 700, except as amended by Article 517.

Informational Note: The provisions of NFPA 110-2010, *Standard for Emergency and Standby Power Systems*, should be considered when designing and installing essential electrical power supply systems.

Substantiation: To Coordinate with NFPA 99. Article 700 is not written to include the critical branch of the essential electrical system. If the critical branch of the emergency power supply system must comply with Article 700 newly installed generators in health care facilities will be required to be substantially oversized. Article 700.5 (A) states:

700.5 Capacity.

(A) Capacity and Rating. An emergency system shall have adequate capacity and rating for all loads to be operated simultaneously.

The emergency system equipment shall be suitable for the maximum available fault current at its terminals.

Whereas,

NFPA 99, Section 6.4.1.1.9* Capacity and Rating. The generator set(s) shall have sufficient capacity and proper rating to meet the maximum actual demand likely to be produced by the connected load of the essential electrical system(s) at any one time.

The critical branch is made up of many patient and equipment related loads. These loads, unlike those for illumination, panic control, life safety, etc. are not intended to all function at the same time. The list is long and has been provided so the Standards Council members can see why requiring all loads to be operated simultaneously would cause the generator to be substantially oversized for the application.

NFPA 99 6.4.2.2.2.3* Critical Branch. The critical branch shall be permitted to be subdivided into two or more branches. The critical branch of the emergency system shall supply power for task illumination, fixed equipment, selected receptacles, and selected power circuits serving the following areas and functions related to patient care:

(1) Critical care areas that utilize anesthetizing gases, task illumination, selected receptacles, and fixed equipment

(2) The isolated power systems in special environments

(3) Task illumination and selected receptacles in the following:(a) Patient care areas, including infant nurseries, selected acute nursing areas, psychiatric bed areas (omit receptacles),and ward treatment rooms

(b) Medication preparation areas

(c) Pharmacy dispensing areas

(d) Nurses' stations (unless adequately lighted by corridor luminaires)

(4) Additional specialized patient care task illumination and receptacles, where needed

(5) Nurse call systems

(6) Blood, bone, and tissue banks

(7)*Telephone equipment rooms and closets

(8) Task illumination, selected receptacles, and selected power circuits for the following area

(a) General care beds with at least one duplex receptacle per patient bedroom, and task illumination as required by the governing body of the health care facility

(b) Angiographic labs

(c) Cardiac catheterization labs

(d) Coronary care units

(e) Hemodialysis rooms or areas

(f) Emergency room treatment areas (selected)

(g) Human physiology labs

(h) Intensive care units

(i) Postoperative recovery rooms (selected)

(9) Additional task illumination, receptacles, and selected power circuits needed for effective facility operation. Single-phase fractional horsepower motors shall be permitted to be connected to the critical branch.

As a result of the August 10, 2011 Standards Council Decision (Final), D#11-7, regarding the scoping issues of electrical requirements in NFPA 99, Health Care Facilities Code, coordination of the electrical requirements is needed between the NEC and NFPA 99.

An excerpt from D#11-7 states: "The Council believes that the distinction between performance requirements and installation requirements is reasonably clear and the Council reiterates that "without deciding in advance what the Council would do regarding specific jurisdictional issues relating to this topic, the Council considers the guidance [from the previous task group] to be Useful". (See Standards Council Minute Item 10-3-21, March 2010). In this Decision, the Council has concluded that selective coordination (cascading outages) properly falls within the jurisdiction of NFPA 99. The NEC project should proceed, as part of its standards development activities, to harmonize the NEC with the relevant provisions of NFPA 99."

This proposal was balloted through the Technical Committee on Electrical Systems with the following results:

24 Members Eligible to Vote

7 Not Returned (Dagenais, Krupa, Lipster, Meade, Peterson, Smidt, and Wolff)

16 Affirmative on All

0 Negatives

0 Abstentions

Note: Supporting material is available for review at NFPA Headquarters.

Panel Meeting Action: Accept in Principle

Panel Statement: See the panel action and statement on Comment 15-39, which addresses the submitter's concern.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

Comment on Affirmative:

SAMPSON, M.: The design of an essential electrical system for a hospital has been significantly altered by the ELS committee of NFPA 99, and the panel was directed to incorporate the revisions.

15-37 Log #786 NEC-P15 **Final Action: Reject**
(517.26)

Submitter: Thomas Guida, TJG Services Inc.

Comment on Proposal No: 15-43

Recommendation: Revise text to read as follows:

Section 517.26 should be accepted with the text as shown below as in the proposal.

517.26 Application of Other Articles. The <u>Life safety and Critical branches of the</u> essential electrical system shall meet the requirements of ~~Article~~ Section 700.10, except as amended by Article 517.

Substantiation: I concur with the explanation of negative on the panel action from Mr. Lipster.

Panel Meeting Action: Reject

Panel Statement: See panel action and statement on Comments 15-4 and 15-39.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

15-38 Log #791 NEC-P15 **Final Action: Reject**
(517.26)

Submitter: Thomas Guida, TJG Services Inc.

Comment on Proposal No: 15-48

Recommendation: This proposal should remain rejected as determined by the TCC and for the reasons outlined in Mr. Lipster's negative vote.

Substantiation: None given.

Panel Meeting Action: Reject

Panel Statement: See panel action and statement on Comments 15-4 and 15-39.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

15-39 Log #1191 NEC-P15 **Final Action: Accept in Part**
(517.26)

TCC Action: The Correlating Committee directs that the date of the latest edition (2012) be included for the referenced standard.
Submitter: Technical Committee on Electrical Systems,
Comment on Proposal No: 15-48
Recommendation: Revise text to read as follows:
517.26 Application of Other Articles. The life safety branch of the essential electrical system shall meet the requirements of Article 700, except as amended by Article 517, and NFPA 99 Chapter 6.
Informational Note No. 1: For additional information see ~~The provisions of~~ NFPA 110-2010, *Standard for Emergency and Standby Power Systems*~~, should be considered when designing and installing essential electrical power supply systems.~~
Informational Note No. 2: For additional information see 517.30 and NFPA 99, Chapter 6.
Substantiation: The action on proposal 15-48 should be accepted as it was prior to the ballot of the Panel. This a performance requirement, the technical merit of which has been reviewed by the ELS committee.
The additional change is intended to correlate with NFPA 99. NFPA 99 has accepted Article 700 by reference as a standard for installation. There will be specific amendments to Article 700 in chapter 6 of NFPA 99 that amend performance requirements. This change is necessary to provide consistency for the user between the documents and Articles.
This comment was balloted through the Technical Committee on Electrical Systems with the following results:
25 Members Eligible to Vote
2 Not Returned (T. Easty, H. Nash)
21 Affirmative
2 Negatives (DeHanes and Fiske)
0 Abstentions
Panel Meeting Action: Accept in Part
Revise text to read as follows:
517.26 Application of Other Articles. The life safety branch of the essential electrical system shall meet the requirements of Article 700, except as amended by Article 517~~, and NFPA 99 Chapter 6~~.
Informational Note No. 1: For additional information see ~~The provisions of~~ NFPA 110-2010, *Standard for Emergency and Standby Power Systems*~~, should be considered when designing and installing essential electrical power supply systems.~~
Informational Note No. 2: For additional information see 517.30 and NFPA 99, Chapter 6.
Panel Statement: Using the reference to "NFPA 99 Chapter 6" in the body of the section language is in violation of the NFPA Style Manual 4.2 "References to Other Standards". References to other standards shall not be in mandatory Code text. References to other Standards shall be in the informational notes.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-40 Log #1219 NEC-P15 **Final Action: Reject**
(517.26)

Submitter: Sheldon Monson, Wadena, MN
Comment on Proposal No: 15-48
Recommendation: The panel should continue to reject this proposal.
Substantiation: Everyone knows that the critical branch of the essential electrical system is the "life safety" branch for those patients and staff that cannot exit the building and take advantage of the life safety branch. Removing the critical branch from meeting the requirements of Article 700 would be a life-threatening mistake.
To do so would remove power for patient care - power for lighting for essential tasks, power to fixed equipment, selected receptacles, and special power circuits. These circuits and systems - essential circuits and systems for those who must stay in the building in the event of an emergency situation - would no longer be afforded the same protection as the circuits and systems relied on to get ambulatory patients and staff out of the building.
Separating the critical branch from the requirements of 700 would leave emergency rooms, intensive care, hemodialysis and coronary care units, postoperative recover rooms as well as angiographic, cardiac catheterization and human physiology labs without task illumination, selected receptacles and special power circuits.
Lost too would be the lighting, receptacles and fixed equipment in critical care areas that utilize anesthetizing gases, special environments with isolated power systems; lighting and selected receptacles in infant nurseries, nurses stations not afforded light by corridor luminaires, the nurse call systems, the blood, bone, and tissue banks. Also, not afforded protection would be the telephone and data (computer system) equipment rooms containing essential patient care records.
The submitter has not provided any evidence supporting for such a major change, especially since the generator sizing issue referred to in the substantiaion is not an issue at all, per the changes made to Section 517.30(D) in the 2011 NEC.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comments 15-4 and 15-39.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14
Comment on Affirmative:
SAMPSON, M.: The design of an essential electrical system for a hospital has been significantly altered by the ELS committee of NFPA 99, and the panel was directed to incorporate the revisions.

15-41 Log #1340 NEC-P15 **Final Action: Accept in Principle**
(517.26)

Submitter: James E. Degnan, Sparling
Comment on Proposal No: 15-48
Recommendation: I support the proposed change to the text.
Substantiation: I support the action of the majority of the panel members in requiring only the life safety branch to be associated with article 700. The goals of Article 700 and the critical branch in Article 517 are different. Article 700 is primarily focused on systems that create an environment for occupants to exit a building; the critical branch is focused on sustaining life within a hospital. Examples where Article 700 has language that adversely affects the Critical Branch include:
700.10 (B)(5)(a) which requires separate vertical sections for wiring from an emergency source(many hospitals have multiple critical branch feeders, switchboard lengths would be unruly)
700.15 only allows appliances and lamps required for emergency use on emergency circuits. The critical branch of a healthcare system includes receptacles. How can the code be complied with when anything can be plugged into a receptacle? (Note: many AHJs use this code provision to prevent the general connection of receptacles on the emergency system in buildings that are not healthcare facilities, the code can't have it both ways.)
700.16 The provision has a requirement for no single lamp failure to leave a space in total darkness. The critical branch serves numerous light circuits in patient rooms, corridors, and nurse stations. How would this apply to a patient bed when the patient is sleeping?
700.20 and 700.21 restricts lighting circuit switching to authorized personnel. If this applies to critical systems, every hospital in the country is in violation, as all patient rooms have lighting that can be switched by anyone.
700.27 Selective coordination can increase arc flash hazards which makes working on live critical branch systems more dangerous.
CMP 15 is urged to make this change.
Panel Meeting Action: Accept in Principle
Panel Statement: See the panel action and statement on Comment 15-39, which addresses the submitter's concern.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14
Comment on Affirmative:
SAMPSON, M.: The design of an essential electrical system for a hospital has been significantly altered by the ELS committee of NFPA 99, and the panel was directed to incorporate the revisions.

15-42 Log #1404 NEC-P15 **Final Action: Reject**
(517.26)

Submitter: Timothy Crnko, St. Louis, MO
Comment on Proposal No: 15-48
Recommendation: Continue to reject Proposal 15-48.
Substantiation: Continue to reject this proposal and retain 2011 NEC 517.26 text.
The substantiation is inaccurate. NFPA 99 permits traditional loads supplied by NEC Article 700 to be supplied by the critical branch, too. 2012 NFPA 99:6.4.2.2.3.3 permits life safety alarm and alerting systems to be connected to either the life safety branch or the critical branch. In addition, 99:6.5.2.2.2.1 pertaining to Type 2 essential electrical systems permits numerous traditional "emergency" loads to be connected to the critical branch. The equipment branch can supply loads that may be vital for life safety, see 99:6.4.2.2.5.3.
"**6.4.2.2.3.3** Alarm and alerting systems (other than fire alarm systems) shall be connected to the life safety branch or critical branch."
NFPA 99 6.5.2.2.2.1 has the critical branch for an Essential Electrical System Type 2 permitted to serve same the loads as the life safety branch:
"**6.5.2.2.2.1** The life safety and **critical branches** shall supply power for lighting, receptacles, and equipment as follows:
(1) lllumination of means of egress in accordance with NFPA 101 A, *Guide on Alternative Approaches to Life Safety*
(2) Exit signs and exit directional signs in accordance with NFPA *101, Life Safety Code*
(3) Alarm and alerting systems, including the following:
(a) Fire alarms
(b) Alarms required for systems used for the piping of nonflammable medical gases as specified in Chapter 5
(4)* Communications systems, where used for issuing instructions during emergency conditions

(5) Sufficient lighting in dining and recreation areas to provide illumination to exit ways of a minimum of 5 ft-candles
(6) Task illumination and select receptacles at the generator set location
(7) Elevator cab lighting, control, communications, and signal systems"
The equipment branch supplies loads that may be vital for life safety, such as:
99: 6.4.2.2.5.3 (Type 1 essential electrical systems equipment branch requirement) "(4) Smoke control and stair pressurization systems" and "(6) Supply, return, and exhaust ventilating systems for the following: (a) Airborne infectious/isolation rooms, (b) Protective environment rooms, (c) Exhaust fans for laboratory fume hoods, (d) Nuclear medicine areas where radioactive material is used, (e) Ethylene oxide evacuation, (f) Anesthetic evacuation"
Panel Meeting Action: Reject
Panel Statement: See the panel action and statement on Comments 15-4 and 15-39.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-43 Log #1408 NEC-P15 **Final Action: Reject**
(517.26)

Submitter: Timothy Crnko, St. Louis, MO
Comment on Proposal No: 15-46
Recommendation: Continue to reject this proposal.
Substantiation: Continue to reject this proposal and retain the 2011 NEC 517.26 text.
The substantiation is inaccurate, NFPA 99 permits traditional loads supplied by NEC Article 700 to be supplied by the critical branch, too, 2012 NFPA 99:6.4.2.2.3.3 permits life safety alarm and alerting systems to be connected to either the life safety branch or the critical branch. In addition, 99:6.5.2.2.2.1 pertaining to Type 2 essential electrical systems permits numerous traditional "emergency" loads to be collected to the critical branch, The equipment branch can supply loads that may be vital for life safety, see 99:6.4.2.2.5.3.
"**6.4.2.2.3.3** Alarm and alerting systems (other than fire alarm systems) shall be connected to the life safety branch or critical branch."
NFPA 99 6.5.22.2.1 has the critical branch for an Essential Electrical System Type 2 permitted to serve same the loads as the life safety branch:
"**6.5.2.2.2.1** The life safety and **critical branches** shall supply power for lighting, receptacles, and equipment as follows:
(1) Illumination of means of egress in accordance with NFPA 101A, *Guide on Alternative Approaches to Life Safety*
(2) Exit signs and exit directional signs in accordance with NFPA *101, Life Safety Code*
(3) Alarm and alerting systems, including the following:
(a) Fire alarms
(b) Alarms required for systems used for the piping of nonflammable medical gases as specified in Chapter 5
(4)*Communications systems, where used for issuing instructions during emergency conditions
(5) Sufficient lighting in dining and recreation areas to provide illumination to exit ways of a minimum of 5 ft-candles
(6) Task illumination and select receptacles at the generator set location
(7) Elevator cab lighting, control, communications, and signal systems"
The equipment branch supplies loads that may be vital for life safety, such as:
99: 6.4.2.2.5.3 (Type I essential electrical systems equipment branch requirement) "(4) Smoke control and stair pressurization systems" and "(6) Supply, return, and exhaust ventilating systems for the following: (a) Airborne infectious/isolation rooms, (b) Protective environment rooms, (c) Exhaust fans for laboratory fume hoods, (d) Nuclear medicine areas where radioactive material is used, (e) Ethylene oxide evacuation, (f) Anesthetic evacuation"
Panel Meeting Action: Reject
Panel Statement: See the panel action and statement on Comments 15-4 and 15-39.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-44 Log #1485 NEC-P15 **Final Action: Reject**
(517.26)

Submitter: Randy Hunter, Las Vegas, NV
Comment on Proposal No: 15-48
Recommendation: Reject the proposal.
Substantiation: The text for 517.26 in the 2011 and previous editions of the NEC involved the requirement of the essential electrical system, such as the life safety and the critical branch, to use Article 700, except as amended by Article 517. For the 2014 NEC, Proposal 15-48 was submitted by the NFPA 99 Technical Committee on Electrical Systems to revise 517.26 as follows: "Application of Other Articles. The life safety branch of the essential electrical system shall meet the requirements of Article 700, except as amended by Article 517." What the NFPA 99 Electrical Committee did not take into consideration is the existing text in 517.30(D) stating the following: "The sizing requirements in 700.4 and 701.4 shall not apply to hospital generator set(s)." Both the NFPA 99 Electrical Committee and CMP-15 may have overlooked NEC 517.30(D) as a solution to their concerns and negating any reason for deleting the critical branch from 517.26. Deleting the critical branch from compliance with Article 700 will also delete safety features covered by Article 700, such as 700.5 for transfer switches where the transfer switches are required to be electrically-operated and mechanically-held. Similar action should be made for Proposal 15-12 making changes to the definition of a "critical branch." Making the necessary changes in Article 517 for critical branch circuits at this point in the process would constitute new material and would not be permitted at the comment stage, however, rejecting the proposal would leave Article 700 as a requirement with a rewrite possible for the 2017 NEC.
Panel Meeting Action: Reject
Panel Statement: See the panel action and statement on Comments 15-4 and 15-39.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-45 Log #1487 NEC-P15 **Final Action: Reject**
(517.30 Figures 1 and 2)

Submitter: Ed Larsen, Schneider Electric USA
Comment on Proposal No: 15-51
Recommendation: Accept the proposal.
Substantiation: The Panel revised the figures to conform to the revised wording in the Code and NFPA 99, Health Care Facilities Code and deleted the brackets that have been in these figures for many editions. The Panel rejected the proposal to include dashed or similar lines for clarity.
Using these figures as a model, proposals were submitted to add similar figures in Articles 700, 701, 702 and 708 (ROP 13-91, 13-130, 13-141 and 13-156 respectively). These proposals, accepted in principle by CMP13, include brackets (see 13-91 example attached). Removing the brackets in Article 517 means that the goal of having like figures in five articles will not be achieved.
The whole idea of the proposal was to add the dashed lines to add clarity. The panel should have accepted the proposal. Partially adding dashed lines like CMP13 did would be acceptable.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: The figures were changed in the ROP to conform to the revised wording in the Code and NFPA 99, *Health Care Facilities Code*. The panel reaffirms its position not to include dashed or similar lines as they do not add clarity.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-46 Log #210 NEC-P15 **Final Action: Accept**
(517.30(B)(1) through (4))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 15-52
Recommendation: The Correlating Committee directs the panel to reconsider this proposal and determine whether the three Informational Notes following (4) are to remain or be removed.
The panel statement did not indicate this action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Change the following text as shown in the 2014 NEC ROP Version:
(B) General.
(1) Separate Branches. Essential electrical systems for hospitals shall be comprised of three separate branches capable of supplying a limited amount of lighting and power service that is considered essential for life safety and effective hospital operation during the time the normal electrical service is interrupted for any reason. The branches are: life safety, critical, and equipment.
(2) Transfer Switches. The number of transfer switches to be used shall be based on reliability, design, and load considerations. Each branch of the essential electrical system shall have one or more transfer switches. One transfer switch and downstream distribution system shall be permitted to serve one or more branches in a facility with a maximum demand on the essential electrical system of 150 kVA.
Informational Note No. 1: See NFPA ~~99-2005, *Standard for Health Care Facilities:* 4.4.3.2~~ 99: 2012 Heath Care Facilities Code, 6.4.3.2 Transfer Switches; 6.4.2.1.5 ~~Transfer Switch Operation Type I~~ Automatic Transfer Switch Features; ~~4.4.2.1.4,~~ 6.4.2.1.5.15 Nonautomatic ~~Automatic~~ Transfer Switch Features; and ~~4.4.2.1.6,~~ 6.4.2.1.7 Nonautomatic Transfer Device Features.
Informational Note No. 2: See Informational Note Figure 517.30, No. 1.
Informational Note No. 3: See Informational Note Figure 517.30, No. 2.
(Informational Note Figure 517.30, No. 1 and Informational Note Figure 517.30, No. 2 are addressed in Comment 15-45.)
~~(5)~~ **(3) Optional Loads.** Loads served by the generating equipment not specifically named in Article 517 shall be served by their own transfer switches such that the following conditions apply:

(1) These loads shall not be transferred if the transfer will overload the generating equipment.
(2) These loads shall be automatically shed upon generating equipment overloading.
~~(6)~~ **(4) Contiguous Facilities.** Hospital power sources and alternate power sources shall be permitted to serve the essential electrical systems of contiguous or same site facilities. ~~[**99:**13.3.4.3]~~
Panel Statement: The panel accepted the Correlating Committee direction to reconsider the proposal. The panel made editorial corrections to correlate the text to NFPA 99, *Health Care Facilities Code*. Informational Note No. 1 was corrected to show the current referenced information in NFPA 99 and Informational Notes No 1, 2, and 3 are contextually accurate and are included to provide additional clarity and information for code users.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-47 Log #1406 NEC-P15 **Final Action: Reject**
(517.30(B)(1) and (4))

Submitter: Timothy Crnko, St. Louis, MO
Comment on Proposal No: 15-52
Recommendation: Revise text to read as follows:
(1) Separate Branches. Type 1 ~~E~~essential electrical systems ~~for hospitals~~ shall be comprised of three separate branches capable of supplying a limited amount of lighting and power service that is considered essential for life safety and effective ~~hospital~~ operation during the time the normal electrical service is interrupted for any reason. The branches are: life safety, critical, and equipment.
(4) Transfer Switches. The number of transfer switches to be used shall be based on reliability, design, and load considerations. Each branch of the Type 1 essential electrical system shall have one or more transfer switches. One transfer switch and downstream distribution system shall be permitted to serve one or more branches in a facility with a maximum demand on the essential electrical system of 150 kVA.
Modify the diagrams in 517.30 FPN No. 1 and 517.30 FPN No. 2 to correspond with this change.
Substantiation: The 2012 NFPA 99 no longer has occupancy-based essential electrical systems such as "hospital essential electrical system." The "essential electrical system" for a hospital could include the use of a Type 1, Type 2 and Type 3 essential electrical systems on the hospital premise. Therefore, the proposal is not appropriate. In different locations of a hospital a Type 1 essential electrical system could supply some loads and in another location a Type 2 essential electrical system could supply some loads. In addition, a doctor's office in an office complex could be required to have a Type 1 essential electrical system.
The 2012 NFPA 99 in 6.3.2.2.10 *Essential Electrical Systems* provides the requirements for the Type essential electrical system (Type 1,2, or 3) that must serve various types of patient care rooms which arc designated with a Category where appropriate.
The last two paragraphs from 2012 NFPA 99 Origins and Development of NFPA 99 on page 99-3 in part:
"The 201 2 edition went through a major overhaul. The premise of an occupancy-based document was modified to become a risk-based document.... The administration of health care continues to change. NFPA 99 has changed to reflect how health care is delivered.
The risk to the patient does not change for a given procedure. If the procedure is performed in a doctor's office versus a hospital, the risk remains the same.
Therefore, NFPA 99 eliminated the occupancy chapters and has gone to a risk-based approach. New Chapter 4 outlines the parameters for this approach. The Code now reflects the risk to the patient in defined categories of risk." The 2012 NFPA 99 Chapter 4 is the foundation for the change to a risked-based approach rather than an occupancy-based:
*"**4.1 * Building System Categories.** Building systems in health care facilities shall be designed to meet system Category 1 through Category 4 requirements as detailed in this code."*
4.1.1 to 4.1.3 details four different categories of facility systems that should be applied to Chapter 6 *Electrical Systems*. For instance, Category 1 systems are intended to supply loads where failure could result in *"major injury or death of patients or caregivers"*.
The 2012 NFPA 99 in Chapter 3 99:3.3.138 ties the patient care rooms to categories. Examples: critical care room would be Category 1, general care room would be Category 2, and basic care room would be Category 3.
The 2012 NFPA 99 has three types of essential electrical systems: Type 1, Type 2, and Type 3. NFPA 99 6.3.2.2.10 specifies which type of essential electrical system is required to serve various categories of rooms. Examples: *"critical care rooms (Category 1 Room) shall be served only by a Type 1 essential electrical system and "general care rooms (Category 2 Room) shall be served only by a Type for Type II"* essential electrical system. (Note the 2012 NFPA is inconsistent in its nomenclature in denoting Types: such as sometime it denotes Type 2 and sometime it denotes Type II.)
Other examples of where the type of essential electrical system is designated is 99:6.3.2.2.6.2: *"Receptacles for Patient Bed Locations in Critical Care Areas (Category I)"* means these receptacles need to be served by an essential electrical system Type 1 and *"Receptacles for Patient Bed Locations in General Care Areas (Category 2)"* means these receptacles need to be served by an, essential electrical system Type 2.
Panel Meeting Action: Reject
Panel Statement: The use of the term "Type 1" as described in NFPA 99, *Health Care Facilities Code*, is not necessary in the NEC and would be confusing to NEC users.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
KRUPA, G.: I disagree with the panel statement in that adding "Type 1" or at least cross-referencing such terms does not confuse readers, but improves our understanding. As a user of the NEC, one of my biggest complaints/concerns is the lack of coordination and consistency of terms between various codes.

15-48 Log #951 NEC-P15 **Final Action: Hold**
(517.30(C))

TCC Action: The Correlating Committee notes that Panel 15 has held Comment 15-48 and related Proposal 15-61 along with Comments 15-52, 15-53, 15-54, and related Proposal 15-62.
The Correlating Committee will appoint a task group as requested by Panel 15.
Submitter: Richard E. Loyd, Sun Lakes, AZ
Comment on Proposal No: 15-61
Recommendation: Reject the Proposal for insufficient substantiation.
Substantiation: The fact finding report file #E96627 dated January 10, 2012 presented to the committee at the Proposal meeting in Hilton Head, SC is incomplete and should not be considered as adequate substantiation to permit a new wiring method.
The sample testing was inconsistent:
The mechanical testing was only done on steel sheath and the fault current tests were only done on Aluminum sheath.
UL 1569 does not specify the thickness of the metal tape sheath presumably because Article 330 does not permit Type MC cable to be used for physical protection. However, this proposal asks for this new type MC cable product to provide mechanical protection equal to EMT. Therefore, the type material (Steel or Aluminum) and the thickness of the metal tape sheath tested must be known to evaluate its suitability for the purpose.
The fault current testing was only performed on Aluminum sheath. These tests should have been performed on both steel and aluminum and the thickness of the armor tape specified.
This proposed wiring method seems to be much heavier than standard Type MC Cable. Why were tension and pullout tests not included? Is additional securing and support needed in this application? It seems this should have been part of the evaluation when comparing it to EMT since circuits covered by 517.30(C) are often long vertical runs where this would be a factor. Article 330.30(D) allows supports to be omitted in some cases. Article 358 for EMT would require both the conductors and the tubing to be supported in a vertical runs per 358.30 and 300.19. This must be a part of the evaluation for physical damage suitability equality.
This proposed Type MC cable has not been considered by CMP-7 as appropriate to be included under Article 330 or if a new Article number should be assigned to by CMP-7 if it is accepted. CMP-7 is the committee responsible for cable wiring systems and provides expertise in cable wiring methods. This proposal should be submitted to that committee before being considered as an approved wiring method in Article 517.
Panel Meeting Action: Hold
Panel Statement: In accordance with 4.4.6.2.2(c) of the Regulations Governing Committee Projects, the panel holds Proposal 15-61 and Comment 15-48 as the subject has a great level of complexity and cannot be properly dealt with in the time frame required for processing the report. This proposal should be reassigned to CMP 7. CMP 15 suggests that a task group be created between CMP 7 and CMP 15 to adequately deal with this subject matter.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
TALKA, D.: This comment should have been acted on. The proposed wiring method has been under consideration for over 10 years. The comment adds no new information that wasn't considered in the past. Either the panel must either accept or reject the wiring method.

15-49 Log #211 NEC-P15 **Final Action: Accept**
(517.30(C)(3))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 15-62
Recommendation: The Correlating Committee directs that the panel reconsider this proposal with respect to the Correlating Committee Action on Proposals 15-19 and 15-20.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept
Revise text to read as follows:
(3) Mechanical protection of the ~~Emergency~~ Essential Electrical System. The wiring of the ~~emergency~~ life safety and critical branches shall be mechanically protected. Where installed as branch circuits in patient care ~~rooms~~ spaces ~~areas~~, the installation shall comply with the requirements ~~of~~ 517.13(A) and (B). The following wiring methods shall be permitted:
Panel Statement: The panel reconsiders its action and agrees with action taken on Proposal 15-19 and Proposal 15-20 to change to the word "space" instead of "room" or "area". An editorial change was made to correct the word "spaces" to "space".
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-50 Log #409 NEC-P15 **Final Action: Reject**
(517.30(C)(3))

Submitter: Russel LeBlanc, The Peterson School of Engineering
Comment on Proposal No: 15-55
Recommendation: This proposal should have been accepted.
Substantiation: The CMP was incorrect with the statement "The submitter's proposal does not add clarity or additional restrictions to the section". The addition of the word "only" places restrictions on which wiring methods are permitted. The present wording "permits" certain wiring methods but does not tell us which wiring methods we CAN'T use. I believe the INTENT of the present wording is to use "only" the wiring methods in 517.30(C)(3), but without the word "only", there are LITERALLY no restrictions on what OTHER wiring methods could be used too. The addition of the word "only" will help clarify the intent.
Panel Meeting Action: Reject
Panel Statement: The current text is intended to be permissive. The submitter's comment does not add clarity and would exclude acceptable wiring methods.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Abstain: 1
Explanation of Abstention:
KRUPA, G.: I disagreed with the panel statement, believing that the addition of "only" increases clarity of the statement. Moreover, not having "only" in the sentence made our discussions on 15-48 a moot point...there was no way to exclude the use of MC cable which we had just put on "Hold."

15-51 Log #1165 NEC-P15 **Final Action: Reject**
(517.30(C)(3))

Submitter: Michael J. Farrell III, IBEW LU #8, Toledo, OH
Comment on Proposal No: 15-57
Recommendation: Reconsider Panel Action of Reject of Proposal 15-57(log #1291).
Substantiation: Panel statement only addressed a part of the proposal as submitted. The panel statement uses the term "mechanical protection" that the NEC Style Manual discourages. The proposal as submitted uses terms and language recognized and encouraged by the NEC Style Manual. (See inserts included with Proposal 15-57 of NEC Style Manual 3.1.2 Permissive Rules and 3.2.5.5 Provisions on Protection Against Physical Damage)
The Panel statement is contrary to the NFPA's clear direction and guidance on language and terms to be used for formulating NEC text.
The first part of the proposal was that the proper term be used for the title by eliminating the improper text (legislative text strikeout) and using the recommended terms as recognized by the Style Manual in its place.
The second part of the proposal, not addressed in the panel statement is to eliminate the confusion created in the text by the use of language that is 'permissive' rather than mandatory in regards to the types of wiring methods allowed for the use of Protection Against Physical Damage for Emergency Systems.' (Mechanical Protection of Emergency Systems)
Another Proposal 15-55 (log114) recognized the same problem with another recommended solution.
The user in the installation world and designers are left to fight out what this requirement really says. The use of the permissive adds to the conflict and confusion. As both a AHJ and a installer I can speak on many problems created in the field by the use of language that does not convey the intent of any code requirement. Making the proposed change would go along way to providing a clearer text that complies with the NEC Style Manual and makes it clear that the list of wiring methods allowed to be used are limited.
Please reconsider the panel action taken and fully review the proposal as submitted with the NEC Style Manual in mind
Panel Meeting Action: Reject
Panel Statement: This comment points to a section of the Code that is a design element that is under the purview of NFPA 99 Electrical Systems committee. The panel suggests that proposals be sent to the NFPA 99 Electrical Systems committee. The current text in 517.30(C)(3) is intended to be permissive. The submitter's comment does not add clarity and would exclude acceptable wiring methods.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-52 Log #1271 NEC-P15 **Final Action: Hold**
(517.30(C)(3)(3))

Submitter: William A. Wolfe, Steel Tube Institute
Comment on Proposal No: 15-61
Recommendation: Delete the proposed new text
(3) Listed MC cable identified as providing crush, impact, and penetration circuit protection performance comparable to electrical metallic tubing.
Substantiation: This proposal should be rejected.
• The fact finding report file #E96627 dated January 10, 2012 presented to Code Panel 15 at the Proposal meeting in Hilton Head, SC is incomplete.
• The proposal 15-61 to add a new 517.30(C)(3)(3)and the fact finding report on Metal Clad Cable objectives page G1 clearly state and request the code be changed by adding "Listed MC cable identified as providing crush, impact, and penetration circuit protection performance equivalent to Electrical Metallic Tubing". Although a crush test and impact test specifically for cable is provided, there is nothing in the report that assesses penetration. The forces applied in the crush and impact tests for cable use flat plates with rounded edges.
Even if the proposed metal clad cable in this proposal might possibly have higher physical performance properties compared to currently listed Steel MC Cable, how can the report and more importantly the product be considered equivalent to Steel EMT in a critical care application, when no such evaluation was performed or presented in the supporting documentation.
• In addition, this report should not be considered as adequate substantiation to permit a new undeveloped wiring method as follows:
1. The report is insufficient to determine equal comparison of EMT sizes commonly used in the application of 517.30(C).
2. Only two samples of the smallest size EMT were inconsistently compared to two samples of the MC Cable.
a. Samples 1 steel interlocked armor containing 4 conductor XHHW TC cable with a 12 AWG bare aluminum conductor wrapped around the TC cable inside the steel armor.
b. Samples 1A aluminum interlocked armor containing 3 conductor XHHW TC cable with a 12 AWG bare aluminum conductor wrapped around the TC cable inside the aluminum armor.
c. Sample 2 trade size ½ EMT contained 12 THHN 14 AWG
d. Sample 3 trade size ½ EMT contained 4 THHN 14 AWG.
3. All tests were only performed on the steel interlocked armor except the vibration test where only the aluminum interlocked armor was tested. Why?
4. This proposed wiring method seems to be heavier than standard Type MC Cable. Why were tension and pullout tests in the cable standard not included? It seems this should have been part of the evaluation when comparing it to EMT since circuits covered by 517.30(C) are often long vertical runs where this would be a factor. Article 330.30(D) allows supports to be omitted in some cases. EMT would require both the conductors and the tubing to be supported in a vertical runs per 358.30 and 300.19. This must be a part of the evaluation for physical damage suitability equality..
• This proposed product has not been considered by CMP-7 as appropriate to be included under Article 330 or if a new Article number should be assigned to it when it has been accepted. CMP-7 is the committee responsible for cable wiring systems and provides expertise in these products. This product should be submitted to that committee before being considered as an approved wiring method in Article 517.
• In conclusion, the testing did not cover the full spectrum of the protective characteristics provided by EMT; the testing was limited to too small of sampling of products; and what testing was done either omitted some of the products or did not report the results for them. The Fact Finding report falls far short of the minimum expectations of a compelling rationale. There would be adequate time prior to the next cycle to correct the omissions, and expand the testing and number of products evaluated. As an example of what one might consider adequate testing is the voluminous data and testing performed on IMC (Intermediate Metal Conduit) before code panel 8 accepted it as an equivalent to rigid steel conduit and added a new article covering IMC.
Panel Meeting Action: Hold
Panel Statement: See the panel action and statement on Comment 15-48. For correlation of all comments and associated proposals concerning this issue the correlating committee should monitor the actions on Comment 15-48.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
TALKA, D.: See explanation of vote for Comment 15-48.

15-53 Log #1353 NEC-P15 **Final Action: Hold**
(517.30(C)(3))

Submitter: Gary A. Beckstrand, Salt Lake City, UT
Comment on Proposal No: 15-62
Recommendation: Revise text to read as follows:
(3) Mechanical Protection of the Essential Electrical System. The wiring of the life safety and critical branches shall be mechanically protected by raceways. Where installed as branch circuits in patient care spaces the installation shall comply with requirements of

517.13(A) and (B). The following wiring methods shall be permitted: **[ROP 15–62]** <u>**[99:** 6.4.2.2.6.4]</u>

Substantiation: The panel should have taken action to Accept in Principle on ROP 15-62 and add text to coordinate NEC 517.30(C) with 2012 NFPA 99 Health Care Facilities Code section 6.4.2.2.6.4. If allowed to remain as shown in the *Draft of Proposed NFPA 70 2014 Edition of the National Electrical Code,* this action will create questions and confusion for code users due to omission of a vital installation directive in NFPA 99, that life safety and critical branch circuits shall be mechanically protected by raceways.

As submitted by the Technical Committee on Electrical Systems, shown as ROP 15-62 requiring mechanical protection of these circuits, the TC stated: "**Substantiation:** To Coordinate with NFPA 99. As a result of the August 10, 2011 Standards Council Decision (Final), D#11-7, regarding the scoping issues of electrical requirements in NFPA 99, Health Care Facilities Code, coordination of the electrical requirements is needed between the NEC and NFPA 99." This statement indicates it is the direction of the NFPA 99 TC that they wish to coordinate NFPA 99 and NFPA 70, Article 517. Acceptance of this proposal is in direct conflict with this directive.

The panel needs to provide coordination between the National Electrical Code 517.30(C)(3) and 2012 NFPA 99 Health Care Facilities Code, 6.4.2.2.6.4 which states, "Mechanical Protection of the Life Safety and Critical Branches. The wiring of the life safety and critical branches shall be mechanically protected by *raceways*, as defined in *NFPA 70*, *National Electrical Code*."

On ROP 15-62, Mr. Stephen Lipster's comment for a negative vote accurately describes the failure of the committee to respond to this issue. Mr. Lipster stated, "The NFPA 99 Electrical Systems Technical Committee did not follow the requirement of providing the exact extracted material from 2012 NPPA 99 6.4.2.2.6.4. As per the Standards Council decision, the coordination of the electrical requirements, material such as this are to be direct extractions from NFPA's health care documents. The 2012 NFPA 99 Health Care Standard 6.4.2.2.6.4. "Mechanical Protection of the Life Safety and Critical Branches. The wiring of the life safety and critical branches shall be mechanically protected by raceways..." The language of the proposal should clearly coordinate with NFPA 99 with extracted material as directed in the NEC Style Manual, 4.3.1 through 4.3.3.

Panel Meeting Action: Hold

Panel Statement: This is new material and should be held to allow for public input.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13 Negative: 1

Explanation of Negative:

TALKA, D.: See explanation of vote for Comment 15-48.

15-54 Log #1354 NEC-P15 **Final Action: Hold**
(517.30(C)(3)(3))

Submitter: Gary A. Beckstrand, Salt Lake City, UT

Comment on Proposal No: 15-61

Recommendation: Reject proposal and return to the 2011 NEC language. Also see related comment on 15-62.

~~(3) Listed MC cable identified as providing crush, impact and penetration circuit protection performance comparable to electrical metallic tubing.~~ **[ROP 15–61]**

<u>(3) Listed flexible metal raceways and listed metal sheathed cable assemblies in any of the following:</u>

<u>a. Where used in listed prefabricated medical headwalls</u>

<u>b. In listed office furnishings</u>

<u>c. Where fished into existing walls or ceilings, not otherwise accessible and not subject to physical damage</u>

<u>d. Where necessary for flexible connection to equipment</u>

Substantiation: The panel should reject this proposal. If allowed to remain as shown in the *Draft of Proposed NFPA 70 2014 Edition of the National Electrical Code* this action will create a direct conflict between the National Electrical Code 517.30(C)(3)(3) and 2012 NFPA 99 Health Care Facilities Code, 6.4.2.2.6.4 which states, "Mechanical Protection of the Life Safety and Critical Branches. The wiring of the life safety and critical branches shall be mechanically protected by *raceways*, as defined in *NFPA 70*, *National Electrical Code*."

A similar proposal by the Technical Committee on Electrical systems, ROP 15-62 requiring mechanical protection of these circuits, the TC stated "**Substantiation:** To Coordinate with NFPA 99. As a result of the August 10, 2011 Standards Council Decision (Final), D#11-7, regarding the scoping issues of electrical requirements in NFPA 99, Health Care Facilities Code, coordination of the electrical requirements is needed between the NEC and NFPA 99." This statement indicates it is the direction of the NFPA 99 TC that they wish to coordinate NFPA 99 and NFPA 70, Article 517. Acceptance of this proposal is in direct conflict with this directive.

On ROP 15-62, Mr. Stephen Lipster's comment for a negative vote accurately describes the failure of the committee to respond to this issue. Mr. Lipster stated, "The NFPA 99 Electrical Systems Technical Committee did not follow the requirement of providing the exact extracted material from 2012 NPPA 99 6.4.2.2.6.4. As per the Standards Council decision, the coordination of the electrical requirements, material such as this are to be direct extractions from NFPA's health care documents. The 2012 NFPA 99 Health Care Standard 6.4.2.2.6.4. "Mechanical Protection of the Life Safety and Critical Branches. The wiring of the life safety and critical branches shall be mechanically protected by raceways..." The language of the proposal should clearly coordinate with NFPA 99.

Also it should be noted that the MC mentioned in the proposal is not available and its practical use cannot be ascertained though a fact finding report. It should be noted that the introduction of this report at the ROP meeting violated the regulations governing committee projects by not being submitted in a timely manner with the proposal.

The panel should reverse its action on this proposal and return to the 2011 NEC language to avoid conflicts between the Codes and confusion for code users.

Panel Meeting Action: Hold

Panel Statement: See the panel action and statement on Comment 15-48. For correlation of all comments and associated proposals concerning this issue the correlating committee should monitor the actions on Comment 15-48.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

15-55 Log #1402 NEC-P15 **Final Action: Reject**
(517.30(C)(3))

Submitter: Timothy Crnko, St. Louis, MO

Comment on Proposal No: 15-62

Recommendation: Revise text to read as follows:

(3) Mechanical Protection of the <u>Type 1</u> Essential Electrical System.

The wiring of the life safety and critical branches shall be mechanically protected. Where installed as branch circuits in patient care spaces, the installation shall comply with the requirements of 517.13(A) and (B). The following wiring methods shall be permitted:

Substantiation: The 2012 NFPA 99 requires the life safety and critical branches to be separate from other wiring for only Type 1 essential electrical systems in 99:6.4.2.2.6.1. Type 2 essential electrical systems are required in 99:6.5.2.2.4.1 to have the life safety and equipment branches independent of all other wiring. If one were to conclude that 517.40 should be titled Type 2 Essential Electrical System, then 517.40(B) is no longer valid to require complying with 517.30(C)(3). The 2012 NFPA 99 has no requirement for the life safety branch to be separate from other wiring for Type 3 essential electrical systems; refer to 99:6.5. If one were to conclude that 517.45, should be titled Type 2 Essential Electrical Systems, then 517.45 (B) is no longer valid to require complying with 517.30(C)(3).

It is important to point out that the 2012 NFPA 99 no longer has occupancy-based essential electrical systems such as "Essential Electrical System for Hospitals": title for 517.30. The "essential electrical system" for a hospital could include the use of a Type I, Type 2 and Type 3 essential electrical systems on the hospital premise.

Therefore, proposal p15-62 is not appropriate without the Type of essential electrical system. In different locations of a hospital a Type I essential electrical system could supply some loads and in another location a Type 2 essential electrical system could supply some loads. In addition, a doctor's office in an office complex could be required to have a Type 1 essential electrical system.

The 2012 NFPA 99 in 6.3.2.2.10 *Essential Electrical Systems* provides the requirements for the Type essential electrical system (Type 1,2, or 3) that must serve various types of patient care rooms which are designated with a Category where appropriate.

The last two paragraphs from 2012 NFPA 99 *Origins and Development of NFPA 99* on page 99-3 in part:

"The 2012 edition went through a major overhaul. The premise of an occupancy-based document was modified to become a risk-based document... The administration of health care continues to change. NFPA 99 has changed to reflect how health care is delivered.

The risk to the patient does not change for a given procedure. If the procedure is performed in a doctor's office versus a hospital, the risk remains the same.

Therefore, NFPA 99 eliminated the occupancy chapters and has gone to a risk-based approach. New Chapter 4 outlines the parameters for this approach. The Code now reflects the risk to the patient in defined categories of risk." The 20 12 NFPA 99 Chapter 4 is the foundation for the change to a risked-based approach rather than an occupancy-based:

"**4.1*** ***Building System Categories.*** *Building systems in health care facilities shall be designed to meet system Category I through Category 4 requirements as detailed in this code."*

4.1.1 to 4.1.3 details four different categories of facility systems that should be applied to Chapter 6 *Electrical Systems*. For instance, Category 1 systems are intended to supply loads where failure could result in *"major injury or death of patients or caregivers"*.

The 2012 NFPA 99 in Chapter 3 99:3.3.138 ties the patient care rooms to categories. Examples: critical care room would be Category I, general care room would be Category 2, and basic care room would be Category 3.

The 2012 NFPA 99 has three types of essential electrical systems: Type 1, Type 2, and Type 3. NFPA 99 6.3.2.2.10 specifies which type of essential electrical system is required to serve various categories of rooms. Examples: *"critical care rooms (Category I Room) shall be served only by a Type 1"* essential electrical system and *"general care rooms (Category 2 Room) shall be served only by a Type for Type II"* essential electrical system. (Note the

2012 NFPA is inconsistent in its nomenclature in denoting Types: such as sometime it denotes Type 2 and sometime it denotes Type II.)

Other examples of where the type of essential electrical system is designated is 99:6.3.2.2.6.2: *"Receptacles for Patient Bed Locations in Critical Care Areas (Category I)"* means these receptacles need to be served by an essential electrical system Type 1 and *"Receptacles for Patient Bed Locations in General Care Areas (Category 2)"* means these receptacles need to be served by an essential electrical system Type 2.

Panel Meeting Action: Reject

Panel Statement: The use of the term "Type 1" as described in NFPA 99, *Health Care Facilities Code*, is not necessary in the NEC and would be confusing to NEC users.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

15-55a Log #1610 NEC-P15 **Final Action: Hold**
(517.30(C)(3).3)

Submitter: Phil Simmons, National Armored Cable Manufacturers Assoc.

Comment on Proposal No: 15-59

Recommendation: Accept the proposal to add a new 517.30(c)(3)(3):
(3) Listed metal sheathed cable assemblies installed where not subject to physical damage or protected in accordance with 300.4.

Substantiation: The panel statement expresses a preference for a new construction of Type MC cable that meets selected performance requirements of EMT. In doing so the panel is not stating a preference for a wiring method that cannot be damaged. All wiring methods can be damaged if installed in inappropriate locations. Type MC cable offers a comparable level of protection to that provided by EMT in ordinary locations and the environment of hospital construction and operation.

There is no need for a special construction of MC where used in normal construction as indicated in the original substantiation for the proposal. A higher level of performance for the cable where exposed to severe physical damage may be appropriate but is not necessary where installed in ordinary locations such as in floors, walls, and ceilings. The requirements in 300.4 provide protection against normal physical damage during construction and operation in general locations.

Panel Meeting Action: Hold

Panel Statement: In accordance with 4.4.6.2.2(c) of the Regulations Governing Committee Projects, the panel holds Comment 15-55a as the subject has a great level of complexity and cannot be properly dealt with in the time frame required for processing the report. This proposal should be reassigned to CMP 7. CMP 15 suggests that a task group be created between CMP 7 and CMP 15 to adequately deal with this subject matter.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 12 Negative: 1

Ballot Not Returned: 1 Shelly, B.

Explanation of Negative:

Talka, D.: This comment should have been acted on. The proposed wiring method has been under consideration for over 10 years. The comment adds no new information that wasn't considered in the past. The panel must either accept or reject the wiring method.

15-56 Log #1585 NEC-P15 **Final Action: Accept**
(517.30(D))

Submitter: James F. Williams, Fairmont, WV

Comment on Proposal No: 15-63

Recommendation: Revise text to read as follows:

517.30 Essential Electrical Systems for Hospitals.

(D) Capacity of Systems. The essential electrical system shall have the capacity and rating to meet the maximum actual demand likely to be produced by the connected load ~~of the essential electrical system~~.

Feeders shall be sized in accordance with 215.2 and Part III of Article 220. The generator set(s) shall have the capacity and rating to meet the demand produced by the load ~~of the essential electrical system~~ at any given time.

Substantiation: Repeating essential electrical system adds nothing to the understanding of this section.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

15-57 Log #368 NEC-P15 **Final Action: Accept**
(517.30(E))

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)

Comment on Proposal No: 15-64

Recommendation: NEMA supports CMP15's Panel Action to Accept Proposal 15-64 adding the proposed new text.

Substantiation: Electrical contractors involved in hospital renovations have reported to NEMA members that prior maintenance replacements of cover plates and receptacles on circuits intended for nonessential electrical loads have used red cover plates or receptacles, the "distinctive color" intended in those health care facilities for essential electrical system circuits.

Under the very conditions that warrant the existence of essential electrical systems, however, there is no definitive confirmation as to which receptacles are in fact successfully being supplied power. An illuminated outlet face or a lighted indicator on the receptacle outlet inherently provides the most apparent visual indication and requires no training of visiting medical personnel working under those conditions activating the essential electrical system as to what is "readily identifiable", particularly where the cited inconsistent maintenance replacements have occurred.

Furthermore, as expressed in Mr. Friedman's affirmative ballot comment on Proposal 15-64, the Panel Actions for Proposals 15-35, 15-36, 15-39 and 15-41 increase the minimum numbers of receptacle outlets required. Rapid visual confirmation of which receptacle outlets are still energized when normal electrical service is interrupted may be essential to avoid incorrect connection into unpowered receptacle outlets of portable cord-and-plug-connected medical equipment and instrumentation during emergency conditions.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 11 Negative: 3

Explanation of Negative:

DUNCAN, J.: The Panel should have rejected this proposal and referred the submitter to NFPA 99 as this is a performance issue.

ERICKSON, D.: With the reliability, frequent testing, and regulatory oversight of emergency systems in healthcare facilities there is no need to require an indicator light on every receptacle. Alarms or battery backup or both are provided to indicate/accommodate a loss of power on vital life support equipment. There was no technical data provided to indicate that there is a widespread problem with poor patient outcomes that could have been averted with the presence of an indicator light. This change would not improve current conditions. If anything, this change could add additional risk to the patient. If the indicator light is faulty, staff may unnecessarily disconnect vital equipment from the emergency system and connect it to non-emergency system receptacles, posing additional risks.

NASH, JR., H.: With the reliability, frequent testing, and regulatory oversight of emergency systems in healthcare facilities there is no need to require an indicator light on every receptacle. Alarms or battery backup or both are provided to indicate/accommodate a loss of power on vital life support equipment. There was substantiation provided to indicate that there is a problem with poor patient outcomes that could have been averted with the presence of an indicator light. This change would not reduce risk and would cause hospital to incur unnecessary cost. Additionally, this is performance issue which should be addressed by NFPA 99.

15-58 Log #438 NEC-P15 **Final Action: Accept in Principle**
(517.30(F))

Submitter: Neil F. LaBrake, Jr., National Grid USA

Comment on Proposal No: 15-66

Recommendation: Accept in principle in part to eliminate Exception 2 and delete the term "selective" from "selective coordination" in the title and delete the word "selectively" from "selectively coordinated" in the first sentence of the proposed new section. This proposal should read in legislative text as:

(F) ~~Selective~~ Coordination. Overcurrent protective devices serving the essential electrical system shall be selectively coordinated for the period of time that a fault's duration extends beyond 0.1 second.

Exception No. 1: Between transformer primary and secondary overcurrent protective devices, where only one overcurrent protective device or set of overcurrent protective devices exists on the transformer secondary.

~~*Exception No. 2: Isolated power systems inherently comply with this selective coordination requirement.*~~

Exception No. 2~~3~~: Between overcurrent protective devices of the same size (ampere rating) in series.

Substantiation: This comment is the work of the Task Group on 2014 NEC/2012 NFPA 99 Correlation with the following representation: Larry Todd, CMP-15; Don Talka, CMP-15; Jim Duncan, CMP-15; Sam Friedman, CMP-15; Walt Vernon, NFPA 99; Dave Dagenais, NFPA 99; James Costley, NFPA 99; Chad Beebe, NFPA 99; Jim Dollard, NEC Correlating Committee; and Neil LaBrake, Jr., NEC Correlating Committee (Chair). As directed by Mr. Michael J. Johnston, NEC Correlating Committee Chair on June 8th, 2012, the Task Group acted on correlation matters and conformance with the Standard Council direction on "Installation vs. Performance" to resolve any conflicts or inconsistencies resulting from proposed revisions in the A2013NEC Report on Proposals (ROP) related to the 2012 NFPA 99. However, this Task Group did not make a determination on any proposal with respect to "installation vs. performance" except on Proposal 15-66 regarding the Standards Council direction on the term "selective coordination".

Exception 2 does not appear in NFPA 99-2012. The term "selective coordination" is a defined term in Article 100 and used in several articles in the NEC. This term is under the NEC Committee's purview. Also, the term "selectively coordinated" needs to be changed under this same concern. The NFPA 99 term used in performance requirements of protective coordination needs to be changed to remove any conflict with the NEC defined term "Coordination (Selective)".

Panel Meeting Action: Accept in Principle

Revise the text to read as follows:

(F) ~~Selective~~ Coordination. Overcurrent protective devices serving the essential electrical system shall be ~~selectively~~ coordinated for the period of time that a fault's duration extends beyond 0.1 second.

Exception No. 1: Between transformer primary and secondary overcurrent protective devices, where only one overcurrent protective device or set of overcurrent protective devices exists on the transformer secondary.

~~*Exception No. 2: Isolated power systems inherently comply with this selective coordination requirement.*~~

Exception No. 2~~3~~: Between overcurrent protective devices of the same size (ampere rating) in series.

Informational Note: The terms "Coordination" and "Coordinated" as used in this section do not cover the full range of overcurrent conditions.

Panel Statement: The word "selectively" is removed in the first sentence to make the wording of the section consistent with the removal of the word "selective". An informational note was added to clarify the meaning of the terms "Coordination" and "Coordinated".

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13 Negative: 1

Explanation of Negative:

KRUPA, G.: While I agree-in-principle, I have serious reservations about the changed definition of "Selective Coordination" made by a different committee; this change has serious implications, especially for design engineers trying to balance competing requirements of Art 517 with NFPA 99.

Comment on Affirmative:

SAMPSON, M.: Claiming jurisdiction of overcurrent coordination as a design issue, the ELS committee of NFPA 99 is systematically diminishing the effectiveness of the essential electrical system by limiting the coordination to overload conditions only.

The ELS committee would have us believe that fully coordinated distribution systems - where continuity of power is critical - are effective for elevators, fire pumps and critical operation power systems, but oddly, will not work in a hospital.

A properly designed selectively coordinated overcurrent protection arrangement that localizes any overcurrent condition - short circuits and overloads - to the conductors or equipment in which the overload or fault condition occurs is a critical safety element that will be lost by this provision.

15-59 Log #572 NEC-P15 **Final Action: Reject**
(517.30(F) (New))

Note: When the ballot result does not confirm the TC action on a Proposal by a two-thirds affirmative vote, the Report on Proposals shall be published with a specific request for public comment on that Proposal. The Proposal is now being reconsidered by the TC as a public comment.

Submitter: Technical Committee on Electrical Systems,

Comment on Proposal No: 15-66

Recommendation: Add new text to read as follows:

(F) Selective Coordination. Overcurrent protective devices serving the essential electrical system shall be selectively coordinated for the period of time that a fault's duration extends beyond 0.1 second.

Exception No. 1: Between transformer primary and secondary overcurrent protective devices, where only one overcurrent protective device or set of overcurrent protective devices exists on the transformer secondary.

Exception No. 2: Isolated power systems inherently comply with this selective coordination requirement.

Exception No. 3: Between overcurrent protective devices of the same size (ampere rating) in series.

Substantiation: To Coordinate with NFPA 99, 6.4.2.1.2. As a result of the August 10, 2011 Standards Council Decision (Final), D#11-7, regarding the scoping issues of electrical requirements in NFPA 99, Health Care Facilities Code, coordination of the electrical requirements is needed between the NEC and NFPA 99.

An excerpt from D#11-7 states: "The Council believes that the distinction between performance requirements and installation requirements is reasonably clear and the Council reiterates that "without deciding in advance what the Council would do regarding specific jurisdictional issues relating to this topic, the Council considers the guidance [from the previous task group] to be Useful". (See Standards Council Minute Item 10-3-21, March 2010). In this Decision, the Council has concluded that selective coordination (cascading outages) properly falls within the jurisdiction of NFPA 99. The NEC project should proceed, as part of its standards development activities, to harmonize the NEC with the relevant provisions of NFPA 99."

This proposal was balloted through the Technical Committee on Electrical Systems with the following results:

24 Members Eligible to Vote

7 Not Returned (Dagenais, Krupa, Lipster, Meade, Peterson, Smidt, and Wolff)

16 Affirmative on All

0 Negatives

0 Abstentions

Note: Supporting material is available for review at NFPA Headquarters.

Panel Meeting Action: Reject

Panel Statement: See the panel action and statement on Comment 15-58.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13 Negative: 1

Explanation of Negative:

KRUPA, G.: I have serious reservations about the changed definition of "Selective Coordination" made by a different committee; this change has serious implications, especially for design engineers trying to balance competing requirements of Art 517 with NFPA 99.

15-60 Log #1002 NEC-P15 **Final Action: Reject**
(517.30(F) (New))

Submitter: David Clements, International Association of Electrical Inspectors

Comment on Proposal No: 15-66

Recommendation: Continue to reject this proposal.

Substantiation: Proposal 15-66 was shown as a reject because it received less than a $^2/_3$ affirmative vote. The panel should continue to reject this proposal because it would create a very significant conflict with the definition of "coordination, selective" in Article 100. As written in Article 100 "Coordination, Selective" is a black or white definition. An electrical system is either selectively coordinated or it is not. There is no "in between". The proposal would add confusion to the NEC because selective coordination, as defined in Article 100 is for the full range of overcurrent conditions, not just for overloads that would take 0.1 seconds or longer to open overcurrent protective devices, as the proposal would allow.

Panel Meeting Action: Reject

Panel Statement: See the panel action and statement on Comment 15-58.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13 Negative: 1

Explanation of Negative:

KRUPA, G.: I have serious reservations about the changed definition of "Selective Coordination" made by a different committee; this change has serious implications, especially for design engineers trying to balance competing requirements of Art 517 with NFPA 99.

15-61 Log #1192 NEC-P15 **Final Action: Reject**
(517.30(F) (New))

Submitter: Technical Committee on Electrical Systems,

Comment on Proposal No: 15-66

Recommendation: Revise text to read as follows:

(F) Selective Coordination. Overcurrent protective devices serving the essential electrical system shall be selectively coordinated for the period of time that a fault's duration extends beyond 0.1 second.

Exception No. 1: Between transformer primary and secondary overcurrent protective devices, where only one overcurrent protective device or set of overcurrent protective devices exists on the transformer secondary.

Exception No. 2: Between overcurrent protective devices of the same size (ampere rating) in series.

Substantiation: The NFPA 99 ELS TC is submitting this without the exemption 2 that was included in the ROP stage. That was an inadvertent inclusion and this comment now matches the language in Section 6.4.2.1.2 of NFPA 99.

This comment was balloted through the Technical Committee on Electrical Systems with the following results:

25 Members Eligible to Vote

2 Not Returned (T. Easty, H. Nash)

20 Affirmative

3 Negatives (DeHanes, Lipster and Loeb)

0 Abstentions

Panel Meeting Action: Reject

Panel Statement: See the panel action and statement on Comment 15-58.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13 Negative: 1

Explanation of Negative:

KRUPA, G.: I have serious reservations about the changed definition of "Selective Coordination" made by a different committee; this change has serious implications, especially for design engineers trying to balance competing requirements of Art 517 with NFPA 99.

15-62 Log #1395 NEC-P15 **Final Action: Reject**
(517.30(F) (New))

Submitter: Kristine Cleary, Marcy, NY

Comment on Proposal No: 15-66

Recommendation: This proposal must continue to be rejected.

Substantiation: No technical substantiation was provided with this proposal. Simply referring to a Standards Council Decision is not an adequate technical substantiation.

Panel Meeting Action: Reject

Panel Statement: See the panel action and statement on Comment 15-58.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13 Negative: 1

Explanation of Negative:

KRUPA, G.: I have serious reservations about the changed definition of "Selective Coordination" made by a different committee; this change has serious implications, especially for design engineers trying to balance competing requirements of Art 517 with NFPA 99.

15-63 Log #1396 NEC-P15 **Final Action: Reject**
(517.30(F) (New))

Submitter: Jessica Dunker, Edwardsville, IL
Comment on Proposal No: 15-66
Recommendation: Continue to reject this proposal.
Substantiation: This proposal introduces significant confusion relative to the definition of selective coordination. This will cause NEC® enforcement problems. It totally disagrees with the NEC Article 100 definition and accepted electrical engineering practices concerning selective coordination. See IEEE Buff, Red and Grey books, and NEMA ABP 1-2010 Selective Coordination.
Panel Meeting Action: Reject
Panel Statement: See the panel action and statement on Comment 15-58.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
KRUPA, G.: I have serious reservations about the changed definition of "Selective Coordination" made by a different committee; this change has serious implications, especially for design engineers trying to balance competing requirements of Art 517 with NFPA 99.

15-64 Log #1398 NEC-P15 **Final Action: Reject**
(517.30(F) (New))

Submitter: Vincent J. Saporita, Cooper Bussmann
Comment on Proposal No: 15-66
Recommendation: CMP 15 should continue to reject this proposal.
Substantiation: Acceptance of Proposal 15-66 introduces conflicts within the NEC and with other key ANSI accredited standards that define and reference selective coordination. ANSI Essential Requirement 2.4 requires that "Good faith efforts shall be made to resolve potential conflicts between and among existing American National Standards and candidate American National Standards". <u>**Acceptance of Proposal 15-66 will be a clear violation of ANSI 2.4 and jeopardizes ANSI accreditation of the 2014 edition of the NEC®**</u>
Panel Meeting Action: Reject
Panel Statement: See the panel action and statement on Comment 15-58.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Abstain: 1
Explanation of Abstention:
KRUPA, G.: While I agree in principle, I have serious reservations about the changed definition of "Selective Coordination" made by a different committee; this change has serious implications, especially for design engineers trying to balance competing requirements of Art 517 with NFPA 99.
Comment on Affirmative:
SAMPSON, M.: The addition to this part to 517.30 will significantly diminish the electrical safety requirements in hospitals.

15-65 Log #1403 NEC-P15 **Final Action: Reject**
(517.30(F) (New))

Submitter: Timothy Crnko, St. Louis, MO
Comment on Proposal No: 15-66
Recommendation: Revise text to read as follows:
(F) ~~Selective Coordination~~ <u>Cascading of Overcurrent Protective Devices.</u>
Overcurrent protective devices serving the essential electrical system shall <u>not cascade</u> ~~be selectively coordinated~~ for the period of time that a fault's duration extends beyond 0.1 second.
Exception No. 1: (no change)
~~*Exception No. 2: Isolated power systems inherently comply with this selective coordination requirement.*~~
Exception No. ~~3~~<u>2</u>*:* (no change)
Substantiation: As proposed, there would be a conflict with the definition of "coordination, selective" in Article 100. By changing to "cascading" rather than "selective coordination", the conflict can be avoided. Exception No.2 is deleted because it does not appear in the latest edition of NFPA 99. In addition, the statement that "Isolated power systems inherently comply with this selective coordination requirement" is not technically correct and has no technical substantiation.
Panel Meeting Action: Reject
Panel Statement: See the panel action and statement on Comment 15-58.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14
Comment on Affirmative:
KRUPA, G.: While I agree-in-principle, I have serious reservations about the changed definition of "Selective Coordination" made by a different committee; this change has serious implications, especially for design engineers trying to balance competing requirements of Art 517 with NFPA 99. The term "Cascading" would further confuse a situation that needs to be coordinated and corrected between competing codes.

15-66 Log #1401 NEC-P15 **Final Action: Reject**
(517.31)

Submitter: Timothy Crnko, St. Louis, MO
Comment on Proposal No: 15-68
Recommendation: Original Proposal 15-68 must be rejected. NFPA 99 has three different essential electrical systems (Type 1, Type 2, and Type 3) that are applied based on the risk to patients and caregivers at specific "locations" within a healthcare facility (risk-based). Article 517 through the proposal stage has three essential electrical systems that are applied based on occupancy type (occupancy-based). There is no suitable correlation between these two different approaches.
The proposed text of Proposal 15-68 conflicts with NFPA 99:6.4.3.1 which applies to Type I essential electrical systems, correlates to the second paragraph of Proposal 15-68.
However, 99:6.5.3.1 which applies to Type 2 essential electrical systems does not correlate to the second paragraph of Proposal 15-68 and does not correlate with 517.42.
99:6.5.3.1 "*Source.* *The life safety and* ***equipment branches*** *shall be installed and connected to the alternate source of power specified in 6.4.1.1.4 and 6.4.1.1.5 so that all functions specified herein for the life safety and equipment branches are automatically restored to operation* ***within 10 seconds*** *after interruption of the normal source."* (Applies to Type 2 essential electrical systems) Note 99:6.5.3.1 applies to the equipment branch where Proposal 15-68 does not include this branch.
In addition 99:6.6.3.1.2, which applies to Type 3 essential electrical systems, does not correlate to the second paragraph of P15-68.
99:6.6.3.1.2 *"The life safety branch shall be so arranged that, in the event of failure of the normal power source, the alternate source of power shall be automatically connected to the load within 10 seconds."* (Applies to Type 3 essential electrical systems) (A TIA removed critical branch from this requirement.)
Substantiation: It is important to point out that the 2012 NFPA 99 no longer has occupancy-based essential electrical systems such as "hospital essential electrical system." In NFPA 99 the "essential electrical system" for a hospital could include the use of a Type I, Type 2 and Type 3 essential electrical systems on the hospital premise, Therefore, the proposal is not appropriate. In different locations of a hospital a Type I essential electrical system could supply some loads and in another location a Type 2 essential electrical system could supply some loads, In addition, a doctor's office in an office complex could be required to have a Type 1 essential electrical system.
The 2012 NFPA 99 in 6.3.2.2.10 *Essential Electrical Systems* provides the requirements for the Type essential electrical system (Type 1,2, or 3) that must serve various types of patient care rooms which are designated with a Category where appropriate.
The last two paragraphs from 2012 NFPA 99 *Origins and Development of NFPA 99* on page 99-3 in part:
"The 2012 edition went through a major overhaul. The premise of an occupancy-based document was modified to become a risk-based document... The administration of health care continues to change. NFPA 99 has changed to reflect how health care is delivered. The risk to the patient does not change for a given procedure. If the procedure is performed in a doctor's office versus a hospital, the risk remains the same.
Therefore, NFPA 99 eliminated the occupancy chapters and has gone to a risk-based approach. New Chapter 4 outlines the parameters/or this approach. The Code now reflects the risk to the patient in defined categories of risk." The 2012 NFPA 99 Chapter 4 is the foundation for the change to a risk-based approach rather than an occupancy-based:
"4.1 **** Building System Categories****. Building systems in health care facilities shall be designed to meet system Category I through Category 4 requirements as detailed in this code."*
4.1.1 to 4.1.3 details four different categories of facility systems that should be applied to Chapter 6 *Electrical Systems*, For instance, Category 1 systems are intended to supply loads where failure could result in *"major injury or death o/patients or caregivers"*.
The 2012 NFPA 99 in Chapter 3 99:3.3.138 tics the patient care rooms to categories. Examples: critical care room would be Category I, general care room would be Category 2, and basic care room would be Category 3.
The 2012 NFPA 99 has three types of essential electrical systems: Type 1, Type 2, and Type 3. NFPA 99 6.3.2.2.10 specifies which type of essential electrical system is required to serve various categories of rooms. Examples: *"critical care rooms (Category I Room) shall be served only by a Type I'* essential electrical system and *"general care rooms (Category 2 Room) shall be served only by a Type 1 or Type II"* essential electrical system. (Note the 2012 NFPA is inconsistent in its nomenclature in denoting Types: such as sometime it denotes Type 2 and sometime it denotes Type II.)
Other examples of where the type of essential electrical system is designated is 99:6.3.2.2.6.2: *"Receptacles for Patient Bed Locations in Critical Care Areas (Category 1)"* means these receptacles need to be served by an essential electrical system Type 1 and *"Receptacles for Patient Bed Locations in General Care Areas (Category 2)"* means these receptacles need to be served by an essential electrical system Type 2.
Panel Meeting Action: Reject

Panel Statement: This comment points to a section of the Code that is a design element that is under the purview of NFPA 99 Electrical Systems committee. The panel suggests that proposals be sent to the NFPA 99 Electrical Systems committee.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-67 Log #919 NEC-P15 **Final Action: Reject**
(517.32(F))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 15-70
Recommendation: Revise text to read as follows:
517.32 Life Safety Branch.
(F) Generator Set Accessories. Generator set accessories as required for generator performance. Loads dedicated to a specific generator, including the fuel transfer pump(s), ventilation fans, electrically operated louvers, controls, cooling system, and other generator accessories essential for generator operation, shall be connected to the life safety branch or to the output terminals of the generator with over-current protective devices <u>directly or through a transformer</u>.
Substantiation: In the case where the generator output voltage is not compatible with the listed loads is it acceptable for the load to be supplied from a transformer fed from the generator output leads?
Panel Meeting Action: Reject
Panel Statement: The suggested wording does not add clarity.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-68 Log #1341 NEC-P15 **Final Action: Reject**
(517.33)

Submitter: James E. Degnan, Sparling
Comment on Proposal No: 15-71
Recommendation: None given.
Substantiation: Assuming that proposal 15-52 (517.30) and 15-48(517.26) are accepted, the panel should reject this proposal and refer the submitter to the panel action on the previous referenced proposals, which meet the submitters intent. By removing the critical branch from what was the “emergency system” this language is no longer necessary.
Panel Meeting Action: Reject
Panel Statement: The submitter failed to make a recommendation.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-68a Log #CC1501 NEC-P15 **Final Action: Accept**
(517.33(B))

Submitter: Code-Making Panel 15,
Comment on Proposal No: 15-71
Recommendation: Reject Proposal 15-71.
Substantiation: Based on the action taken on Proposals 15-52 and 15-48, the added language in 517.33(B) is no longer required because Article 700 no longer applies to the Critical Branch. Therefore, switching of task illumination is permitted.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-69 Log #1143 NEC-P15 **Final Action: Reject**
(517.34(C))

Submitter: Stephen McCluer, Schneider Electric
Comment on Proposal No: 15-76
Recommendation: Add new text to read as follows:
Delete all text revisions from proposal 15-76 that were in paragraph 517.34 and put the following text in a new 517.33(C)
517.33 Critical Branch
(A) (no change)
(B) (no change)
<u>**(C) 517.33(C) Bridging system.** A bridging system shall be provided where uninterrupted power is necessary for patient care on the critical power branch per 517.33(A).</u>
<u>*Informational Note 1: A bridging system is intended to temporarily support the critical load with stored energy until an alternate energy source can assume the load. Uninterrupted power for the ride-through tolerance of the power supplies used in most electronic equipment is less than two cycles. Reboot of critical equipment can take minutes or even hours to recover. Equipment with built-in reserve power, such as battery backup, would satisfy this requirement.*</u>
<u>*Informational Note 2: NFPA 111-2010, Standard on Stored Electrical Energy Emergency and Standby Power Systems, defines “bridging system”, provides guidance for use of bridging systems, and provides figures for placement of a bridging system in an emergency power system architecture when energy storage is not already built into the critical equipment.*</u>
Substantiation: This comment would have the effect of “accept Proposal15-76 in principle”; it relocates the concept from under 517.34(C) (Equipment System Connection to Alternate Power Source / AC Equipment for Nondelayed Automatic Connection) to a new subparagraph (C) under 517.33 for “critical branches.”
The Panel rejected the original proposal on the basis that energy storage is always an option and can generally be provided as onboard backup systems by the critical load equipment manufacturers. While “generally” this is true, it is not mandatory. Proposal 15-76 and this comment would make it mandatory for equipment that is defined as “critical”. Such equipment is enumerated in 517.33(A), which states,
“The critical branch of an emergency system shall supply power for... fixed equipment... and special power circuits serving the following <nine> areas and functions related to patient care.”
The types of circuits and equipment that could be designated as “critical” to patient care are identified by reference to 517.33(A), so Informational Note #2 in the original proposal 15-76 is no longer needed.
New Informational Note #1 is added to briefly explain the function of a “bridging system.” It also points out that the stored energy in most equipment power supplies is only sufficient for a few milliseconds of interruption; restarting of equipment following an interruption can take time measured in minutes or hours compared to the 8 seconds it takes for a generator to start. The informational note addresses the panel’s observation that some equipment might have built-in backup. When that is provided it would meet the intent of this section.
New Informational Note #2 is added to address those applications where onboard power backup is not available. Informational Note #2 is mostly carried over from the original proposal. It points the reader to NFPA 111 where the necessity for stored electrical energy in emergency systems is delineated and where solutions external to the critical care equipment can be provided.
With the increasing use of electronics and electronic controls found connected to patient care areas, and in particular on the critical branch, a 10 second interruption can be completely unacceptable for patient care. Technology exists to “bridge” the concern on this momentary power loss risk by requiring the system to be evaluated and a “bridge” provided where it is deemed necessary to mitigate such risk.
Panel Meeting Action: Reject
Panel Statement: The NEC does not currently prohibit these installations. The equipment found in these areas generally have onboard power backup systems, rendering the recommendation in this proposal redundant.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-70 Log #369 NEC-P15 **Final Action: Accept**
(517.41(E))

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 15-80
Recommendation: NEMA supports CMP15’s Panel Action to Accept Proposal 15-80 adding the proposed new text.
Substantiation: Electrical contractors involved in hospital renovations have reported to NEMA members that prior maintenance replacements of cover plates and receptacles on circuits intended for <u>non</u>essential electrical loads have used red cover plates or receptacles, the “distinctive color” intended in those health care facilities for essential electrical system circuits.
Under the very conditions that warrant the existence of essential electrical systems, however, there is no definitive confirmation as to which receptacles are in fact successfully being supplied power. An illuminated outlet face or a lighted indicator on the receptacle outlet inherently provides the most apparent visual indication and requires no training of visiting medical personnel working under those conditions activating the essential electrical system as to what is “readily identifiable”, particularly where the cited inconsistent maintenance replacements have occurred.
Furthermore, as expressed in Mr. Friedman’s affirmative ballot comment on Proposal 15-80, the Panel Actions for Proposals 15-35, 15-36, and 15-39 increase the minimum numbers of receptacle outlets required. Rapid visual confirmation of which receptacle outlets are still energized when normal electrical service is interrupted may be essential to avoid incorrect connection into unpowered receptacle outlets of portable cord-and-plug-connected medical equipment and instrumentation during emergency conditions.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 11 Negative: 3
Explanation of Negative:
DUNCAN, J.: The Panel should have rejected this proposal and referred the submitter to NFPA 99 as this is a performance issue.
ERICKSON, D.: With the reliability, frequent testing, and regulatory oversight of
emergency systems in healthcare facilities there is no need to require an indicator light on every receptacle. Alarms or battery backup or both are provided to indicate / accommodate a loss of power on vital life support equipment. There was no technical data provided to indicate that there is a widespread problem with poor patient outcomes that could have been averted with the presence of an indicator light. This change would not improve current conditions. If anything, this change could add additional risk to the patient. If

the indicator light is faulty, staff may unnecessarily disconnect vital equipment from the emergency system and connect it to non-emergency system receptacles, posing additional risks.

NASH, JR., H.: With the reliability, frequent testing, and regulatory oversight of emergency systems in healthcare facilities there is no need to require an indicator light on every receptacle. Alarms or battery backup or both ar provided to indicate / accommodate a loss of power on vital life support equipment. There was substantiation provided to indicate that there is a problem with poor patient outcomes that could have been averted with the presence of an indicator light. This change would not reduce risk and would cause hospital to incur unnecessary cost. Additionally, this is performance issue which should be addressed by NFPA 99.

Comment on Affirmative:

KRUPA, G.: I agree with vote. As an editorial comment, the word “nonessential” in the second line of the substantiation probably should read “essential.”

SAMPSON, M.: The panel is right to insist on an indicator that permits staff to readily identify powered receptacles and insure that equipment and instrumentation continue to operate during a power interruption.

15-71 Log #1260 NEC-P15 **Final Action: Reject**
(517.71)

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 15-90
Recommendation: I ask the panel to reject this proposal. The proposal would change 600 volts to 1000 volts.
Substantiation: Replacing 600 volts with 1000 volts will have a major impact on installers, component manufacturers, and industry standards. Increased spacing must be considered when going from 600 volts to 1000 volts. Personal safety must also be considered.
Because the proposer has not provided enough information to the public to justify and understand all the ramifications of the proposal, the committee should reject the submitter’s proposal.
Panel Meeting Action: Reject
Panel Statement: Proposal 15-90 does not require or prohibit equipment rated over 600V. Electrical system including alternate energy systems use voltages over 600V and can reach up to 1000V. Equipment must first be evaluated and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

15-72 Log #757 NEC-P15 **Final Action: Accept**
(517.71(C))

TCC Action: The Correlating Committee directs that the unnumbered text following Article 517, Part V, be identified as “517.70” with the title “Applicability.” This is an editorial correction only.
Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 15-90
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity.
The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

ARTICLE 520 — THEATRES, AUDIENCE AREAS OF MOTION PICTURE AND TELEVISION STUDIOS, PERFORMANCE AREAS AND SIMILAR LOCATIONS

15-73 Log #1195 NEC-P15 **Final Action: Reject**
(520.2 (New))

Submitter: Daniel J. Culhane, SECOA
Comment on Proposal No: 15-99
Recommendation: Revise text to read as follows:

Stage Lighting “Packaged” Hoist. A serially manufactured motorized lifting device that contains a moveable mounting position for one or more Iumninaires, a connector strip with wiring devices for connection of Iumninaires to branch circuits, and integral flexible cables to allow the luminaires and connector strip to travel over the lifting range of the hoist while energized~~.~~
Substantiation: Mr. Terry proposed a new class of “packaged” hoists. Add the words “packaged” and “serially manufactured” to the definition to differentiate this new class of “packaged” hoist from the majority of single purpose built hoist for one location type of hoist that is prevalent in the market place.
Panel Meeting Action: Reject
Panel Statement: This section is a definition of a stage lighting hoist and may not include requirements such as “packaged” or “serially manufactured”. The definition is the same whether or not the hoist is “packaged” or “serially manufactured”.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 18

15-74 Log #1193 NEC-P15 **Final Action: Reject**
(520.2.Switchboard, Stage Lighting (New))

Submitter: Daniel J. Culhane, SECOA
Comment on Proposal No: 15-98
Recommendation: Revise text to read as follows:

Stage lighting and audio equipment. Equipment at any location on the premises integral to the stage production, including but not limited to equipment for lighting, audio, ~~special effects, rigging, motion control,~~ projection or video.

Stage Lighting Switchboard. A switchboard, panelboard, or rack containing dimmers or relays with associated overcurrent protective devices, or overcurrent
protective devices alone, used primarily. to feed stage lighting equipment.
Substantiation: While stage lighting is evolving with the inclusion of circuit breakers and relay cabinets, Section 520 does not have enough safety features in place to replace NFPA 79 and UL 508A for controlling hoists that are holding and moving thousands of pounds of scenery and lighting equipment above people’s heads. I do not see within this section the safety related requirements outlined in both NFPA 70 and UL 508A. Until appropriate safety measures are in place for hoist control it is best to leave NFP A 79 and UL 508A as the standard for machine control design. Delete all references to “special effects”, “rigging”, and “motion control” out of this section of the code and add “lighting” and “audio” to the definition to clarify what is being referenced.

Panel Meeting Action: Reject
Panel Statement: Stage switchboards are no longer limited to feeding only lighting and audio equipment. They feed a wide variety of stage equipment as outlined in the original Proposal 15-98. The submitter suggests that lack of specific safety requirements in Article 520 for switchboards feeding different types of devices provides a reason for eliminating those types of devices from the definition of stage equipment, and limiting the definition of a stage equipment switchboard to cover only audio and lighting. Since the NEC is an installation code, specific requirements for various types of switchboards and control equipment do not belong in article 520. Rather, they are contained in applicable product standards, two of which are mentioned by the submitter. Inclusion of all stage equipment in the proposed definitions does not obviate the need for application of appropriate product safety standards.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 18

15-75 Log #1194 NEC-P15 **Final Action: Reject**
(520.40 (New))

Submitter: Daniel J. Culhane, SECOA
Comment on Proposal No: 15-111
Recommendation: Delete text as follows:
~~**520.40 Stage Lighting Hoists.** Stage lighting hoists shall be listed. Where a listed state lighting hoist contains an integral cable handling system and cable to connect a moving connector strip wiring device to a fixed junction box for connection to permanent wiring, the extra hard usage requirement of section 520.44(C)(1) shall not apply.~~
Substantiation: The substantiation for acceptance of this language is based upon a new class of devices listed as "packaged" stage lighting hoist but the proposed language will apply not only to the "packaged" stage lighting hoists but to all stage lighting hoists. Most stage lighting hoists manufactured today are a custom hoist design manufactured to meet a specific situation and location. They are not serially produced as the "packaged" stage lighting hoists are manufactured. Hoist controls are already listed under NFPA 79 and UL508A. As written, the definition of a stage lighting hoist is so broad as to include a regular stage hoist that happens to have a wired junction box attached to it. Adopting this language would inadvertently include all stage hoists as well as the single one-off designs that dominate the marketplace. Delete the proposed language.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 15-77.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 18

15-76 Log #1196 NEC-P15 **Final Action: Reject**
(520.40 (New))

Submitter: Daniel J. Culhane, SECOA
Comment on Proposal No: 15-111
Recommendation: Delete text as follows:
~~**520.40 Stage Lighting Hoists.** Stage lighting hoists shall be listed. Where a listed stage lighting hoist contains an integral cable handling system and cable to connect a moving connector strip wiring device to a fixed junction box for connection to permanent wiring, the extra hard usage requirement of section 520.44(C)(1) shall not apply.~~
Substantiation: The premise for acceptance for this section is flawed. The substantiation for acceptance of this language is based upon a new class of devices listed as "packaged" stage lighting hoist but the proposed language will apply not only to the "packaged" stage lighting hoists but to all stage lighting hoists. Most stage lighting hoists manufactured today are a custom hoist design manufactured to meet a specific situation and location. They are not serially produced as the ''packaged'' stage lighting hoists are manufactured. Imposing a set of listing restrictions upon a single pwpose built hoist would be very cost prohibitive to the end user in a market place dominated by custom designed hoists for specific situations. Hoist controls are already listed under NFP A 79 and UL508A. The definition of a stage lighting hoist is so broad as to include a regular stage hoist that has an electrical cable attached to it Adopting this language would inadvertently include all stage hoists as well as the single one-off designs that dominate the marketplace. Delete the proposed language.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 15-77.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 18

15-77 Log #1197 NEC-P15 **Final Action: Accept in Principle**
(520.40 (New))

Submitter: Daniel J. Culhane, SECOA
Comment on Proposal No: 15-111
Recommendation: Revise text to read as follows:
520.40 Stage Lighting Serially Manufactured "Packaged" Hoists. Stage lighting "packaged" hoists that are serially manufactured shall be listed. Where a listed serially manufactured "packaged" stage lighting hoist contains an integral cable handling system and cable to connect a moving connector strip wiring device to a fixed junction box for connection to permanent wiring, the extra-hard-usage requirement of section 520.44(C)(1) shall not apply.
Substantiation: Mr. Terry proposed that "packaged" hoists be listed. 'Packaged" lighting hoists are serially manufactured which differentiates them from the majority of lighting hoists that are single purpose built for one location. The addition of the words "packaged" and "serially manufactured" aligns with the commenter's reason for submitting his comment and draws a distinction between "Packaged" hoists and the majority of single purpose built for one location hoists prevalent in the market place.
Panel Meeting Action: Accept in Principle
Revise text as follows:
520.40 Stage Lighting Hoists. ~~Stage lighting hoists shall be listed.~~ Where a ~~listed~~ stage lighting hoist is listed as a complete assembly and contains an integral cable handling system and cable to connect a moving wiring device to a fixed junction box for connection to permanent wiring, the extra-hard-usage requirement of section 520.44(C)(1) shall not apply.
Panel Statement: Some stage lighting hoists are assembled in the field from listed components. The revised wording accomplishes the intent of the submitter, while maintaining the removal of the extra hard usage cable requirement for hoists listed as a complete assembly.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 18

15-78 Log #212 NEC-P15 **Final Action: Accept**
(520.53(K)(3)c.)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 15-116
Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action taken on Proposal 1-114.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Accept Proposal 15-116, thereby adding a new last sentence after 520.53(K)(3)c as follows:
The warning sign(s) or label(s) shall comply with 110.21(B).
Number Eligible to Vote: 18
Ballot Results: Affirmative: 18

ARTICLE 522 — CONTROL SYSTEMS FOR PERMANENT AMUSEMENT ATTRACTIONS

15-79 Log #1582 NEC-P15 **Final Action: Accept**
(522.2.Control Unit)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 11-5
Recommendation: Delete text as follows:
522.2 Definitions.
~~**Control Circuit.** For the purposes of this article, the circuit of a control system that carries the electrical signals directing the performance of the controller but does not carry the main power current.~~
Substantiation: Article 100 Definitions now contains essentially the same text for Control Circuit.
Panel Meeting Action: Accept
Panel Statement: This action is contingent upon final acceptance of the definition of "control circuit" being included in Article 100 by CMP 11.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

ARTICLE 525 — CARNIVALS, CIRCUSES, FAIRS, AND SIMILAR EVENTS

15-80 Log #1218 NEC-P15 **Final Action: Accept**
(525.23)

Submitter: Sheldon Monson, Wadena, MN
Comment on Proposal No: 5-122
Recommendation: The panel should reject this proposal.
Substantiation: The panel should reject this proposal for several reasons. First the submitter has not provided any evidence that open-neutral issues exist at carnival, festival and fair sites. Next, he alleges that "there is a comparable restriction" for temporary wiring at construction sites, which is not true (Section 590.6(A)(2) permits, but does not require GFCI listed for portable use. Third, at a carnival, festival or fair setting all the receptacles except those connected to permanent distribution are - at some point - supplied by cord-and-plug to the branch circuit. So, it appears to require all portable receptacles to have GFCI listed for portable use. And lastly, a code section requiring the use of portable cordsets is unenforceable as these rather expensive units will no doubt move around the fesitval grounds ahead of the inspector and then disappear when he does.
While the intent to provide a higher level of protection is understandable,

there is no substantiation, there is no precedent, the rule has larger than intended conseq1uences and is unenforceable.

Panel Meeting Action: Accept

Panel Statement: This is actually a comment on Proposal 15-122. This action rejects Proposal 15-122.

Number Eligible to Vote: 19

Ballot Results: Affirmative: 17 Negative: 2

Explanation of Negative:

ROCK, B.: NEMA supports the ballot comments expressed by Mr. Talka of UL. Portable GFCIs provide open neutral detection to assure delivery of ground-fault circuit-interrupter protection for personnel. In relation to GFCIs "identified for portable use", "portable" does not relate to the GFCI itself but rather to the nature of the supply connections powering the GFCI function. Where such supply connections are relocatable, the integrity of neutral connection essential for GFCI functionality has a higher risk of being diminished than those where the supply connections are permanent.

TALKA, D.: Open neutral protection is an important GFCI feature, especially in applications dealing with abuse and wear. Sam Sampson, in his IAEI Article entitled "Electrical Inspections for Carnivals, Fairs and Traveling Shows", points out that plug and socket connections in those venues are subject to damage and wear. Quoting from this article, "Cords are often damaged by exposure to oils, gasoline, direct sunlight, foot and vehicular traffic arriving on site worse for the wear. Distribution boxes and cords are unloaded at each stop in various stages of disrepair." The article goes on to state,"With the safety of the carnival workers and the public at stake, it is important to check the entire distribution system for properly sized over-current devices, grounding and bonding continuity and GFCI functionality." Portable GFCIs with open neutral protection provides the protection needed to deal with worn cord and plug connections.

Comment on Affirmative:

SAMPSON, M.: I urge the panel to continue to reject the original proposal by accepting this comment.

The submitter failed to provide any evidence that the existing GFCI requirements at carnivals, festivals and other outdoor events have a need for this level of protection. The fact that GFCI products "listed for portable use" come in styles designed for easy transport and are intended for temporary use makes this requirement impossible to enforce. "Regular" GFCI devices have been saving lives for over 20-years. If there was reason to believe that GFCI devices with the "no-load" release feature (found only in "GFCI listed for portable use" products) was necessary for these venues, then it stands to reason that all GFCI devices -in all locations - need to have this feature, as well. But, since there is no substantiation for this change, the proposal appears to be an attempt to mandate the use of a solution that has no problem.

15-81 Log #1026 NEC-P15 **Final Action: Hold**
(525.32)

Submitter: Mike Holt, Mike Holt Enterprises

Comment on Proposal No: 15-126

Recommendation: Accept the proposal in principle with the following changes:

525.32 Equipment Grounding Conductor Continuity Assurance. The continuity of the equipment grounding conductor<u>s</u> ~~system used to reduce electrical shock hazards as required by 250.114, 250.138, 406.4(C), and 590.4(D)~~ shall be verified each time that portable electrical equipment is connected.

Substantiation: The Code references stated do not add any value to this section. Referring to the Code sections that required the EGC doesn't change the fact (or help me understand) that I have to verify its continuity.

Panel Meeting Action: Hold

Panel Statement: The removal of these references was not introduced by the original proposal or panel action.

Number Eligible to Vote: 19

Ballot Results: Affirmative: 19

ARTICLE 530 — MOTION PICTURE AND TELEVISION STUDIOS AND SIMILAR LOCATIONS

15-82 Log #213 NEC-P15 **Final Action: Accept**
(530.22(A)(3)c.)

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 15-128

Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action taken on Proposal 1-114.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Accept Proposal 15-128, thereby adding a new last sentence after 530.22(A)(3) c as follows:

<u>The warning sign(s) or label(s) shall comply with 110.21(B).</u>

Number Eligible to Vote: 18

Ballot Results: Affirmative: 18

15-83 Log #758 NEC-P15 **Final Action: Accept**
(530.61)

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 15-129

Recommendation: Continue to Accept.

Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity.

The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept

Number Eligible to Vote: 18

Ballot Results: Affirmative: 18

ARTICLE 545 — MANUFACTURED BUILDINGS

19-3 Log #926 NEC-P19 **Final Action: Reject**
(545.5)

Submitter: James F. Williams, Fairmont, WV

Comment on Proposal No: 19-9

Recommendation: Revise text to read as follows:

545.5 Supply Conductors. Provisions shall be made to route the service-entrance, underground service conductors, service-lateral, feeder, or branch-circuit supply to the service or building disconnecting means ~~conductors~~.

Substantiation: As written the text makes no sense. Deleting the last word helps.

Panel Meeting Action: Reject

Panel Statement: Removal of the word "conductors" introduces a deletion of text that is unrelated to the original proposal. CMP-19 has determined that accepting this comment might alter the intent of the original text.

Number Eligible to Vote: 11

Ballot Results: Affirmative: 11

ARTICLE 547 — AGRICULTURAL BUILDINGS

19-4 Log #1444 NEC-P19 **Final Action: Reject**
(547.2)

Submitter: Donald W. Zipse, Electrical Forensics, LLC
Comment on Proposal No: 19-11
Recommendation: Delete text.
Substantiation: Please see 547.10 for comments.
Panel Meeting Action: Reject
Panel Statement: See panel statement on Comment 19-10.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9 Negative: 1
Explanation of Negative:
ZIPSE, D.: See my statement on Comment 19-5.

19-5 Log #1357 NEC-P19 **Final Action: Accept in Principle**
(547.2.Equipotential Planes)

Submitter: Barry S. Bauman, Alliante Energy / Rep. American Society of Agricultural and Biological Engineers
Comment on Proposal No: 19-11a
Recommendation: Revise text to read as follows:
Equipotential Plane. An area where wire mesh or other conductive elements are embedded in or placed under concrete, bonded to all metal structures and fixed nonelectrical equipment that may become energized, and connected to the electrical grounding system to minimize voltage potentials within the plane and between the plane and grounded electrical equipment.
Substantiation: At the CMP 19 ROP meeting it was understood that this definition needed rewording for clarity at the ROC meeting. The proposed wording provides this clarification.
Panel Meeting Action: Accept in Principle
Revise text to read as follows:
Equipotential Plane. An area where wire mesh or other conductive elements are embedded in or placed under concrete, bonded to all metal structures and fixed nonelectrical equipment that may become energized, and connected to the electrical grounding system to minimize voltage potentials within the plane and between the plane, grounded equipment, and the earth.
Panel Statement: CMP-19 has revised the suggested language to more clearly describe the concept of an equipotential plane.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9 Negative: 1
Explanation of Negative:
ZIPSE, D.: "An area where wire mesh or other conductive elements are embedded in or placed under concrete, bonded to all metal structures and fixed nonelectrical equipment that may become energized, and connected to the electrical grounding system to minimize voltage potentials within the plane and between the plane, grounded equipment, and the earth."
The change from, "to prevent a difference in voltage from developing within the plane" to "minimize voltage potentials within the plane and between the plane, grounded equipment, and the earth" ignores the fact that the equipotential plane is connected to the equipment grounding conductor, which is connected to the neutral at the service entrance equipment, which in turn is connected to the utility companies transformer, where the primary neutral is connected to the secondary neutral.
The panel is oblivious to the fact that the neutral is an energized conductor that carries current. It is current and not voltage that is the electrical parameter that harms dairy cows.
It is evident the panel is conceding that equipotential planes do not prevent but only minimize. The panel needs to recognize and take the next step to delete this erroneous, unscientific requirement.

19-6 Log #1230 NEC-P19 **Final Action: Reject**
(547.5(A))

Submitter: Christel K. Hunter, Alcan Cable, a General Cable Company
Comment on Proposal No: 19-14
Recommendation: Revise text to read as follows:
547.5 Wiring Methods.
(A) Wiring Systems. Types UF, NMC, ~~copper~~ SE cables, jacketed Type MC cable, rigid nonmetallic conduit, liquidtight flexible nonmetallic conduit, or other cables or raceways suitable for the location, with approved termination fittings, shall be the wiring methods employed.
Substantiation: The submitter's proposal should have been accepted. The panel's statement that "Aluminum wire is more susceptible to corrosion in agricultural environments." is incorrect. In order to provide technical substantiation for the proposed change, several resources were consulted. As stated in the negative responses by NEMA and the Aluminum Association, common corrosive gases found in agricultural applications are methane, ammonia, carbon dioxide and hydrogen sulfide.
Let's analyze each of these gases in turn in relation to their corrosive effect on copper and aluminum:
Methane (natural gas): Copper has good corrosion resistance, but may be more severely affected if there are contaminants like water, sulfides, acids and various organic compounds, which can increase corrosion significantly. Methane has no corrosive effect on aluminum.
Ammonia: In absolutely dry ammonia environments, copper has excellent corrosion resistance. However, in moist ammonia environments, copper has poor resistance to corrosion. Aluminum has excellent corrosion resistance in ammonia environments, with no effect in a 10% ammonia environment up to 120 degrees F.
Carbon dioxide: In dry environments, copper has excellent resistance to corrosion by carbon dioxide. However, in moist environments, it only has good resistance. In both dry and moist environments, carbon dioxide may have a mild corrosive effect on aluminum.
Hydrogen sulfide: In dry environments, copper has excellent resistance to corrosion by hydrogen sulfide. However, in moist environments, it has poor resistance.
Aluminum in a moist, hydrogen sulfide environment will experience mild attack from the gas.
Nitrogen dioxide: Although this was not mentioned originally, it is a common agricultural gas. Copper is not recommended for use due to the corrosive effects of the nitrogen dioxide gas. Aluminum is satisfactory, but can experience corrosion in the presence of moisture.
Bleach: Although this was not mentioned originally, bleach is a common cleaning material. While concentrated chlorine water can have a corrosive effect on submerged aluminum, at the concentrations used for bleach, it has no effect on aluminum. Bleach is corrosive to copper.
As this comparison shows, aluminum is arguably a far better metal to use for electrical connections when installed in the often harsh agricultural environments. In fact, many connectors are made of aluminum, and are only corroded by contact with the copper conductors used for wiring when used in a damp environment. This type of galvanic corrosion could be avoided by using both aluminum conductors and connectors, resulting in a more stable electrical system.
Resources:
http://www.copper.org/resources/properties/microstructure/coppers.html
Guidelines for the use of Aluminum with Food and Chemicals, published April 1994.
Corrosionsource.com,
http://encyclopedia.airliquide.com/Encyclopedia.asp?GasID=25
Panel Meeting Action: Reject
Panel Statement: Several panel members have observed rapid deterioration of aluminum grounding conductors in type SE cable where contaminants have entered under the cable jacket. The gases weren't the only consideration in the original requirement for copper. The contaminants present in livestock confinement areas are numerous and varied and are most detrimental when residue builds on the bare aluminum conductor. The substantiation addresses bare conductors only and there is not compelling substantiation for aluminum Type SE cable.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 8 Negative: 2
Explanation of Negative:
EDWARDS, T.: Several panel members expressed concern about Type SE cable construction in agricultural environments because of the bare ground under the outer jacket. Excluding aluminum will not resolve the issues observed with this construction.
MCNEIVE, T.: Sufficient evidence was submitted to the Panel to prove that aluminum SE cable is equal to or better than copper SE cable in agricultural installations.
Comment on Affirmative:
BAUMAN, B.: Other reasons that were identified at the ROC for rejecting this comment are: there has been no documentation presented on aluminum subjected to the various mixtures of contaminants found in agricultural environments, because the wrapped ground wire is not individually covered corrosion inhibitor can not be effective applied and when the outer jacket is scored for removal the aluminium is typically nicked enhancing a location for deterioration.
MICHAELIS, R.: There are two main reasons why aluminum conductors fail, these being improper installations and coefficient of expansion. Improper installation can cause aluminum oxidation which is not a conductor. The studies presented did not take into account actual field conditions or the chemicals in compound forms. The problem with aluminum wiring does not lie in the wiring itself, it lies in the connection. When aluminum heats up it expands more than copper and when it cools down it contracts more than copper. Over time this can cause a loose connection. Additionally, it is harder to make a tight connection with aluminum wire in the first place because aluminum wire has to be a thicker gauge wire than copper to carry the same electrical current. All metals also oxidize over time but there is a primary difference in how copper oxidizes compared to aluminum. When copper oxidizes it forms a conductor which creates no threat. When aluminum oxidizes it develops as a resistor which causes a major threat. Resistance causes heat which could lead heating up and possibly catching on fire or the insulation melting around the wire causing additional fire risk. The common use of razor knifes to strip the outer jacket nicks the thin strands of the conductors and causes future fatigue.

19-7 Log #1231 NEC-P19 **Final Action: Reject**
(547.5(C)(3), Informational Note 2)

Submitter: Christel K. Hunter, Alcan Cable, a General Cable Company
Comment on Proposal No: 19-16
Recommendation: Revise text to read as follows:
Informational Note No. 2: ~~Aluminum and m~~Magnetic ferrous materials may corrode in agricultural environments.
Substantiation: The submitter's proposal should have been accepted. In order to provide technical substantiation for the proposed change, several resources were consulted. As stated in the negative responses by NEMA and the Aluminum Association to Proposal 19-14, common corrosive gases found in agricultural applications are methane, ammonia, carbon dioxide and hydrogen sulfide. Let's analyze each of these gases in turn in relation to their corrosive effect on aluminum:
Methane (natural gas): Methane has no corrosive effect on aluminum.
Ammonia: Aluminum has excellent corrosion resistance in ammonia environments, with no effect in a 10% ammonia environment up to 120 degrees F.
Carbon dioxide: In both dry and moist environments, carbon dioxide may have a mild corrosive effect on aluminum.
Hydrogen sulfide: Aluminum in a moist, hydrogen sulfide environment will experience mild attack from the gas.
Nitrogen dioxide: Although this was not mentioned originally, it is a common agricultural gas. Aluminum is satisfactory, but can experience corrosion in the presence of moisture.
Bleach: Bleach is a common cleaning material. While concentrated chlorine water can have a corrosive effect on submerged aluminum, at the concentrations used for bleach, it has no effect on aluminum.
Aluminum is an excellent metal to use for electrical applications when installed in the often harsh agricultural environments. While aluminum (like all metals) may corrode in agricultural applications, it is no more likely and often less likely to corrode than other metals used in the same way.
Resources:
Guidelines for the use of Aluminum with Food and Chemicals, published April 1994.
Corrosionsource.com
http://encyclopedia.airliquide.com/Encyclopedia.asp?GasID=25
Panel Meeting Action: Reject
Panel Statement: The informational note in question is an accurate statement.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9 Negative: 1
Explanation of Negative:
EDWARDS, T.: The Informational Note provides misleading and biased information in that it singles out aluminum as the only non-ferrous metal that may corrode in agricultural environments whereas copper is also non-ferrous and is known to corrode in some agricultural environments.
Comment on Affirmative:
BAUMAN, B.: A reason that was identified at the ROC for rejecting this comment is: there has been no documentation presented on aluminum subjected to the various mixtures of contaminants found in agricultural environments.

19-8 Log #1232 NEC-P19 **Final Action: Accept**
(547.5(F))

Submitter: Christel K. Hunter, Alcan Cable, a General Cable Company
Comment on Proposal No: 19-20
Recommendation: Revise text to read as follows:
547.5 Wiring Methods.
(F) Separate Equipment Grounding Conductor. ~~Where an equipment grounding conductor is installed within a location falling under the scope of Article 547, it shall be a copper conductor.~~ Where an equipment grounding conductor is installed underground <u>within a location falling under the scope of Article 547,</u> it shall be insulated or covered ~~copper~~.
Substantiation: The submitter's proposal should have been accepted. In order to provide technical substantiation for the proposed change, several resources were consulted. As stated in the negative responses by NEMA and the Aluminum Association to Proposal 19-20, all metals corrode, but aluminum is highly corrosion resistant. This is true in agricultural applications as well. Common corrosive gases found in agricultural applications are methane, ammonia, carbon dioxide and hydrogen sulfide. Let's analyze each of these gases in turn in
relation to their corrosive effect on copper and aluminum:
Methane (natural gas): Copper has good corrosion resistance, but may be more severely affected if there are contaminants like water, sulfides, acids and various organic compounds, which can increase corrosion significantly. Methane has no corrosive effect on aluminum.
Ammonia: In absolutely dry ammonia environments, copper has excellent corrosion resistance. However, in moist ammonia environments, copper has poor resistance to corrosion. Aluminum has excellent corrosion resistance in ammonia environments, with no effect in a 10% ammonia environment up to 120 degrees F.
Carbon dioxide: In dry environments, copper has excellent resistance to corrosion by carbon dioxide. However, in moist environments, it only has good resistance. In both dry and moist environments, carbon dioxide may have a mild corrosive effect on aluminum.
Hydrogen sulfide: In dry environments, copper has excellent resistance to corrosion by hydrogen sulfide. However, in moist environments, it has poor resistance.
Aluminum in a moist, hydrogen sulfide environment will experience mild attack from the gas.
Nitrogen dioxide: Although this was not mentioned originally, it is a common agricultural gas. Copper is not recommended for use due to the corrosive effects of the nitrogen dioxide gas. Aluminum is satisfactory, but can experience corrosion in the presence of moisture.
Bleach: Although this was not mentioned originally, bleach is a common cleaning material. While concentrated chlorine water can have a corrosive effect on submerged aluminum, at the concentrations used for bleach, it has no effect on aluminum. Bleach is corrosive to copper.
As this comparison shows, aluminum is arguably a far better metal to use for electrical applications when installed in the often harsh agricultural environments. While aluminum may corrode in agricultural applications, it is no more likely and often less likely to corrode than other metals used in the same way.
Resources:
http://www.copper.org/resources/properties/microstructure/coppers.html, last accessed 10/14/12.
Guidelines for the use of Aluminum with Food and Chemicals, published April 1994. Corrosionsource.com
Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 8 Negative: 2
Explanation of Negative:
CHILTON, R.: The study brought to the Panel was based mainly on gases and not solid contaminates which affect stranded conductors differently than solid conductors. There were no indications that these should be considered separately, nor were actual solid contaminates based on site conditions addressed.
MICHAELIS, R.: There are two main reasons why aluminum conductors fail, these being improper installations and coefficient of expanThere are two main reasons why aluminum conductors fail, these being improper installations and coefficient of expansion. Improper installation can cause aluminum oxidation which is not a conductor. The studies presented did not take into account actual field conditions or the chemicals in compound forms. The problem with aluminum wiring does not lie in the wiring itself, it lies in the connection. When aluminum heats up it expands more than copper and when it cools down it contracts more than copper. Over time this can cause a loose connection. Additionally, it is harder to make a tight connection with aluminum wire in the first place because aluminum wire has to be a thicker gauge wire than copper to carry the same electrical current. All metals also oxidize over time but there is a primary difference in how copper oxidizes compared to aluminum. When copper oxidizes it forms a conductor which creates no threat. When aluminum oxidizes it develops as a resistor which causes a major threat. Resistance causes heat which could lead heating up and possibly catching on fire or the insulation melting around the wire causing additional fire risk.sion. Improper installation can cause aluminum oxidation which is not a conductor. The studies presented did not take into account actual field conditions or the chemicals in compound formats. The problem with aluminum wiring does not lie in the wiring itself, it lies in the connection. When aluminum heats up it expands more than copper and when it cools down it contracts more than copper. Over time this can cause a loose connection. Additionally, it is harder to make a tight connection with aluminum wire in the first place because aluminum wire has to be a thicker gauge wire than copper to carry the same electrical current. All metals also oxidize over time but there is a primary difference in how copper oxidizes compared to aluminum. When copper oxidizes it forms a conductor which creates no threat. When aluminum oxidizes it develops as a resistor which causes a major threat. Resistance causes heat which could lead heating up and possibly catching on fire or the insulation melting around the wire causing additional fire risk.

19-9 Log #928 NEC-P19 **Final Action: Hold**
(547.9)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 19-21
Recommendation: Revise text to read as follows:
547.9(A)
(5) Grounding. At the site-isolating device, the system grounded conductor shall be connected to a grounding electrode system via a grounding electrode conductor. <u>The equipment grounding conductor is connected to the grounded circuit conductor and the site-isolating device enclosure at the distribution point.</u>
547.9(B)(3)
(2) The equipment grounding conductor is connected to the grounded circuit conductor ~~and the site-isolating device enclosure at the distribution point~~<u>at the disconnecting means</u>.

Substantiation: 1) 547.9 Electrical Supply to Building(s) or Structure(s) from a Distributing Point. It does not reference a site-isolating device.
2) 547.9(A) references a site-isolating device. It is required to be pole-mounted.
3) 547.9(A) (4) and (5) discuss Bonding and Grounding.
4) 547.9(B) does not reference a site-isolating device. It references disconnects at buildings or structures. Although a pole might be considered a structure, I believe (A) and (B) are designed to separate pole-mounted from non-pole-mounted.
5) Now in 547.9(B)(3) (1) and (2) we are talking about Grounding and Bonding.
6) in 547.9(B)(3)(2) we are back to talking about site-isolating device, even though it appears we don't have one in (B).
It appears to me that 547.9(B)(3)(2) properly belongs in 547.9(A)(5)
It appears to me that most of 547.9(B)(3)(2) should be retained.
Panel Meeting Action: Hold
Panel Statement: This amendment is new material that has not had public review.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

19-10 Log #1445 NEC-P19 **Final Action: Reject**
(547.10)

Submitter: Donald W. Zipse, Electrical Forensics, LLC
Comment on Proposal No: 19-25
Recommendation: Please delete Section 547.10 in its entirety.
Substantiation: Please delete Section 547.10 in its entirety for the following reasons:

The testing justifying the selection of the grid spacing was based on voltage alone. Voltage is only the pressure that pushes the current. Voltage does not burn the body. It is the current that burns the body, sets the heart into fibrillation, halting the pumping action of the heart, resulting in death of both.

It is clear that it is the current that causes a reaction in animals, which include both humans and dairy cows, not the voltage.

Professor Dalziel in 1946 states, "Perhaps the most serious misconception concerns the effect of voltage versus the effects of current. Current and not voltage is the proper criterion of shock intensity."

There is no difference between the fundamentals in low voltage and high voltage as Ohms Law, Kirchhoff's Laws, etc. apply equally to each.

Measurement of voltage alone without measuring resistance invalidates the tests to determine harm to animals, which includes humans and dairy cows. See attached peer reviewed technical paper, "THE MISUSE OF VOLTAGE AS A PARAMETER OF CONCERN FOR ELECTRICAL HAZARD".

The fallacy of the tests conducted on the spacing of the so called equipotential plane was the measurement of voltage when voltage alone does harm. Ohms Law states that current equals resistance divided by voltage and since it is current that harms the measurement of voltage alone without resistance invalidates the testing.

In 1985, the proposers of 547.10 lacked sufficient knowledge of the Institute of Electrical and Electronic Engineers' (IEEE) Standard 80, IEEE Guide for Safety in AC Substation Grounding. They based their proposals on substation protection for step and touch potentials from fault current. It is opined that they failed to understand the difference between hundreds of amperes flowing for only a very short time, until the protective device opens stopping the flow of fault current in a substation and the condition existing with stray current in dairies where the current is very low and flows continuously.

An equipotential plane 1) prevented the cows from entering the milking parlor because the cows received an electric shock when stepping onto the equipotential plane, 2) reduced the milk production because the dairy cows were getting an electric shock when being milked while standing on an equipotential plane and/or bumped into the stations, 3) injured the cows and resulted in deteriorated health of the herd, reduced milk production and ultimate death of the dairy cows.

One of the dairies that we tested had three dairy areas. Two areas did not have Equipotential Planes and there were no problems with stray current. The newest dairy had an Equipotential Plane installed and problems with stray current existed resulting in reduced milk production, sick dairy cows and difficulty with breeding. In my opinion, this unnecessary requirement is driving the dairy industry to extinction, especially the small dairies. Equipotential Planes do not protect dairy cows against stray voltage or stray current and are a figment of the imagination.

This section needs to be eliminated so that the dairy industry can survived. From the years of testing, it is opined that the equipotential plane is no more than an excellent earth electrode, which lacks any ability to maintain or to have zero voltage gradient across it when any amount of electrical current flows over, across or through the equipotential plane. As an excellent electrode-earthing element, the equipotential plane has the potential for attracting uncontrolled stray current from the multigrounded neutral electrical distribution system allowing dangerous and hazardous stray current to flow across the equipotential plane permitting the stray current to shock humans, cows and pigs.

When a dairy cow is in the milking parlor and bumps against the stanchions, she receives an electrical shock and will not let down her milk. If the dairy cow is not milked out completely she gets mastitis, inflammation of the udder, which ultimately usually leads to being turned into ground beef. In addition, dairy cows standing 24 hours per day 7 days per week on Equipotential Planes in dairy barns have continuous stray current flowing in their legs. Their joints have sufficient resistance that heating occurs and the joint becomes inflamed and swollen to the point where the dairy cow cannot walk. She is rendered into ground beef.

As should be evident from the above information Section 547.10 should be eliminated in its entirety in order to improve the health of dairy cows, improve milk production and breeding and sanity of the dairyman and his family. The original proposal was based on lack of understanding of electrical principles. The panel needs to rectify this problem by eliminating Section 547.10, as there is no redeeming justification for Section 547.10.

Please delete Section 547.10 as the deletion will restore the dairy farmer to sanity, improve the dairy's milk production, and save the dairy farm from extinction.

This substantiation also applies to the deletion of 547.2 Definition of Equipotential Plane.

Attached peer reviewed IEEE Technical paper titled: "THE MISUSE OF VOLTAGE AS A PARAMETER OF CONCERN FOR ELECTRICAL HAZARD".

(Staff Note: IEEE paper was not provided.)

Panel Meeting Action: Reject
Panel Statement: The submitter has provided no new substantiation to reverse the code-making panel's decision on the original proposal.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9 Negative: 1
Explanation of Negative:

ZIPSE, D.: Equipotential planes do not protect livestock against stray current. Equipotential planes do not prevent a difference in voltage from developing within the plane (reference IEEE I&CPS technical paper titled Equipotential Planes: A Figment of the Imagination dated May 2006). This paper asserts that since 1994 it has been shown through testing that dairy cows can be and are electrically shocked while standing on so-called equipotential planes.

ARTICLE 550 — MOBILE HOMES, MANUFACTURED HOMES, AND MOBILE HOME PARKS

19-11 Log #504 NEC-P19 **Final Action: Reject**
(550.2.Manufactured Home and 550.5.1 through 550.4.4 (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 19-30
Recommendation: Revise text to read as follows:

Manufactured Home. A structure, transportable in one or more sections, that~~, in the traveling mode, is 2.4 m (8 body-ft) or more in width or 12.2 m (40 body-ft) or more in length, or, when erected on site, is 29.7 m2 (320 ft2) or more and that~~ is built on a permanent chassis and designed to be used as a dwelling, with or without a permanent foundation, when connected therein. ~~The term *manufactured home* includes any structure that meets all the provisions of this paragraph except the size requirements and with respect to which the manufacturer voluntarily files a certification required by the regulatory agency, and except that such term does not include any self-propelled recreational vehicle. Calculations used to determine the number of square meters (square feet) in a structure are based on the structure's exterior dimensions, measured at the largest horizontal projections when erected on site. These dimensions include all expandable rooms, cabinets, and other projections containing interior space but do not include bay windows. For the purpose of this *Code* and unless otherwise indicated, the term *mobile home* includes manufactured homes.~~**Informational Note No. 1:** See the applicable building code for definition of the term *permanent foundation*.**Informational Note No. 2:** See Part 3280, *Manufactured Home Construction and Safety Standards, of the Federal Department of Housing and Urban Development*, for additional information on the definition.

550.4 General Requirements

550.4.1 The size of a manufactured home shall be 2.4 m (8 body-ft) or more in width or 12.2 m (40 body-ft) or more in length (in the traveling mode) or 29.7 m2 (320 ft2) or more (when erected on site).

550.4.2 The term *manufactured home* (see 550.2) includes any structure that meets all the provisions of the definition except the size requirements and with respect to which the manufacturer voluntarily files a certification required by the regulatory agency, and except that such term does not include any self-propelled recreational vehicle.

550.4.3 Calculations used to determine the number of square meters (square feet) in a structure are based on the structure's exterior dimensions, measured at the largest horizontal projections when erected on site. These dimensions include all expandable rooms, cabinets, and other projections containing interior space but do not include bay windows.

550.4.4 For the purpose of this *Code* and unless otherwise indicated, the term *mobile home* includes manufactured homes.

Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains a list of examples and such examples are not usually contained in definitions. Moreover, the information included should really be considered a requirement. If the CMP agrees that this is a requirement it should be placed somewhere else in Article

550, and section 550.4, on general requirements, is the perfect location, since NEC definitions shall not contain requirements. Moreover, the NEC manual of style does not permit the definition to contain the defined term and the second sentence contains the defined term "manufactured home". This is a more generic approach than the alternate comment because it eliminates all the requirements from the definition.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Panel Meeting Action: Reject
Panel Statement: For enforcement purposes, the examples and descriptive details contained in the present definition provide clarity for distinguishing a manufactured home from other structures.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

19-12 Log #505 NEC-P19 **Final Action: Reject**
(550.2.Manufactured Home and 550.5.1 through 550.4.3 (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 19-30
Recommendation: Revise text to read as follows:
Manufactured Home. A structure, transportable in one or more sections, that, in the traveling mode, is 2.4 m (8 body-ft) or more in width or 12.2 m (40 body-ft) or more in length, or, when erected on site, is 29.7 m2 (320 ft2) or more and that is built on a permanent chassis and designed to be used as a dwelling, with or without a permanent foundation, when connected therein. ~~The term *manufactured home* includes any structure that meets all the provisions of this paragraph except the size requirements and with respect to which the manufacturer voluntarily files a certification required by the regulatory agency, and except that such term does not include any self-propelled recreational vehicle. Calculations used to determine the number of square meters (square feet) in a structure are based on the structure's exterior dimensions, measured at the largest horizontal projections when erected on site. These dimensions include all expandable rooms, cabinets, and other projections containing interior space but do not include bay windows. For the purpose of this *Code* and unless otherwise indicated, the term *mobile home* includes manufactured homes.~~**Informational Note No. 1:** See the applicable building code for definition of the term *permanent foundation*.**Informational Note No. 2:** See Part 3280, *Manufactured Home Construction and Safety Standards, of the Federal Department of Housing and Urban Development*, for additional information on the definition.
550.4 General Requirements
<u>**550.4.1** The term *manufactured home* (see 550.2) includes any structure that meets all the provisions of the definition except the size requirements and with respect to which the manufacturer voluntarily files a certification required by the regulatory agency, and except that such term does not include any self-propelled recreational vehicle.</u>
<u>**550.4.2** Calculations used to determine the number of square meters (square feet) in a structure are based on the structure's exterior dimensions, measured at the largest horizontal projections when erected on site. These dimensions include all expandable rooms, cabinets, and other projections containing interior space but do not include bay windows.</u>
<u>**550.4.3** For the purpose of this *Code* and unless otherwise indicated, the term *mobile home* includes manufactured homes.</u>
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains a list of examples and such examples are not usually contained in definitions. Moreover, the information included should really be considered a requirement. If the CMP agrees that this is a requirement it should be placed somewhere else in Article 550, and section 550.4, on general requirements, is the perfect location, since NEC definitions shall not contain requirements. Moreover, the NEC manual of style does not permit the definition to contain the defined term and the second sentence contains the defined term "manufactured home". An alternate comment eliminates all the size requirements.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Panel Meeting Action: Reject
Panel Statement: For enforcement purposes, the examples and descriptive details contained in the present definition provide clarity for distinguishing a manufactured home from other structures.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

19-13 Log #506 NEC-P19 **Final Action: Reject**
(550.2.Mobile Home and 550.5.1 through 550.4.3 (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 19-31
Recommendation: Revise text to read as follows:
Mobile Home. A factory-assembled structure or structures transportable in one or more sections that are built on a permanent chassis and designed to be used as a dwelling without a permanent foundation where connected to the required utilities and that include the plumbing, heating, air-conditioning, and electrical systems contained therein.~~For the purpose of this *Code* and unless otherwise indicated, the term *mobile home* includes manufactured homes.~~
550.4 General Requirements
<u>**550.4.1** The term *manufactured home* (see 550.2) includes any structure that meets all the provisions of the definition except the size requirements and with respect to which the manufacturer voluntarily files a certification required by the regulatory agency, and except that such term does not include any self-propelled recreational vehicle.</u>
<u>**550.4.2** Calculations used to determine the number of square meters (square feet) in a structure are based on the structure's exterior dimensions, measured at the largest horizontal projections when erected on site. These dimensions include all expandable rooms, cabinets, and other projections containing interior space but do not include bay windows.</u>
<u>**550.4.3** For the purpose of this *Code* and unless otherwise indicated, the term *mobile home* includes manufactured homes.</u>
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains a list of examples and such examples are not usually contained in definitions. Moreover, the information included should really be considered a requirement. If the CMP agrees that this is a requirement it should be placed somewhere else in Article 550, and section 550.4, on general requirements, is the perfect location, since NEC definitions shall not contain requirements. Moreover, the NEC manual of style does not permit the definition to contain the defined term and the second sentence contains the defined term "mobile home".
New proposed sections 550.4.1 and 550.4.2 are associated with the comment to proposal 19-30.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Panel Meeting Action: Reject
Panel Statement: The use of the defined term "mobile home" within the definition is seen as appropriate in this context. See the panel action and panel statement on Comment 19-11.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

19-14 Log #929 NEC-P19 **Final Action: Accept in Principle**
(550.17(C)(1))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 19-27
Recommendation: Revise text to read as follows:
550.17(C)
(1) Exposed Non–Current-Carrying Metal Parts. All exposed non–current-carrying metal parts that are likely to become energized shall be effectively bonded to the grounding terminal or enclosure of the panelboard. A bonding conductor shall be connected between the panelboard and <u>an</u> accessible terminal on the chassis.
Substantiation: Grammar, easier to read.
Panel Meeting Action: Accept in Principle
Revise text to read as follows:
550.<u>16</u>~~17~~(C)(1) Exposed Non–Current-Carrying Metal Parts. All exposed non–current-carrying metal parts that are likely to become energized shall be effectively bonded to the grounding terminal or enclosure of the panelboard. A bonding conductor shall be connected between the panelboard and <u>an</u> accessible terminal on the chassis.
Panel Statement: CMP-19 agrees that this amendment is strictly an editorial improvement, but has amended the section number to the correct reference to 550.16(C).
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

19-15 Log #930 NEC-P19 **Final Action: Reject**
(550.30)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 19-27
Recommendation: Revise text to read as follows:
550.30 Distribution System. The mobile home park secondary electrical distribution system to mobile home lots shall be single-phase, 120/240 <u>or 120/208</u> volts, nominal. For the purpose of Part III, where the park service exceeds 240 volts, nominal, transformers and secondary panelboards shall be treated as services.
Substantiation: Is a three-wire 120/208 service forbidden for mobile homes?
Panel Meeting Action: Reject
Panel Statement: The submitter is introducing a new concept during the comment period without any technical substantiation. CMP-19 suggests the submitter resubmit this item as a proposal for the next Code revision cycle with technical justification for the amendment.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

19-16 Log #931 NEC-P19 **Final Action: Reject**
(550.32(C))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 19-43a
Recommendation: Revise text to read as follows:
C.32 Service Equipment.
(C) Rating. Mobile home service equipment shall be rated at not less than 100 amperes at 120/240 volts, and provisions shall be made for connecting a mobile home feeder assembly by a permanent wiring method. Power outlets used as mobile home service equipment shall also be permitted to contain receptacles rated up to 50 amperes with appropriate overcurrent protection. Fifty-ampere receptacles shall conform to the configuration ~~shown~~ in ~~Figure~~ 550.10(C).
~~Informational Note: Complete details of the 50-ampere plug and receptacle configuration can be found in ANSI/NEMA WD 6-2002 (R2008), National Electrical Manufacturers Association,~~ ~~*Standard for Wiring Devices — Dimensional Requirements*~~, ~~Figure 14-50.~~ ~~**[ROP 19–43a]**~~
Substantiation: The complete description of the receptacle is found in 550.10(C). The informational note is not necessary.
Panel Meeting Action: Reject
Panel Statement: The submitter is introducing a new concept during the comment period. Also, the comment does not at all address the amendment made via Proposal 19-43a. CMP-19 suggests the submitter resubmit this item as a proposal for the next Code revision cycle.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

ARTICLE 551 — RECREATIONAL VEHICLES AND RECREATIONAL VEHICLE PARKS

19-17 Log #934 NEC-P19 **Final Action: Reject**
(551)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 19-45
Recommendation: Revise text to read as follows:
IV. Nominal 120-Volt<u>, 208Y/120-Volt,</u> or 120/240-Volt Systems
551.40 120-Volt<u>, 208Y/120-Volt,</u> or 120/240-Volt, Nominal, Systems.
(A) General Requirements. The electrical equipment and material of recreational vehicles indicated for connection to a wiring system rated 120 volts, nominal, 2-wire with equipment grounding conductor, or a wiring system rated 120/240 volts <u>or 208Y/120 volt</u> nominal, 3-wire with equipment grounding conductor, shall be listed and installed in accordance with the requirements of Parts I, II, III, IV, and V of this article. Electrical equipment connected line-to-line shall have a voltage rating of 208–230 volts.
C.42 Branch Circuits Required.
(C) Two to Five 15- or 20-Ampere Circuits. A maximum of five 15- or 20-ampere circuits to supply lights, receptacle outlets, and fixed appliances shall be permitted. Such recreational vehicles shall be permitted to be equipped with panelboards rated 120 volts maximum<u>, 208Y/120 volt,</u> or 120/240 volts maximum and listed for 30-ampere application supplied by the appropriate power-supply assemblies. Not more than two 120-volt thermostatically controlled appliances (e.g., air conditioner and water heater) shall be installed in such systems unless appliance isolation switching, energy management systems, or similar methods are used. **[ROP 19–45]**
551.60 Factory Tests (Electrical). Each recreational vehicle designed with a 120-volt<u>, 208Y/120 volt,</u> or a 120/240-volt electrical system shall withstand the applied potential without electrical breakdown of a 1-minute, 900-volt ac or 1280-volt dc dielectric strength test, or a 1-second, 1080-volt ac or 1530-volt dc dielectric strength test, with all switches closed, between ungrounded and grounded conductors and the recreational vehicle ground.
551.72 Distribution System. Receptacles rated at 50 amperes shall be supplied from a branch circuit of the voltage class and rating of the receptacle. Other recreational vehicle sites with 125-volt, 20- and 30-ampere receptacles shall be permitted to be derived from any grounded distribution system that supplies 120-volt single-phase power. The neutral conductors shall not be reduced in size below the size of the ungrounded conductors for the site distribution. The neutral conductors shall be permitted to be reduced in size below the minimum required size of the ungrounded conductors for<u> 208-volt or </u>240-volt, line-to-line, permanently connected loads only.
Substantiation: Make voltage consistent in Article.
551.4(A) General Requirements.
(A) Not Covered. A recreational vehicle not used for the purposes as defined in 551.2 shall not be required to meet the provisions of Part IV pertaining to the number or capacity of circuits required. It shall, however, meet all other applicable requirements of this article if the recreational vehicle is provided with an electrical installation intended to be energized from a 120-volt, *208Y/120-volt*, or 120/240-volt, nominal, ac power-supply system.
(B) Systems. This article covers combination electrical systems, generator installations, and 120-volt, *208Y/120- volt*, or 120/240-volt, nominal, systems.
Panel Meeting Action: Reject
Panel Statement: The commenter is introducing a new concept during the comment period. The comment does not address either the original Proposals 19-45 and 19-77 or the CMP-19's actions on those proposals.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

19-18 Log #933 NEC-P19 **Final Action: Reject**
(551.2.Dead Front, Disconnecting Means)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 19-45
Recommendation: Delete the following text:
551.2 Definitions.
~~**Dead Front (as applied to switches, circuit breakers, switchboards, and panelboards).**~~ ~~Designed, constructed, and installed so that no current-carrying parts are normally exposed on the front.~~ ~~**[ROP 19–45]**~~
~~**Disconnecting Means.**~~ ~~The necessary equipment usually consisting of a circuit breaker or switch and fuses, and their accessories, located near the point of entrance of supply conductors in a recreational vehicle and intended to constitute the means of cutoff for the supply to that recreational vehicle.~~ ~~**[ROP 19–45]**~~
Substantiation: The article 100 definitions of *Dead Front* and *Disconnecting Means* serve as the definitions for these terms through the entire rest of the NEC. They appear to be sufficient for Article 551 as well.
Panel Meeting Action: Reject
Panel Statement: See panel statement on Comment 19-19.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

19-19 Log #1529 NEC-P19 **Final Action: Reject**
(551.2.Dead Front)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 19-47
Recommendation: Delete the following text:
551.2 Definitions. (See Article 100 for additional definitions.)
~~**Dead Front (as applied to switches, circuit breakers, switchboards, and panelboards).**~~ ~~Designed, constructed, and installed so that no current-carrying parts are normally exposed on the front.~~
Substantiation: If the definition of "Dead Front" is essentially the same as the 100 I definition of "Dead Front" why redefine it here?
"Panel Statement: Article 551 was originally created from a previous chapter in NFPA 501C (now NFPA 1192, *Standard on Recreational Vehicles*), to provide the RV industry with consolidated and concise electrical requirements. The panel continues to recognize the need to retain the definitions in Article 551."
551.2 states "See Article 100 for additional definitions." So Article 551 itself indicates that it depends on definitions in Article 100. I fail to see how the definition in Article 100 for Dead Front can not also serve Article 551.
Panel Meeting Action: Reject
Panel Statement: CMP-19 has been consistent over the years in consolidating requirements for the RV industry, despite some redundancy, as clearly communicated in the panel's statement on Proposal 19-47.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

19-20 Log #507 NEC-P19 **Final Action: Reject**
(551.2.Recreational Vehicle, 551.4.1 and 551.4.2 (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 19-48
Recommendation: Revise text to read as follows:
Recreational Vehicle. A vehicular-type unit primarily designed as temporary living quarters for recreational, camping, or travel use, which either has its own motive power or is mounted on or drawn by another vehicle. ~~The basic entities are travel trailer, camping trailer, truck camper, and motor home.~~
551.4 General Requirements
<u>**551.4.1** The basic types of recreational vehicle are travel trailer, camping trailer, truck camper, and motor home.</u>
<u>**551.4.2** Plots within in a recreational vehicle park can be used as a recreational vehicle site or as camping unit sites.</u>
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains a list of examples and such examples are not usually contained in definitions. Moreover, the information included should really be considered a requirement. If the CMP agrees that this is a requirement it should be places somewhere else in Article 551, and section 551.4, on general requirements, is the perfect location, since NEC definitions shall not contain requirements. Moreover, the NEC manual of style does not permit the definition to contain the defined term. The new section 551.4.2 is associated with the comment to proposal 19-49.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Panel Meeting Action: Reject

Panel Statement: For enforcement purposes, the "basic entities" included in the definition provide additional clarity and are not seen as suitable text for a requirement. See panel action on Comment 19-21.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

19-21 Log #508 NEC-P19 **Final Action: Accept in Principle in Part**
(551.2.Recreational Vehicle, 551.4.1 and 551.4.2 (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 19-49
Recommendation: Revise text to read as follows:
Recreational Vehicle Site. A plot of ground within a recreational vehicle park set aside for the accommodation of a recreational vehicle on a temporary basis. ~~It can be used as either a recreational vehicle site or as a camping unit site.~~
551.4 General Requirements
551.4.1 The basic types of recreational vehicle are travel trailer, camping trailer, truck camper, and motor home.
551.4.2 Plots within in a recreational vehicle park can be used as a recreational vehicle site or as camping unit sites.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains a list of examples and such examples are not usually contained in definitions. Moreover, the information included should really be considered a requirement. If the CMP agrees that this is a requirement it should be places somewhere else in Article 551, and section 551.4, on general requirements, is the perfect location, since NEC definitions shall not contain requirements. Moreover, the NEC manual of style does not permit the definition to contain the defined term and the second sentence of the definition contains the term "recreational vehicle site". The new section 551.4.1 is associated with the comment to proposal 19-48.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Panel Meeting Action: Accept in Principle in Part
Revise text to read as follows:
Recreational Vehicle Site. A plot of ground within a recreational vehicle park set aside for the accommodation of a recreational vehicle on a temporary basis or used as a camping unit site. ~~It can be used as either a recreational vehicle site or as a camping unit site.~~
Panel Statement: CMP-19 does not accept the creation of 551.4.1 and 551.4.2. The revision of the text in the definition addresses the submitter's style concern about using the defined term within the definition. See Comment 19-20.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

19-22 Log #932 NEC-P19 **Final Action: Reject**
(551.4(C))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 19-44
Recommendation: Add text to read as follows:
551.4 (D) Motors and Actuators. Electric motors and actuators that have manual controls shall meet the requirements of 110.25.
Substantiation: From ROP:
"Substantiation:
A disconnect for these motors within sight of the motor or a lockable disconnect is just as important for an RV tip out motor as for any other motor. If a person is underneath an RV working on these tip outs a person inside could engage the tip out and cause a severe injury from the screw jacks. The gear reduction ratio makes these jacks extremely powerful."
"Panel Statement:
Regarding the protection of individuals working on slideouts that could be operated while one is underneath, a provision is provided within NFPA 1192 that the activation mechanism be a non-latching switch; only a momentary switch so the slideout cannot be activated, should the operator walk away while the system was in the functioning mode."
I'm astonished at the suggestion underlined above. The argument immediately falls apart as soon as you realize that it is possible for 2 persons to be present at the same time. That scenerio is the whole reason behind *disconnects within sight* and *lockable disconnects* that permeate the *NEC*.
Panel Meeting Action: Reject
Panel Statement: This comment represents new material and does not reference at all the subject matter of Proposal 19-44.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

19-23 Log #1447 NEC-P19 **Final Action: Accept in Principle**
(551.4(C))

TCC Action: The Correlating Committee directs that the date of the latest referenced standard in 551.4(C) Information Note be included in the Code.
Submitter: Bruce A. Hopkins, Recreation Vehicle Industry Association
Comment on Proposal No: 19-50
Recommendation: Revise the Panel Meeting Action by adding the following text to the first part of the sentence:
551.4(C) Labels. Labels required by Article 551 shall comply with *ANSI Z535 Product Safety Signs and Labels* and shall be made of etched...".
Substantiation: NFPA has approved 2014 code changes proposals for NFPA 1192 Standard for Recreational Vehicles that require all signs and labels to comply with the requirements of ANSI Z535 and therefore to remain consistent the labels as identified in Article 551 for RVs should follow suit. This will enable the RV industry to provide a set of RV labels that will be uniform and better recognizable labels for the RV consumer.
Panel Meeting Action: Accept in Principle
Add a new informational note to 551.4(C) to read:
Informational Note. For guidance on other label criteria used in the recreational vehicle industry, refer to *ANSI Z535, Product Safety Signs and Labels*.
Panel Statement: The informational note provides the desired reference on additional label criteria without the use of unenforceable language.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

19-24 Log #1448 NEC-P19 **Final Action: Accept**
(551.42(C))

Submitter: Bruce A. Hopkins, Recreation Vehicle Industry Association
Comment on Proposal No: 19-59
Recommendation: Recommendation: revise the proposal to read as follows:
Exception No. 2: Six 15- or 20-ampere circuits shall be permitted without employing an energy management system, provided the ~~combined load of two circuits does not exceed the allowable load of a single circuit~~. added sixth circuit serves only the power converter; and the combined load of all six (6) circuits does not exceed the allowable load that was designed for use by the original five (5) circuits.
Substantiation: The proposed revision adds clarity to this requirement by indicating that the sixth circuit can only serve a converter and that the total combined load when employing six circuits cannot be more than what five circuits could handle.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

19-25 Log #285 NEC-P19 **Final Action: Accept**
(551.45(B))

Submitter: Jerome A. Hoover, Monaco RV, LLC
Comment on Proposal No: 19-61
Recommendation: Revise Panel Meeting action, and change the word "and" back to the original proposal "or" so that the exception reads:
Exception No. 1: Where the panelboard cover is exposed to the inside aisle space, one of the working clearance dimensions shall be permitted to be reduced to a minimum of 550 mm (22 in.). A panelboard is considered exposed where the panelboard cover is within 50 mm (2 in.) of the aisle's finished surface, ~~and~~ or no more than 25 mm (1 in.) from the backside of doors that enclose the space.
Substantiation: Changing "or" to "and" requires both conditions be met simultaneously which, as illustrated below, cannot be achieved in all installations. Some doors mounted flush to the aisles finished surface require installation of the panel board cover more than 50 mm (2 in.) of the aisle's finished surface. This proposal permits an alternate installation when the door installation prohibits meeting the specified 50 mm (2 in.) setback limit but provides for a alternative setback reference point which is 25 mm (1 in.) behind the door inner surface. This proposal prevents storage of material in front of the panelboard without sacrificing circuit breaker accessibility.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

19-26 Log #1449 NEC-P19 **Final Action: Accept**
(551.45(B))

Submitter: Bruce A. Hopkins, Recreation Vehicle Industry Association
Comment on Proposal No: 19-60
Recommendation: Reject Proposal 19-60, Log #2592.
Substantiation: The proposal was originally submitted for the purpose of harmonizing the NEC requirements governing installation locations for panel boards inside RVs with the parallel Canadian requirements.
The term "condensation" was used in the proposal and the panel determined in its discussions that this is a difficult and subjective word to add to the NEC. To approve the proposal, the panel added language that would prohibit panelboards from being installed under sinks or in areas occupied by toilets, showers or tubs. This added language, however, eliminates locations that have been safely used for years without issue. Further, the proposed change as it now reads will not achieve the intended NEC/Canadian harmonization, as some of these now prohibited stated locations are still permitted in Canada.
Due to these considerations, we are now commenting that the entire proposal should be deleted until more clarification can be obtained from Canada. To

date, no issues have been brought to the panel's attention suggesting that the existing requirement does not provide adequate safety. Therefore, rejecting this proposal and retaining the existing text of the 2011 NEC will not lessen safety.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

19-27 Log #1587 NEC-P19 **Final Action: Accept**
(551.47(S)(3))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 19-75
Recommendation: Revise text to read as follows:
551.47 Wiring Methods.
(S) Prewiring for Other Circuits.
(3) A safety label with the signal word "WARNING" with minimum 1/4 in. (6 mm) high letters minimum and body text with minimum 1/8 in. (3 mm) high letters on a contrasting background, shall be affixed on or adjacent to the junction box or device listed for the purpose and shall read as follows:
WARNING THIS CONNECTION IS FOR _____ RATED _____ VOLT AC, 60 HZ, _____ AMPERES MAXIMUM. DO NOT EXCEED CIRCUIT RATING.
~~AN AMPERE RATING NOT TO EXCEED 80 PERCENT OF THE CIRCUIT RATING SHALL BE LEGIBLY MARKED IN THE BLANK SPACE.~~
EXCEEDING THE CIRCUIT RATING MAY CAUSE A FIRE AND RESULT IN DEATH OR SERIOUS INJURY.
An ampere rating not to exceed 80 percent of the circuit rating shall be legibly marked in the blank space.
Substantiation: The deleted sentence does not appear in the ROP. 19-50 has similar text to the corrected text.
Panel Meeting Action: Accept
Panel Statement: CMP-19 notes that this sentence was inadvertently omitted during the ROP stage, which was not the panel's intent.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

19-28 Log #1220 NEC-P19 **Final Action: Reject**
(551.75)

TCC Action: The Correlating Committee directs that Proposal 19-79 and Comment 19-28 be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative. The concept proposed in Proposal 19-79 no longer has consensus.
Submitter: Sheldon Monson, Wadena, MN
Comment on Proposal No: 19-79
Recommendation: The panel should reject this proposal.
Substantiation: These pedestals are the outdoor interface" from the distribution to the portable equipment (RV) with equipment grounding (bonding) conductors back to the service/source of supply. The grounded and grounding conductors within the equipment are isolated and nothing is gained by establishing yet another grounding electrode system adjacent to the RV equipment.

250.4(A)(1) states that these systems are to limit the voltage imposed by lightning, line surges, or unintentional contact with higher-voltage lines and that will stabilize the voltage to earth during normal operation. Requiring 2-ground rods (or possibly another electrode system) at multiple locations accomplishes none of the above, and conflicts with the panel's goad of reducing unintentional circulating currents in premises distribution.

Not only is there no substantiating evidence for this proposal, this requirement is just not a good idea.
Panel Meeting Action: Reject
Panel Statement: CMP-19 accepted Proposal 19-79 to clarify that an RV pedestal is a separate structure and the provisions of Article 250 apply.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 6 Negative: 8
Explanation of Negative:

BAUMAN, B.: I agree with the comments submitted by B. Hopkins.

ELLIOTT, W.: 1. No documentation of any accidents, incidents, injuries or deaths due to lack of grounding electrodes at the RV Site equipment, have been documented and these installations have been being installed for more than 30 years.
2. There has been NO testing to prove that electrodes are needed or if present would prevent injury or death beyond the presence of the equipment ground.
3. RV Site equipment is a distribution point, not a separate structure. It is NEMA 3R equipment that meets NEC and UL listing requirements and is for exterior distribution and not housed in any further enclosures or buildings.
4. RV Site equipment is UL listed for a specific purpose, and all major manufactures have their equipment listed as RV Site equipment. Only Milbank and Jamestown also list their RV Site equipment as listed for temporary power.
5. Equipment not listed as suitable for use as RV Site equipment (for example an 816 box installed for a site) is not allowed by the NEC and should not be an excuse for demanding that each site is a separate structure. In practice, the use of non-listed equipment is so minimal as to be considered nonexistent.
6. All RV Site equipment have provisions for equipment grounding back to the service entrance equipment and are grounded back to the service entrance in practice. In fact a case can be made for a common ground for safety reasons because of the close proximity of neighboring RV Sites.
7. If RV Site equipment is considered a separate structure and requires local grounding electrodes, why would marina site equipment be different? The case could be made that NEITHER are separate structures and should not be considered such.
8. Finally, the cost of adding individual grounding electrodes in today's average size RV Park is economically disastrous as costs of $75 to $100 per site will be required without improvement in safety.

HOPKINS, B.: 1. No documentation of any accidents, incidents, injuries or deaths due to lack of grounding electrodes at the RV Site equipment, have been documented and these installations have been being installed for more than 30 years.
2. There has been NO testing to prove that electrodes are needed or if present would prevent injury or death beyond the presence of the equipment ground.
3. RV Site equipment is a distribution point, not a separate structure. It is NEMA 3R equipment that meets NEC and UL listing requirements and is for exterior distribution and not housed in any further enclosures or buildings.
4. RV Site equipment is UL listed for a specific purpose, and all major manufactures have their equipment listed as RV Site equipment. Only Milbank and Jamestown also list their RV Site equipment as listed for temporary power.
5. Equipment not listed as suitable for use as RV Site equipment (for example an 816 box installed for a site) is not allowed by the NEC and should not be an excuse for demanding that each site is a separate structure. In practice, the use of non-listed equipment is so minimal as to be considered nonexistent.
6. All RV Site equipment have provisions for equipment grounding back to the service entrance equipment and are grounded back to the service entrance in practice. In fact a case can be made for a common ground for safety reasons because of the close proximity of neighboring RV Sites.
7. If RV Site equipment is considered a separate structure and requires local grounding electrodes, why would marina site equipment be different? The case could be made that NEITHER are separate structures and should not be considered such.
Finally, the cost of adding individual grounding electrodes in today's average size RV Park is economically disastrous as costs of $75 to $100 per site will be required without improvement in safety.

MULVANEY, D.: Reasons for Negative vote:
1. No documentation of any accidents, incidents, injuries or deaths due to lack of grounding electrodes at the RV Site equipment.
2. There has been NO testing to prove that electrodes are needed or if present would prevent injury or death beyond the presence of the equipment ground.
3. RV Site equipment is a distribution point, not a separate structure. It is NEMA 3R equipment that meets NEC and UL listing requirements and is for exterior distribution and not housed in any further enclosures or buildings.
4. RV Site equipment is UL listed for a specific purpose, and all major manufactures have their equipment listed as RV Site equipment. Only Milbank and Jamestown also list their RV Site equipment as listed for temporary power.
5. Equipment not listed as suitable for use as RV Site equipment (for example an 816 box installed for a site) is not allowed by the NEC and should not be an excuse for demanding that each site is a separate structure. In practice, the use of non-listed equipment is so minimal as to be considered nonexistent.
6. All RV Site equipment have provisions for equipment grounding back to the service entrance equipment and are grounded back to the service entrance in practice. In fact a case can be made for a common ground for safety reasons because of the close proximity of neighboring RV Sites.
7. If RV Site equipment is considered a separate structure and requires local grounding electrodes, why would marina site equipment be different? I would make the case that NEITHER are separate structures and should not be considered such.
8. Finally, the cost of adding individual grounding electrodes in today's average size RV Park is economically disastrous.

SABIN-MERCADO, L.: I agree with the submitter of Comment 19-28 that the panel should have rejected Proposal 19-79.

A factory-built RV pedestal should not be considered a structure. RV pedestals are "equipment". The requirements of Article 250.32 should not apply. The action taken by CMP-19 to accept Proposal 19-79 and define the RV pedestal as a separate structure, requiring the provisions of 250.32 to be met, was not justified by any technical substantiation. There has been a lot of discussion over the years about whether a grounding electrode (system) is required at each RV pedestal providing site power. No justification has been submitted to CMP-19 that the level of safety provided by the existing requirements in 551.74 and 551.75 are not sufficient. A grounding electrode system at each pedestal or site power supply is not necessary since an equipment grounding conductor is routed with the feeder to each site. A grounding electrode at each RV pedestal may be "nice" to have, but should not be a "requirement".

THIERHEIMER, T.: I agree with the voting comments submitted by L. Sabin-Mercado.

ZIEMAN, M.: I believe the original proposal (19-79) should be rejected and thus comment 19-28 asking that proposal 19-79 be rejected should have been accepted by the committee.

My reasons include:

1. I concur with some of the reasons stated by those who voted negative on the committee action on 19-28.

2. I believe the committee's actions have unintended consequences such as unjustified increased cost which need to be reviewed.
3. I believe the actions of the committee may not provide added or needed safety.
4. I would like to see this matter revisited in the next code cycle.

ZIPSE, D.: A grounding electrode system at each pedestal or site power supply is not necessary since an equipment grounding conductor (EGC) is routed with the feeder to each site. A grounding electrode at each RV pedestal may be "nice" to have, but should not be a "requirement". Back before the requirement for EGC a ground rod at each pedestal was needed, but not today.

19-29 Log #404 NEC-P19 **Final Action: Reject**
(551.79)

Submitter: Thomas L. Adams, Macomb, IL
Comment on Proposal No: 19-81
Recommendation: This Proposal should be rejected.
Substantiation: The present text of OSHA 1926.403(i) limits the requirements in that paragraph to applications up to 600 Volts. Changing the application of the text in 551.79 will create a conflict between the two documents causing voltages from 601 to 1000 Volts to be in violation of OSHA requirements. In addition, a Note within the OSHA document states that "If the electrical installation is made in accordance with the National Electrical Code ANSI/NFPA 70-1984, exclusive of Formal Interpretations and Tentative Interim Amendments, it will be deemed to be in compliance with 1926.403 through 1926.408, except for 1926.404(b)(1) and 1926.405(a)(2)(ii)(E), (F), (G), and (J)." This would further conflict with the proposed text without significant amendment.
Panel Meeting Action: Reject
Panel Statement: Section 551.79 addresses "Clearances for overhead conductors" in recreational vehicle parks. CMP-19 questions the relevance of the requirements in OSHA 1926.403, Safety and Health Regulations for Construction, Sub Part K, Electrical. Further, CMP-19 noted that the proposals to change 600 V to 1000 V in Sections 225.18 and 225.19 were accepted in principle by CMP-4.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

19-30 Log #760 NEC-P19 **Final Action: Accept**
(551.79)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 19-81
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

19-31 Log #1261 NEC-P19 **Final Action: Reject**
(551.79)

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 19-81
Recommendation: I ask the panel to reject this proposal. The proposal would change 600 volts to 1000 volts.
Substantiation: Replacing 600 volts with 1000 volts will have a major impact on installers, component manufacturers, and industry standards. Increased spacing must be considered when going from 600 volts to 1000 volts. Personal safety must also be considered.
Because the proposer has not provided enough information to the public to justify and understand all the ramifications of the proposal, the committee should reject the submitter's proposal.
Panel Meeting Action: Reject
Panel Statement: Section 551.79 addresses "Clearances for overhead conductors" in recreational vehicle parks. The concerns expressed in the submitter's substantiation do not seem relevant to the application of the change in Section 551.79. CMP-19 noted that the proposals to change 600 V to 1000 V in Sections 225.18 and 225.19 were accepted in principle by CMP-4.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

ARTICLE 553 — FLOATING BUILDINGS

19-32 Log #1568 NEC-P19 **Final Action: Reject**
(553.4)

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 19-96
Recommendation: Accept the proposal.
Substantiation: The comments in the voting are exactly on point. The notion that one device could address the plethora of instances of floating buildings, from little houseboats to major maritime floating aquariums and other large commercial applications is preposterous. In addition, the differences cited in the substantiation between fresh and salt water further compound the problem.
Panel Meeting Action: Reject
Panel Statement: Since the adoption of the "not to exceed 100 mA" leakage limit for residual current devices at marinas and boatyards in the 2011 Code, it is the understanding of CMP-19 that 30 mA ground-fault protection of equipment (GFPE) industrial circuit breakers have been employed. While it is recognized that the optimal level of protection for personnel is 5 mA, CMP-19 recognizes that only part of the solution to electrocutions at these locations can be solved on the docks and marinas. A large contributor to the safety issue comes from the watercraft and any measures taken at the services at the marinas cannot solve the problem. Constant nuisance tripping caused by expected wide disparities between the levels of the stray currents and optimal personnel protection can be expected to meet with strong resistance by the marina and boatyard owner/operators.

The panel has proposed an NFPA Research Foundation Code Fund Project to review the American Boat and Yacht Council (ABYC) study on the subject, titled "Research on the Mitigation of Residual Current/Voltage Detection in Marinas, Boatyards to a Level Below Muscular Tentanization Level". CMP-19 hopes that results from such a study will provide necessary stimulus for development of life saving technologies. In the meantime, CMP-19 has concluded that elimination of the present requirement would be regressive at this time and lead to no required protection at all.

CMP-19 recognizes the critical nature and immediacy of the safety issue and, if this above-mentioned code fund project is approved, intends to address the findings of the project when any recommendations become available.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 8 Negative: 2
Explanation of Negative:

CHILTON, R.: Although information was submitted during the Proposal meeting that reflected a need for better protection at marinas, the Action is based on a study that contains obvious flaws. The 100 MA setting claimed by some to eliminate this hazard far exceeds the 4-6 MA Standard set for GFCI, the limit considered maximum to protect personnel. With electrocutions growing in number each summer, and the recent July 2012 tragic events providing an emotional reaction to public demands for more regulations this simply does not help. The known responses to current imposed on the human body just will not stop with the 100 MA level and the public is being convinced this will. As experienced laymen of the Electrical Industry, with all facets represented on this Code Making Panel, we have become part of the charade that we're protecting the Public by this requirement. The real protection would incorporate GFCI protection on each feeder and branch circuit.

LICHTENSTEIN, T.: The panel should have accepted the comment and proposal 19-103. The 100mA recommendation by the Coast Guard research far exceeds the level of 5mA which is the level that should not be exceeded to prevent muscle tetanization of children in water. See definition of "Ground-Fault Circuit Interrupter" in Article 100. Muscle tetanization is a state of muscle contraction that results in the inability of a person to control their muscles. When the muscles tetanize the ability to control breathing and to swim or climb out of the water is lost which results in swimmers sinking to the bottom of the water and drowning. Ground fault protection of equipment (GFPE) circuit breakers that trip at the 30mA level will not provide ground fault protection for personnel and will only serve to provide a false sense of protection.

The intent of the Coast Guard research to address a known problem has merit, however, implementing the 100mA limit alone may not have an impact on solving this problem, and may even increase the hazard by giving those in or near the water a false sense of protection. As the panel statement indicated "A large contributor to the safety issue comes from the watercraft and any measures taken at the services at the marinas cannot solve the problem." A comprehensive solution including ground fault protection, wiring methods, wiring devices, grounding, system design and enforcement must be developed to alleviate this hazard.

ARTICLE 555 — MARINAS AND BOATYARDS

19-33 Log #1027 NEC-P19 **Final Action: Accept**
(555.3)

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 19-103
Recommendation: Continue to reject.
Substantiation: I agree with the panel. This is an important safety requirement that should be retained.
Panel Meeting Action: Accept
Number Eligible to Vote: 11
Ballot Results: Affirmative: 9 Negative: 2
Explanation of Negative:

CHILTON, R.: See my Comment on 19-32.

LICHTENSTEIN, T.: The panel should have rejected the comment and accepted the proposal 19-103. The 100mA recommendation by the Coast Guard research far exceeds the level of 5mA which is the level that should not be exceeded to prevent muscle tetanization of children in water. See definition of "Ground-Fault Circuit Interrupter" in Article 100. Muscle tetanization is a state of muscle contraction that results in the inability of a person to control their muscles. When the muscles tetanize the ability to control breathing and to swim or climb out of the water is lost which results in swimmers sinking to the bottom of the water and drowning. Ground fault protection of equipment (GFPE) circuit breakers that trip at the 30mA level will not provide ground fault protection for personnel and will only serve to provide a false sense of protection.

The intent of the Coast Guard research to address a known problem has merit, however, implementing the 100mA limit alone may not have an impact on solving this problem, and may even increase the hazard by giving those in or near the water a false sense of protection. As the panel statement for comment 19-32 indicated "A large contributor to the safety issue comes from the watercraft and any measures taken at the services at the marinas cannot solve the problem." A comprehensive solution including ground fault protection, wiring methods, wiring devices, grounding, system design and enforcement must be developed to alleviate this hazard.

19-34 Log #1569 NEC-P19 **Final Action: Reject**
(555.3)

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 19-103
Recommendation: Accept the proposal.
Substantiation: The comments in the voting are exactly on point. The notion that one device could address the plethora of instances of marinas, from little mom and pop operations to major maritime commercial applications is preposterous. In addition, the differences cited in the substantiation between fresh and salt water further compound the problem.
Panel Meeting Action: Reject
Panel Statement: See panel statement on Comment 19-32.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 9 Negative: 2
Explanation of Negative:

CHILTON, R.: See my comment on 19-32.

LICHTENSTEIN, T.: The panel should have rejected the comment and accepted the proposal 19-103. The 100mA recommendation by the Coast Guard research far exceeds the level of 5mA which is the level that should not be exceeded to prevent muscle tetanization of children in water. See definition of "Ground-Fault Circuit Interrupter" in Article 100. Muscle tetanization is a state of muscle contraction that results in the inability of a person to control their muscles. When the muscles tetanize the ability to control breathing and to swim or climb out of the water is lost which results in swimmers sinking to the bottom of the water and drowning. Ground fault protection of equipment (GFPE) circuit breakers that trip at the 30mA level will not provide ground fault protection for personnel and will only serve to provide a false sense of protection.

The intent of the Coast Guard research to address a known problem has merit, however, implementing the 100mA limit alone may not have an impact on solving this problem, and may even increase the hazard by giving those in or near the water a false sense of protection. As the panel statement for comment 19-32 indicated "A large contributor to the safety issue comes from the watercraft and any measures taken at the services at the marinas cannot solve the problem." A comprehensive solution including ground fault protection, wiring methods, wiring devices, grounding, system design and enforcement must be developed to alleviate this hazard.

19-35 Log #761 NEC-P19 **Final Action: Accept**
(555.4)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 19-104
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept

Number Eligible to Vote: 11

Ballot Results: Affirmative: 10 Negative: 1

Explanation of Negative:

MICHAELIS, R.: There are two main reasons why aluminum conductors fail, these being improper installations and coefficient of expansion. Improper installation can cause aluminum oxidation which is not a conductor. The studies presented did not take into account actual field conditions or the chemicals in compound forms. The problem with aluminum wiring does not lie in the wiring itself, it lies in the connection. When aluminum heats up it expands more than copper and when it cools down it contracts more than copper. Over time this can cause a loose connection. Additionally, it is harder to make a tight connection with aluminum wire in the first place because aluminum wire has to be a thicker gauge wire than copper to carry the same electrical current. All metals also oxidize over time but there is a primary difference in how copper oxidizes compared to aluminum. When copper oxidizes it forms a conductor which creates no threat. When aluminum oxidizes it develops as a resistor which causes a major threat. Resistance causes heat which could lead heating up and possibly catching on fire or the insulation melting around the wire causing additional fire risk.

19-36 Log #1233 NEC-P19 **Final Action: Accept**

(555.15(B) and (C))

Submitter: Christel K. Hunter, Alcan Cable, a General Cable Company

Comment on Proposal No: 19-106

Recommendation: Revise text to read as follows:

555.15(B) Type of Equipment Grounding Conductor. The equipment grounding conductor shall be an insulated ~~copper~~ conductor with a continuous outer finish that is either green or green with one or more yellow stripes. The equipment grounding conductor of Type MI cable shall be permitted to be identified at terminations. For conductors larger than 6 AWG, or where multiconductor cables are used, re-identification of conductors as allowed in 250.119(A)(2)(b) and (A)(2)(c) or 250.119(B)(2) and (B)(3) shall be permitted.

(C) Size of Equipment Grounding Conductor. The insulated ~~copper~~ equipment grounding conductor shall be sized in accordance with 250.122 but not smaller than 12 AWG.

Substantiation: The submitter's proposal should have been accepted. In order to provide technical substantiation for the proposed change, several resources were consulted.

According to corrosionsource.com, the effects of both seawater and fresh water on aluminum will be minor. According to aluminum.org, "Used in the marine industry for more than 100 years, aluminum combines light weight and ease of fabrication with corrosion and fatigue resistance." According to copper.org, copper also has excellent resistance to a marine atmosphere, forming a protective green basic copper chloride or carbonate patina.

In the Aluminum Electrical Conductor Handbook (1989), corrosion resistance is addressed with the following statement: "The inherent corrosion resistance of aluminum is due to the thin, tough, oxide coating that forms directly after a fresh surface of metallic aluminum is exposed to air. Another reason for the excellent corrosion resistance of aluminum conductors in ordinary atmospheres is that the alloy components are selected so as to minimize corrosion. Thus, suitable alloys of the 6000-series, though not listed as "marine" alloys, are well suited for oceanshore applications, as well as for the usual industrial and chemical atmospheres, as are the aluminum 1350 conductors. Instances where corrosion has appeared are usually traceable to connections between dissimilar metal subjected to moisture conditions. Protective means should be employed to prevent this. Present-day compression connectors act to break the oxide layer on the wires of stranded cable connections. Where unplated flat surfaces are joined, as with bus conductors or terminal pads, scratch brushing and the addition of oxide-inhibiting joint compound remove the oxide and prevent its further formation because the compound excludes oxygen."

ASTM performed a 10-year study to determine the corrosion rates of four metals exposed to desert, rural, coastal and industrial atmospheric conditions. In the coastal test environments (Key West, FL and La Jolla, CA), aluminum outperformed copper, zinc and lead. While both copper and aluminum held up very well in coastal testing, aluminum lost only 0.004 mils/year in Key West and 0.028 mils/year in La Jolla, compared with a copper loss of 0.020 mpy in Key West and 0.052 mpy in La Jolla.

Note that aluminum conductors are usually made of AA-1350 or AA-8000 series aluminum. Both of these types are highly corrosion resistant. Aluminum connectors are made of highly corrosion resistant materials as well, usually AA-6061 or AA-1000 series, depending on the connector type.

Resources:

http://www.copper.org/resources/properties/microstructure/coppers.html

Corrosionsource.com

Aluminum Electrical Conductor Handbook, published 1989.

Panel Meeting Action: Accept

Number Eligible to Vote: 11

Ballot Results: Affirmative: 10 Negative: 1

Explanation of Negative:

CHILTON, R.: Stranded conductors should be addressed in this environment separately from solid conductors, no considerations were given in the Comment. Oxidation occurs more rapidly when salt water and air contaminates and settles within the strands of exposed aluminum.

19-37 Log #1177 NEC-P19 **Final Action: Reject**

(555.16)

Submitter: Donald W. Zipse, Zipse Electrical Forensics, LLC

Comment on Proposal No: 19-107

Recommendation: Add new text to read as follows:

555.16 Mitigation of Neutral Related Stray Voltages and Stray Currents. To provide protection for neutral related stray voltages and stray currents, when 5 ma or more exists, a suitably rated transformer that isolates the service neutral conductor from the load neutral conductor at the branch circuit service panel supplying the shore power shall be installed. The following shall be required for a transformer that isolates system neutral conductors:

(1) The transformer that isolates shall be rated to carry full through-fault current.

(2) The transformer that isolates shall have over current protection on the supply side as required in Section 450.3.

(3) The metal enclosure of the transformer shall be connected to the supply side grounded conductor as required by Section 250.4(A).

(4) The load side grounded conductor and equipment grounding conductors shall be connected together and bonded at the transformer as required by Section 250.20(B). To provide adequate isolation, the installed grounding electrode shall be located at least 6m (20 ft) from the nearest grounding electrode on the supply side of the transformer and shall be connected to the transformer by an insulated grounding conductor.

(5) There shall be three conductors attached to the secondary side of the transformer XO terminal:

(1) The identified conductor (the neutral).

(2) The equipment grounding conductor (the green conductor).

(3) The insulated grounding electrode conductor.

(6) The location of the transformer that isolates shall be on the load side of the service disconnecting means and shall not be below the electrical datum plane.

Note: Supporting Material is available for review at NFPA headquarters.

Substantiation: THIS IS NOT NEW MATERIAL AS A VERSION APPEARED IN THE ROP.

The only change is the addition of "when 5 ma or more exists."

This revised text meets Article 250, Separately Derived Systems. Transformers that isolate have been used successfully since 1994 in isolating the distribution system neutral return current from the user's property. This method of using a transformer to isolate the dangerous and hazardous stray current emanating from the distribution system neutral return current will save lives and reduce electrical shock hazards.

This neutral isolating transformer has been installed in dairies and residential homes since 1994. The author has a neutral isolation transformer installation which has been approved by the local inspection agency.

This installation is required only if the stray current exceeds 5 mA which is the same as a GFCI trip setting. The stray current is on the identified conductor, neutral (white conductor) and the equipment grounding conductor (Bare or Green color). The equipment grounding conductor does not have any protection such as a GFCI in the equipment grounding conductor circuit. There is no other protection from stray current except by interrupting the current flow from the primary neutral of the supply transformer by the installation of a neutral isolation transformer.

Panel Meeting Action: Reject

Panel Statement: The comment intends to reverse CMP-19's action on the original proposal. It, however, also introduces new concepts during the comment period. The original proposal only asked for an isolation transformer to be "permitted". The comment introduces a new requirement for the transformer when 5 mA leakage current is detected.

Number Eligible to Vote: 11

Ballot Results: Affirmative: 10 Negative: 1

Explanation of Negative:

ZIPSE, D.: The use of transformers that isolate the primary neutral from the secondary neutral, preventing stray current from entering premises, such as a marina, will eliminate a source of potential harmful current. Such transformers have been used for approximately 20 years to prevent stray current from shocking and the potential of electrocution of humans. The panel is remiss in failing to take this opportunity to protect the public - one of the objects of the National Electrical Code.

19-38 Log #1224 NEC-P19 **Final Action: Reject**

(555.16)

Submitter: Carson Day, Georgia Institute of Technology - NEETRAC

Comment on Proposal No: 19-107

Recommendation: The following text would be a new paragraph under section 555. Below are the changes recommended to the original change proposal submitted in November 2011.

555.16 Mitigation of Neutral Related Stray Voltages and Currents
To provide protection for neutral related stray voltages and currents, a suitably rated isolation transformer (a separately derived system) at the branch circuit service panel supplying the shore power shall be permitted.
The following ~~shall be required~~ configuration is recommended for the isolated system:
~~(1) The isolation transformer should be double insulated or its equivalent and shall have an internal shield between t he windings that is rated to carry full fault current.~~
(1)The isolation transformer shall have overcurrent protection on the supply side as required in 450.3.
(2) The isolation transformer shall be provided with a ground fault protection device on the load side ~~not exceeding 30mA (UL943C Class B Ground Fault Circuit Interrupter)~~
(3) Metal enclosure ~~and internal shield conductor~~ of the transformer shall be connected to the supply side neutral and grounding system as required by 250.4 (A).
(4) The load side neutral and equipment grounding conductors shall be connected together and grounded on the secondary side of the transformer as required by 250.20(8). To provide adequate isolation, the installed grounding electrode shall ~~should~~ be located atleast 6' from the nearest grounding electrode of the supply side and shall ~~should be~~ connected to the transformer by an insulated grounding conductor.
(5) The location of the isolation transformer shall be on the load side of the service disconnecting means ~~panel containing breaker and/or disconnecting means~~ and shall not be below the electrical datum plane.
Substantiation: Last summer, four children and one adult died in a two week period around July 4 due to electrocution while swimming around boat docks. These occurred in Missouri and Tennessee. The source of the electricity, whether contact voltage or stray voltage, was not detailed in the reports. During testing at similar boat docks, in North Carolina and Georgia, the stray voltage was great enough to pose a similar risk. Application of the isolation transformer, as described in the change proposal, effectively mitigates the risk to people swimming near docks. In the case of single branch circuit, the isolation transformer can also serve as a back up to GFCI outlets and provide effective protection against contact voltages.
The changes presented here address some of the committee member comments to the original change proposal. This includes, changing the verbiage which makes this application mandatory and removing references to obsolete GrCl equipment.
A more detailed description of the isolation transformer application and the test results for contact voltage and stray voltage scenarios is presented in the report, "Summary of NEC Change Proposal for Mitigation of Neutral Related Exposure Voltages at Marinas and Boat Docks."
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: As previously written in CMP-19's action and statement on Proposal 19-107, the installation of a transformer intended to isolate stray voltage (current) is not presently prohibited. The NEC is not intended as a design guide.
CMP-19 is very sympathetic to the evident safety concerns surrounding electrocution hazards at marinas and boatyards. See Comment 19-32.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

19-39 Log #1356 NEC-P19 **Final Action: Reject**
(555.16)

Submitter: Robert Metz, Duke Energy
Comment on Proposal No: 19-107
Recommendation: The following text would be a new paragraph under section 555. Below are the changes recommended to the original change proposal submitted in November 2011.
555.16 Mitigation of Neutral related Stray Voltages
To provide protection for neutral related stray voltages, a suitably rated isolation transformer at the branch circuit service panel supplying the shore power may be permitted.
The following configuration is recommended for the isolated system:
(1) The isolation transformer should be double insulated or its equivalent and shall should have an internal shield between the windings that is rated to carry full fault current.
(2) The isolation transformer should have overcurrent protection on the supply side as required in 450.3.
(3) The isolation transformer should be provided with a ground fault protection device on the load side.
(4) Metal enclosure and internal shield conductor of the transformer should be connected to the supply side neutral and grounding system as required by 250.4(A).
(5) The load sisde neutral and equipment gronding conductors should be connected together and grounded at the tramsformer as required by 250.20(B). to provide adequate isolation, the installed grounding electrode should be located at least 6 ft from the nearest grounding electrode and shouold be connected to the transformer by an insulated grounding conductor.
(6) The location of the isolation transformer should be on the load side of the service panel containing breaker and/or disconnecting means and should not be below the electrical datum plane.
Substantiation: This change proposal was submitted by Carson Day from Georgia Tech NEETRAC. Duke Energy supports this change to provide a method for boat dock owners to mitigate both stray voltage and contact voltage problems. As a registered professional engineer in North and South Carolina and as a Power Quality Specialist with duke Energy, I have worked to address numerous contact and stray voltage issues at docks on Lakes Jocassee, Keowee and Hartwell in South Carolina. Years of monitoring shows that dock safety is a serious issue that is not adequately addressed in the NEC.
The five deaths due to electrocution around boat docks show the importance of this change proposal. contact voltage problems are possible at any boat dock that has electric service. Stray voltage is a problem that can occur even when the dock is wired correctly due to current NEC requirements.
During their testing, NEETRAC has shown that both contact voltage and stray voltage can be fatal. The testing also showed that the use of an isolation transformer can successfully mitigate these dangers.
Panel Meeting Action: Reject
Panel Statement: See the panel statement on Comment 19-38.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

19-40 Log #1439 NEC-P19 **Final Action: Reject**
(555.16)

Submitter: Marty L. Page, Georgia Power Company
Comment on Proposal No: 19-107
Recommendation: The following text would be a new paragraph under section 555. Below are the changes recommended to the original change proposal submitted in November 2011.
555.16 Mitigation of Neutral Related Stray Voltages
To provide protection 'for neutral related stray voltages, a suitable rated isolation transformer at the branch circuit service panel supplying the shore power may be permitted.
The following configuration is recommended for the isolated system:
(I) The isolation transformer should be double insulated or its equivalent and shall should have an internal shield between the windings that is rated 10 carry full fault current.
(2) The isolation transformer should have overcurrent protection on the supply side as required in 450.3.
(3) The isolation transformer should be provided with a ground fault protection device on the load side.
(4) Metal enclosure and internal shield conductor of the transformer should be connected to the supply side neutral and grounding system as required by 250.4 (A).
(5) The load side neutral and equipment grounding conductors should be connected together and grounded at the transformer as required by 250.20(B). To provide adequate isolation. the installed grounding electrode should be located at least 6' from the nearest grounding electrode and should be connected to the transformer by an insulated grounding conductor.
(6) The location of the isolation transformer should be on the load side of the service panel containing breaker and/or disconnecting means and should not be below the electrical datum plane.
Substantiation: This change proposal was submitted by Carson Day from Georgia Tech - NEETRAC. My company supports this change to provide a method for boat dock owners 10 mitigate both stray voltage and contact voltage problems.
The five deaths due to electrocution around boat docks show the importance of this change proposal. Contact voltage problems are possible at any boat dock that has electric service. Stray voltage is a problem that can occur even when the dock is wired correctly due to current NEC requirements.
During their testing. NEETRAC has shown that both contact voltage and stray voltage can be fatal. The testing also showed that the use of an isolation transformer can successfully mitigate these dangers.
Panel Meeting Action: Reject
Panel Statement: See panel statement on Comment 19-38.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

14-71 Log #240 NEC-P14 **Final Action: Accept**
(555.21)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 19-108
Recommendation: The Correlating Committee directs that this proposal be reported as "Accept" to correlate with the action on Proposal 14-238.
The Correlating Committee notes that motor fuel dispensing stations are under the purview of Code-Making Panel 14.
The Correlating Committee understands that the text deleted in this proposal is relocated into 514.3(C) as indicated in the action on Proposal 14-238.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept

Panel Statement: CMP-14 understands that the action by the Correlating Committee is to accept Proposal 19-108, which deletes requirements from Section 555.21 and places them in Article 514, in accordance with CMP-14's acceptance of Proposal 14-238.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

ARTICLE 590 — TEMPORARY INSTALLATIONS

3-32 Log #1028 NEC-P03 **Final Action: Accept**
(590.4(C))

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 3-100
Recommendation: Revise this proposal to correlate with the term "switchgear."
Substantiation: "Metal-enclosed power switchgear"ris no longer a defined term. "Switchgear" is.
Panel Meeting Action: Accept
Panel Statement: The panel clarifies that the recommendation is to replace the words "metal-enclosed power switchgear" with "switchgear".
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-33 Log #936 NEC-P03 **Final Action: Accept**
(590.4(D)(2))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 3-102
Recommendation: Revise text to read as follows:
590.4 General.
(D) Receptacles.
(2) Receptacles in Wet Locations. All 15- and 20-ampere, 125- and 250-volt receptacles installed in a wet location shall comply with 406.9(B)(1). ~~The requirement shall also pertain to temporary installations at one- and two-family dwellings.~~
Substantiation: 406.9(B)(1) from 2011 NEC has been altered for 2014:
406.9 Receptacles in Damp or Wet Locations.
(B) Wet Locations.
(1) 15- and 20-Ampere Receptacles in a Wet Location. 15- and 20-ampere, 125- and 250-volt receptacles installed in a wet location shall have an enclosure that is weatherproof whether or not the attachment plug cap is inserted. ~~For other than one- or two-family dwellings, a~~ An outlet box hood installed for this purpose shall be listed, ~~and where installed on an enclosure supported from grade as described in 314.23(B) or as described in 314.23(F)~~ and shall be identified as "extra-duty." All 15- and 20-ampere, 125- and 250-volt nonlocking-type receptacles shall be listed weather-resistant type.
The exception for 1&2-family dwellings no longer exists and need not be overridden by 3-102.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-34 Log #1065 NEC-P03 **Final Action: Accept in Principle**
(590.4(J))

Submitter: Michael J. Johnston, National Electrical Contractors Association
Comment on Proposal No: 3-105
Recommendation: Adjust the proposed new third sentence as follows:
Cable assemblies and flexible cords installed for temporary branch circuit or feeder wiring shall not be permitted to be laid on the floor or the ground.
Substantiation: The submitter has identified a significant physical damage concern that should be addressed. This comment provides a slight adjustment to the proposed third sentence in an effort to address the comments and concerns in the negative ballot statements and the panel statement related to the proposal being to broad and overly restrictive. As adjusted, the proposed sentence now clarifies that where cable assemblies and flexible cords are installed as branch circuits or feeders (not connected by cord-and-plug connections) they are not permitted to be laid on the floor or ground. As adjusted this section would not impact the normal construction site use of extension cords that are normally connected and disconnected to a branch circuit. Extension cord use would still be subject to protection from physical damage during such transient use.
Panel Meeting Action: Accept in Principle
Panel Statement: Refer to the panel action and statement on Comment 3-35 that addresses the same issue.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Negative: 1
Explanation of Negative:
WALSH, R.: This revised text is an effort to coordinate with OSHA regulations and will not to include extension cords. However, this new text is not enforceable in a practical sense because the the question of what is considered an extension cords is not easily interpreted by the installers. Most often, electrical inspectors are dispatched to approve temporary electrical installations on job sites for supply from the serving utility. Once the utility supply has been approved, the contractors can avoid code compliance of supporting the branch circuits and feeders above the ground or floors by requesting an inspection before installing the cords and cables or after the temporary cords and cables have been removed. Presently, many contractors are reminded by the AHJ to provide GFCI protection for existing outlets during the course of construction. All contractors that are cited agree to comply, however, the next dispatch request is usually for a final inspection when all of the power tools and cords have been removed.
Comment on Affirmative:
CASPARRO, P.: See my comment on Comment 3-35.

3-35 Log #1538 NEC-P03 **Final Action: Accept in Principle**
(590.4(J))

TCC Action: The Correlating Committee directs that the text in the new third sentence in this comment be modified by deleting the comma after "Cable assemblies" as follows: "Cable assemblies and flexible cords and cables installed as branch circuits or feeders shall not be installed on the floor or on the ground."
Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 3-105
Recommendation: This proposal should be Accepted in Principal as follows:
(J) Support of Branch Circuits and Feeders. Cable assemblies and flexible cords and cables shall be supported in place at intervals that ensure that they will be protected from physical damage. Support shall be in the form of staples, cable ties, straps, or similar type fittings installed so as not to cause damage. Cable assemblies and flexible cords and cables shall not be laid in the floor or the ground.
Substantiation: As explained in the substantiation provided in proposal 3-105, this proposed revision seeks to align the NEC requirements with existing OSHA requirements and address a serious safety issue. As the submitter of this proposal, I understand the confusion and rejection by CMP-3. The proposed revision did not seek to prohibit extension cords from being laid on the ground. That would be impossible. It is important to note that the term "extension cord" literally means an extension of the branch circuit. We permit these extensions of branch circuits on the ground in tough/wet construction environments because we need to power hand tools and because we have rules in place that mandate GFCI or an AEGCP for these extensions. There is no such GFCI or AEGCP requirement for branch circuits and feeders, which is why they must be prohibited from being laid on the floor or ground. This is practical, feasible, safety driven and required by OSHA.
The revision to the title of first level subdivision (J), now clarifies that the requirement applies only to branch circuits and feeders. Extension cords are not impacted in any manner.
The proposed text in this comment does not represent new material; it is included in the negative vote of Mr. Casparro and has had public review in the ROP. The negative statement of Mr. Clary says it all.
Panel Meeting Action: Accept in Principle
Revise the comment recommendation to read as follows:
(J) Support. Cable assemblies and flexible cords and cables shall be supported in place at intervals that ensure that they will be protected from physical damage. Support shall be in the form of staples, cable ties, straps, or similar type fittings installed so as not to cause damage. Cable assemblies, and flexible cords and cables installed as branch circuits or feeders shall not be installed on the floor or on the ground. Extension cords shall not be required to comply with 590.4(J). Vegetation shall not be used for support of overhead spans of branch circuits or feeders. (Exception unchanged.)
Panel Statement: The panel recognizes the OSHA regulations in CFR 1926.405(a)(2)(ii)(B). The revised text meets the intent of the submitter. The existing title has been retained because some of the requirements apply more generally.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Negative: 1
Explanation of Negative:
WALSH, R.: This revised text is an effort to coordinate with OSHA regulations and will not to include extension cords. However, this new text is not enforceable in a practical sense because the the question of what is considered an extension cords is not easily interpreted by the installers. Most often, electrical inspectors are dispatched to approve temporary electrical installations on job sites for supply from the serving utility. Once the utility supply has been approved, the contractors can avoid code compliance of supporting the branch circuits and feeders above the ground or floors by requesting an inspection before installing the cords and cables or after the temporary cords and cables have been removed. Presently, many contractors are reminded by the AHJ to provide GFCI protection for existing outlets during the course of construction. All contractors that are cited agree to comply, however, the next dispatch request is usually for a final inspection when all of the power tools and cords have been removed..
Comment on Affirmative:
CASPARRO, P.: OSHA requirements address a serious safety issue of laying cable assemblies, flexible cords and cables installed as branch circuits or feeders on the floor or the ground.

STENE, S.: The text in the new third sentence in this comment should be further modified by deleting the comma after "Cable assemblies" as follows: "Cable assemblies and flexible cords and cables installed as branch circuits or feeders shall not be installed on the floor or on the ground." This new sentence should have the same punctuation marks as the first sentence in this section, otherwise, the comma separates the title from the remainder of the sentence and makes it an incomplete sentence. Without the change in punctuation, "installed as branch circuits or feeders shall not be installed on the floor or on the ground" only applies to "flexible cords and cables", not to "cable assemblies."

3-36 Log #1463 NEC-P03 **Final Action: Reject**
(590.6(A))

Submitter: Michael O. Flegel, Reliance Controls Corporation
Comment on Proposal No: 3-106
Recommendation: Accept the proposal.
Substantiation: Either using GFCI protection or an assured equipment conductor program in the harsh environments covered by this article is a must. But using GFCI protection with a portable generator in ungrounded systems must be understood and is dangerous if not done properly. The changes proposed show how to do it properly as stated in the proposal justification and the study done by Construction Safety Association of Ontario (provided).

The panel continues not to understand the problem. Someone on the panel said that not having a ground wire connected to a GFCI receptacle will not prevent its operation. This is true but is not the point. The point is that GFCI's work only in bonded and grounded systems because those are the systems that can have ground faults back to the source. When I talked to the panel during the last comment cycle, it was clear that the panel didn't understand the benefits of a floating system and the need to have the GFCI protection as close to the tool as possible. At that time and when I realized you were going to require GFCI protection on all portable generators, I asked the panel to at least require the system to be grounded even though this creates an unnecessary environment that more readily creates a ground fault. If you are going to use GFCI protection in portable generator applications, it has to be installed correctly. Please take time to read and understand the material in the proposal and the attached study. If you don't,
you will make a bad decision that will demonstrate that this process is not working and people will get hurt. There is a good reason that the personnel GFCI protection worked prior to the changes in the 2011 NEC. You must give workers the correct information on GFCI use with portable generators so they have the best opportunity to survive ground faults.

The panel statement is incorrect about my proposal. Grounding of the generator with built in GFCI protection would be an alternative to using downstream GFCI protection. If such a generator is not grounded, it would require downstream GFCI protection. It doesn't remove the requirement for integral GFCI protection. It says if it is present, you need to ground the generators to make it work. It does allow generators without integral GFCI protection but they must not be grounded and people must use downstream GFCI protection. This is safer than grounding a generator with the integral protection.

Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: There has been no additional technical information provided in the comment stage to warrant accepting this comment or the referenced proposal. The conclusions on page 14 and 15 of the GFCI generator study that was done in Canada accurately reflect the safety provided by generators with GFCIs provided. Compliance with 250.34(A) permits the grounding electrode to be eliminated where the neutral is connected to the frame of the portable or vehicle-mounted generator before supplying the line side of the GFCI and providing an equipment grounding conductor with the output of the GFCI to the load downstream.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-37 Log #1162 NEC-P03 **Final Action: Reject**
(590.6(A), Informational Note (New))

Submitter: Thomas A. Domitrovich, Eaton Corporation
Comment on Proposal No: 3-107
Recommendation: This proposal should have been accepted.
Substantiation: The Code panel rejected this proposal stating "All components of an electrical system must comply with 110.10, therefore, if the information is available from the manufacturer, inserting it into an Informational Note is unnecessary. This same information could be inserted throughout the NEC on many different products and would just load the NEC with data when the installer can receive the same information from the manufacturer or on-line... "

However, the case of a GFCI receptacle is much different than most products in that many people are not even aware that these devices have a short circuit rating.

The UL 943 Standard requires a 2000A test for the typical device, and permits an Optional 10kA Short Circuit Current Test, but does NOT permit it to be marked 10kA. UL 943 states the following:

"SA3.1 A ground-fault circuit-interrupter that complies with SA2.1 and SA2.2 shall not be marked to indicate the ability to withstand a 10kA short circuit current as a result of these tests."

The rating information for these products, especially for the inspector reviewing the installation after these products have been installed, is often unchecked. This enables the misapplication of these life saving devices beyond their ratings. There are many areas where these devices are applied, especially in commercial and industrial environments, where the available fault currents may exceed the rating of the device.

This informational note is important for safety as it raises the awareness to installers and inspectors alike who are not aware of the short circuit capabilities of these devices. This will go a long way for ensuring these devices are applied within their rating.
Panel Meeting Action: Reject
Panel Statement: As stated in the panel statement for Proposal 3-107, all components of an electrical system must comply with 110.10. Therefore, if the information is available from the manufacturer, inserting it into an Informational Note is unnecessary.

This same information could be inserted throughout the NEC on many different products and would just load the NEC with data when the installer can receive the same information from the manufacturer or on-line.

The panel recognizes the proposal is dealing with 2000 ampere short circuit current rating. The submitter has not provided any additional technical substantiation for inserting this informational note into 590.6(A).
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-38 Log #354 NEC-P03 **Final Action: Accept**
(590.6(A)(1))

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 3-107a
Recommendation: Revise text to read as follows:
(1) Receptacle Outlets Not Part of Permanent Wiring. All 125-volt, single-phase,15-, 20-, and 30-ampere receptacle outlets that are not a part of the permanent wiring of the building or structure and that are in use by personnel shall have ground-fault circuit-interrupter protection for personnel. Listed cord sets or devices incorporating listed ground-fault circuit-interrupter protection for personnel identified for portable use shall be permitted.
Substantiation: The permissible use of "listed cord sets or devices incorporating listed ground-fault circuit-interrupter protection for personnel identified for portable use" is not explicitly stated in the existing Article 590.6(A)(1) language, as is done in Article 590.6(A)(2) and Article 590.6(A)(3). The proposed language is to add this text which makes it explicitly clear that these cord sets or devices are permitted in addition to the ground-fault circuit-interrupter (GFCI) protected wiring.
In addition, the proposed language requires that listed cord sets or devices incorporate GFCI protection for personnel, resulting in all of the outlets of these cord sets providing GFCI protection.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13
Comment on Affirmative:

STENE, S.: This comment should have been an accept in principle with the following underlined text as follows: Listed cord sets or devices incorporating listed ground-fault circuit-interrupter protection for personnel identified for portable use shall be permitted, where already protected by a GFCI device as required by the first sentence in (A)(1) above."
The added phrase "where already protected by a GFCI device as required by the first sentence in (A)(1) above" ensures that the portable GFCI device is located downstream from a GFCI device already protecting the circuit conductors out to the location of the portable device.

3-39 Log #1488 NEC-P03 **Final Action: Reject**
(590.6(A)(3))

Submitter: Richard E. Loyd, Sun Lakes, AZ
Comment on Proposal No: 3-106
Recommendation: Revise text to read as follows:
(3) Receptacles on ~~15- kW or less~~ Portable Generators. 125-volt and 125/250-volt, single-phase, 15-, 20-, and 30-ampere receptacle outlets that are a part of a ~~15 -kw or smaller~~ portable generator shall be ~~have~~ listed ground-fault circuit-interrupter protection for personnel type. All 15- and 20- ampere, 125- and 250-volt receptacles, including those that are part of a portable generator, used in a damp or wet location shall comply with 406.9(A) and a. Listed cord sets or devices incorporating listed ground-fault circuit interrupter protection for personnel identified for portable use shall be permitted ~~for use with 15-kW or less portable generators manufactured or remanufactured prior to January 1, 2011~~.
Substantiation: There has been no substantiation for limiting this rule to 15 kW or smaller generators.

The submitter as well as many comments in CMP-3, 13 and 5 related to this subject has substantiated that in some cases the safety intended may not protect those using the portable generator regardless of the installation of GFCI receptacles on the equipment. This fact should cause concern to the committee, 90.1(A) states the purpose of the code is "safeguarding persons and property" It is an established fact that placing the GFCI protection as close to the tool as possible or using double insulated tools is desirable to achieved this safeguarding.

There has been no substantiation of a safety problem even though both the floating neutral and the bonded types of generators are being used every day in many applications. Based on the ECOA/IBEW study both types can be safe or not so safe based on the conditions of use.

Placing the GFCI nearest to likely fault (tool or personnel) and using double insulated tools provides the greatest safety. Nothing in the study indicates the bonded type is safer.

In 1997 the construction safety association of Ontario (ECAO) in conjunction with the IBEW, with the assistance of Kubota Canada completed a in-depth study on the use of GFCIs on portable generators. They tested both types the following are the analysis and conclusions of that study:

Analysis: It is clear that when generators of the floating-neutral or bonded-neutral type sit on dry surfaces in dry environments, they behave similarly In both cases, the GFCIs failed to trip In addition, the reading of little or no current on the multimeter indicated that there was not enough electricity leaking to ground to constitute a hazard In both cases, the GFCI did not trip when there was only one ground fault in the system. When effective grounding was established, GFCIs performed as expected Testing also proved that wet surfaces can create grounding for bonded-neutral generators When a bonded-neutral generator was placed on wet ground, the GFCI tripped under the prescribed current leakage.

However, testing also showed that grounding can vary from one place to another, even when both are relatively close In one test, a variation in ground elevation yielded different results When the screwdriver was inserted in wet ground, the GFCI tripped When the screwdriver was moved 100 feet to a slope that had better drainage, the GFCI did not trip.

The second series of tests showed that the placement of the GFCI in the circuit is critical to a floating-neutral system.

When the GFCI was plugged directly to the generator, the GFCI failed to detect any imbalance in the current As a result, it did not trip even when the current leak reached a higher than acceptable level When the GFCI was placed at the tool, however, it tripped at the prescribed level.

Conclusions: Since the GFCI test button functioned regardless of the generator's grounding property, GFCI test buttons cannot and should not be used to test the effectiveness of GFCIs as personnel protection or the grounding of portable generators The test button should only be used to test GFCIs after grounding has been established. Portable generators *with established ground* must be treated the same way as any grounded utility system Workers must be protected by GFCIs to prevent electrocution by ground fault Ground should be established and verified only by competent workers trained to do so and using specialized instruments.

Generators with established ground allow a GFCI mounted at the generator outlet to work effectively. When there is a current leak, the current goes to ground to complete the circuit. This creates an imbalance, causing the GFCI to trip When generators with established ground are being used, GFCIs should be located *closest to the generator,* protecting all workers from ground faults, not just the generator user.

Construction people complain that GFCIs trip unnecessarily, especially with extension cords As a result, personnel often consider GFCIs a nuisance and don't use them But GFCIs trip for a reason These trips should be treated as a warning that there is a ground fault in the system When a GFCI trips, tools, cords, and plugs should be inspected for defects and, where necessary, replaced before work continues.

When the electrical system does not have reference to ground, GFCIs mounted on the generator do not work With one fault, not enough current leaks to ground to be considered a hazard.

Thus, in a floating-neutral circuit, workers are not endangered by electrocution from current going to ground *as long as there is only ONE fault in the system.*

However, with two faults in the system, one on the neutral and one on the hot side, it is possible that the floating-neutral system can become grounded In that case, workers without properly located GFCIs can be electrocuted Two faults can be produced by a defective generator, poorly insulated or defective extension cord, defective tool, or defective plug, to name just a few causes Other conditions such as wet ground, rain, or high humidity can increase the risk that the electrical system will become grounded.

Testing showed that in a two-fault system, the placement of the GFCI is critical The GFCI must be placed between the two faults in order to function Since the likely locations for faults are tool cord, tool plug, and extension cord, the GFCI should be placed *closest to the tool.*

Last but not least, the hazards of electrocution can be minimized by using only double-insulated tools in good working order and well-insulated cords.

Panel Meeting Action: Reject

Panel Statement: There has been no additional technical information provided in the comment stage to warrant accepting this comment or the referenced proposal. The conclusions on page 14 and 15 of the GFCI generator study that was done in Canada accurately reflect the safety provided by generators with GFCIs provided. Compliance with 250.34(A) permits the grounding electrode to be eliminated where the neutral is connected to the frame of the generator before supplying the line side of the GFCI and providing an equipment grounding conductor with the output of the GFCI to the load downstream. Requiring GFCI protection on the generator provides a safer installation as indicated in the conclusion of the Construction Safety Association of Ontario study as noted above. Using an additional portable GFCI protection device is permissible but leaving the conductors unprotected between the source of supply (the generator) and the portable GFCI leaves these conductors and personnel totally unprotected against a ground fault.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

ARTICLE 600 — ELECTRIC SIGNS AND OUTLINE LIGHTING

18-43 Log #238 NEC-P18 **Final Action: Accept**

(600.3)

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 18-90

Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action taken on Proposal 18-91.

See the Correlating Committee action taken on Proposal 18-91.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Revised Text to read as follows:

600.3 Listing Fixed, mobile or portable electric signs, section signs, outline lighting, and retrofit kits, regardless of voltage, shall be listed, provided with installation instructions, and installed in conformance with that listing, unless otherwise approved by special permission.

Panel Statement: The panel accepts the direction of the TCC and has correlated the action taken on proposals 18-90 and 18-91.

Number Eligible to Vote: 11

Ballot Results: Affirmative: 11

18-44 Log #239 NEC-P18 **Final Action: Accept**

(600.3)

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 18-91

Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action taken on Proposal 18-90.

See the Correlating Committee action on Proposal 18-90.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Panel Statement: See panel action and statement on Comment 18-43.

Number Eligible to Vote: 11

Ballot Results: Affirmative: 11

18-45 Log #1029 NEC-P18 **Final Action: Reject**

(600.4(E))

Submitter: Mike Holt, Mike Holt Enterprises

Comment on Proposal No: 18-93

Recommendation: Reject this proposal.

Substantiation: While doing an inspection, the installer hands me the instructions for the sign. I am then supposed to fail him or her because the sign isn't marked to state that instructions are required, despite the fact that I have the instructions in my hand? That is indefensible.

Panel Meeting Action: Reject

Panel Statement: Marking is a reminder to the inspector. Actions taken by installers does not circumvent the code requirements.

Number Eligible to Vote: 11

Ballot Results: Affirmative: 9 Negative: 2

Explanation of Negative:

CARPENTER, F.: While we acknowledge that UL 48 requires all signs to be supplied with installation instructions, there is no justification to require marking all signs with a statement indicating that installation instructions have been provided. The current edition of UL 48 requires Section Signs to be marked "Installation and assembly required, see installation instructions" since Section Signs frequently require significant field wiring. Many complete signs are considerably simpler in construction and requiring a similar marking for all signs has not been substantiated.

TODD, S.: The requirement for installation instructions is a part of the product standard as stated in Mr. F. Carpenter's negative ballot on Proposal 18-93 and does not add to the safety of the installation.

18-46 Log #924 NEC-P18 **Final Action: Accept in Principle**
(600.6(A)(1))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 18-99
Recommendation: Revise text to read as follows:
600.6 Disconnects.
(A) Location.
1. At Point of Entry to a Sign Enclosure. The ~~disconnect shall be located at the point the~~ feeder circuit or branch circuit(s) supplying a sign or outline lighting system shall enter the disconnect and shall not enter~~s~~ a sign enclosure. ~~and shall disconnect all wiring where it~~ The disconnect shall open all ungrounded conductors before they enter~~s~~ the enclosure of the sign. **[ROP 18–99]**
Substantiation: The above text is clearer and, I believe, matches the admirable intent of the original proposal. Note that the exception allows the feed before the disconnect to pass through the sign ONLY if it is completely enclosed in a raceway.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and statement on Comment 18-47 which meets the intent of the submitter.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

18-47 Log #1451 NEC-P18 **Final Action: Accept in Principle in Part**
(600.6(A)(1))

Submitter: William S. Dundas, International Sign Association
Comment on Proposal No: 18-99
Recommendation: Revise text to read as follows:
(1) At Point of ~~Entry~~ Connection to a Sign ~~Enclosure~~. The disconnect shall be located at the point the feeder circuit or branch circuit(s) supplying a sign or outline lighting system ~~enters~~ connects to a sign enclosure or a metal or nonmetallic pole in accordance with 600.5(C)(3) and shall disconnect all wiring ~~where~~ at the point it enters ~~the enclosure of~~ the sign enclosure or metal or nonmetallic pole.
~~Exception: A disconnect is not required for branch or feeder circuits passing through the sign where enclosed in a Chapter 3 listed raceway.~~
Substantiation: The phraseology for this new rule must be changed to include the connection point for feeders and branch circuits on freestanding signs which typically are located at the base of the sign structure and not at or on the sign enclosure itself. Poles are an integral part of a freestanding sign and are permitted as enclosures for supply conductors in signs and luminaires. (410.30(B) A disconnecting means, either snap switch or circuit breaker in a panelboard supplying the sign meets the intent of the original proposal. [ROP 18-99] The use of the term "connection" is appropriate and harmonizes with 90.2(3). Electric signs are utilization equipment that is connected to the electrical supply. A Connection Point is analogous to the Code term "Service Point" and clearly describes the intent to disconnect conductors before they enter a sign enclosure.
Exception. Agree with dissenting vote by B. Gray. The proposed rule applies only to conductors that supply a sign or flood lights that are part of the sign system. A raceway for conductors that does not terminate in the sign is an integral part of the sign construction and covered under UL 48. Article 300 is not intended to apply to conductors that are integral part of listed utilization equipment. (300.1)(B).
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Accept in Principle in Part
Revise text to read as follows:
(1) At Point of Entry to a Sign Enclosure. The disconnect shall be located at the point the feeder circuit or branch circuit(s) supplying a sign or outline lighting system enters a sign enclosure or a pole in accordance with 600.5(C)(3) and shall disconnect all wiring where it enters the enclosure of the sign or pole.
Exception: A disconnect shall not be required for branch or feeder circuits passing through the sign where enclosed in a Chapter 3 listed raceway.
Panel Statement: The panel accepts adding poles to the rule, but did not se the need to reference both metallic and non-metallic types." And delete all other proposed changes. The existing language adequately describes the intent of the panel. In addition, the Panel added the words "or pole" to the base paragraph and " shall" and "be" to the exception for better clarity. The panel concluded that the exception should be retained as Chapter 3 wiring methods are suitable to pass conductors through a sign enclosure.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11
Comment on Affirmative:
KOCHAN, M.: I agree with the addition of the words "sign body" to clarify where the disconnect can be safely placed in most general duty signs. My concern is when I build an extremely large sign with a super structure and provided with multiple feeders, branch circuits with multiple 200 amp panels provided at each level of the structure that will qualify as the disconnect. These panel are delivered and comply with Chapter Three wiring methods. The circuit breaker in these panel will act as the disconnect before the circuits enter the sign section or enclosure.
WRIGHT, R.: I accept the action of the panel to correct and clarify our intention. My concern is we have omitted the words "Body" after sign and before enclosure. Also we did not change the word wiring to "ungrounded conductors" and could have the impression the neutrals need opened as well. The wiring is not as critical as the exclusion of the sign body. The intention of this section is to protect the service personnel from contacting live conductors when they believe they have disconnected the sign. Electric signs have either a sign body or sign enclosure or both. My concern is with the revised text we could allow a conductor to be live in the sign body and then disconnected when it enters the sign enclosure. Corrective text could be:
(1) At Point of Entry to a Sign Body or Enclosure. The disconnect shall be located at the point the feeder circuit or branch circuit(s) supplying a sign or outline lighting system enters a sign body, enclosure or a pole in accordance with 600.5 (C) (3) and shall disconnect all wiring ungrounded conductors where it enters the enclosure or body of the sign or pole.

18-48 Log #925 NEC-P18 **Final Action: Hold**
(600.6(B))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 18-102a
Recommendation: Revise text to read as follows:
600.6 Disconnects.
(B) Control Switch Rating. Switches, flashers, and similar devices controlling transformers and electronic power supplies shall be rated for controlling inductive loads or have a current rating not less than twice the current rating of the transformer or the electronic power supply. **[ROP 18–102a]**
Substantiation: Transformerless electronic power supplies typically have high inrush currents.
Panel Meeting Action: Hold
Panel Statement: The panel finds that this is not a comment related to Proposal 102a and is therefore new material and needs to be held as a proposal for the next cycle.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

18-49 Log #1450 NEC-P18 **Final Action: Accept**
(600.12(A))

Submitter: William S. Dundas, International Sign Association
Comment on Proposal No: 18-110
Recommendation: Revise text to read as follows:
(A) 1000 Volts or Less. Neon and ~~S~~secondary circuit wiring of 1000 volts or less shall comply with 600.31.
Substantiation: To harmonize 600.12(B) with 600.32, CMP 18 agreed that scope of 600.32 was specific to neon secondary wiring over 1000 volts but at the same time rejected harmonizing 600.12(A) with the scope of 600.31, Neon Secondary-Circuit Wiring, 1000 volts or Less.
The Panel's premise is that this applies to secondary wiring for fluorescent, HID and other. This overlooks the fact that there are neon cold cathode systems used for sign illumination which employ transformers rated 1000 volts or less. Secondly, 600.31 was inserted into Article 600 during the 1996 Code Cycle. The Panel's substantiation at that time was that 600.31 applied to a secondary circuit of a transformer and ballast; presumably neon and fluorescent electric discharge tubing. Including neon along
with secondary wiring in the reference to 600.31 will avoid confusion and will harmonize 600.12(A) with the title and scope of 600.31.
"Sections 600.31 (b) and 600-32(b) apply to the secondary circuit of a transformer or ballast." [1996 ROP 18-91(a)]
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Accept
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

18-50 Log #1030 NEC-P18 **Final Action: Reject**
(600.21(D))

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 18-114
Recommendation: Accept the proposal in principal, but reject the change to (D).
Substantiation: Requiring a 36" by 36" working space in front of a Class 2 power supply (which cannot electrocute a person) is unreasonable. This is akin to requiring this working space to a residential doorbell transformer, which has the same amount o power as the power source being discussed in this change.
Panel Meeting Action: Reject
Panel Statement: The primary side of the supply must be considered as well.
Section 110.26 provides requirements for access and working space around equipment for its safe operation and maintenance. Table 110.26(A)(1) sets the requirements based on the nominal voltage including the voltages of a Class 2 power supply. Exception to the 36" space requirement is permitted by Table 110.26(A)(1) (b) "Low Voltage. By special permission, smaller working spaces shall be permitted where all exposed live parts operate at not greater than 30 volts rms, 42 volts peak, or 60 volts dc."
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

18-51 Log #342 NEC-P18 **Final Action: Accept in Principle**
(600.33)

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 16-124
Recommendation: In 600.33(A) and 600.33(A)(2) make the following change:
Table 725.154(A ~~G~~)
Substantiation: This is a correlating comment to our comment on proposal 3-154a to reorganize 725.154. If that comment is accepted, the current 725.154(G) will be renumbered (re-lettered) to 725.154(A).
Panel Meeting Action: Accept in Principle
Panel Statement: The panel accepts in principle the submitter's comment. However, staff will make the necessary editorial changes to citations based on actions taken by CMP-3.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

ARTICLE 604 — MANUFACTURED WIRING SYSTEMS

19-41 Log #1297 NEC-P19 **Final Action: Reject**
(604.4 Exception No. 3 (New))

Submitter: Fred Carpenter, Acuity Brands Lighting Inc.
Comment on Proposal No: 19-110
Recommendation: The Panel should accept the recommended text for new Exception No. 3 from Proposal 19-110.
Substantiation: The Panel indicated that they had two problems with the proposal. The first problem indicated was that, "Some manufactured wiring systems, listed or not, are comprised of wiring methods themselves which are not suitable for concealed spaces according to Chapter 3 of the Code". The proposed wording for new Exception No. 3 does not negate Section 604.5, so this stated concern is already addressed by the Code. The second reason stated for rejecting the proposal was, "Presently, neither Article 604 or UL 183 have provisions for manufactured wiring systems listed for use in concealed spaces". I concur with the Panel, neither Article 604 nor UL 183 have provisions for MWS in concealed spaces; that's why I proposed the revision. UL has a policy that prohibits their standards from conflicting with the Code. When a panel accepts a revision to the Code that would subsequently require UL to address the Code revisions in one or more of their standards, UL is obligated to undertake the necessary standards revisions. Since listing requirements for Manufactured Wiring Systems designed for use in concealed spaces do not currently exist, accepting Proposal 19-110 would clearly prompt a revision to UL 183 to develop appropriate listing requirements. Historically, Code revisions have prompted revisions to UL standards, so the current lack of provisions in UL 183 should not be used as a restriction to this proposed revision. If desired the Panel could add a future effective date to allow ample time for the needed standard revision.
Panel Meeting Action: Reject
Panel Statement: The proposed language is a paradox. The definition of "Concealed" in Article 100 starts with "Rendered inaccessible…". The panel cannot understand how a "listed enclosure that provides access for inspection" can be located in concealed spaces. Limitations on placement of electrical connections and certain wiring systems in concealed spaces does not only address inspection, say at rough in, it also addresses accessibility for maintenance without the destruction of fixed structures.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10
Comment on Affirmative:
LICHTENSTEIN, T.: The addition of new Exception No. 3 to 604.4 is unnecessary. Proposal 19-110 supporting documentation included an illustration of what the submitter was trying to revise the Code to permit. The illustration showed a MWS power distribution assembly that was accessible above a ceiling with a cable/flexible conduit whip tap that extended down into a concealed framed wall and terminated in a device box for connection to a switch or receptacle. This construction is already permitted by 604.4 Exception No. 1.

ARTICLE 605 — OFFICE FURNISHINGS

18-52 Log #343 NEC-P18 **Final Action: Accept**
(605.3)

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 18-127
Recommendation: Revise text to read as follows:
A wiring channel that is separate from the channel containing the branch circuits for light and power may be provided within the system components for the routing of communications, signaling, and ~~fiber~~ optical fiber cables.
Substantiation: This is an editorial comment. Terminology should be consistent throughout the code. Article 770 covers optical fiber cables not fiber optic cables. There are many places this change needs to be made to correlate with Article 770.
Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

18-53 Log #1085 NEC-P18 **Final Action: Reject**
(605.3)

Submitter: Michael Everhart, Steelcase Inc.
Comment on Proposal No: 18-125a
Recommendation: Revise text to read as follows:
~~A wired partition shall not extend from floor to ceiling.~~ A wired partition shall not penetrate the ceiling.
~~Exception: Where permitted by the Authority Having Jurisdiction, these relocatable wired partitions shall be permitted to extend to, but shall not penetrate, the ceiling.~~
Substantiation: NEC clean up. Proposed wording provides the same requirements as previous, with less words.
Panel Meeting Action: Reject
Panel Statement: The submitter's recommended revision completely changes the intent of the article. The proposed text deletes the rule that prohibits wired partitions from extending from floor to the ceiling and would only require wired partitions from penetrating the ceiling. In addition, removing the exception an AHJ would not be able to grant a modification to the rule.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

18-54 Log #1084 NEC-P18 **Final Action: Accept**
(605.6(6))

Submitter: Michael Everhart, Steelcase Inc.
Comment on Proposal No: 18-125a
Recommendation: Revise text to read as follows:
A cord provided ~~on the load side of a~~ on a listed Class 2 power source shall be of the type provided with the listed luminaire assembly or of the type specified in Sections 725.130 and 725.127.
Substantiation: Existing wording would require that a listed Class 2 power supply have a supply cord of "hard usage type" per Section 605.6(5). Hard usage type cord on a Class 2 power supply is not an industry standard and extremely limits the power supplies that are available for this application. Other Class 2 power supplies that are utilized in the office environment (computers, desk lamps, radios etc.) are not required to be supplied with "hard usage cords".
Adding the requirements from NEC Section 725.127 will ensure that the supply side as well as the load side of a Class 2 power supply is adequately constructed.
Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

ARTICLE 610 — CRANES AND HOISTS

12-1 Log #165 NEC-P12 **Final Action: Accept**
(610.31)

TCC Action: The Correlating Committee recognizes that the action on this comment includes the action taken on Proposal 12-12a.
Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 12-10
Recommendation: The Correlating Committee directs that the panel clarify the panel action with regard to the specific text that is to be added and deleted in 610.31.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise text to read as follows:
610.31 Runway Conductor Disconnecting Means.
A disconnecting means that has a continuous ampere rating not less than that calculated in 610.14(E) and (F) shall be provided between the runway contact conductors and the power supply. The disconnecting means shall comply with 430.109. This disconnecting means shall be as follows:
(1) Readily accessible and operable from the ground or floor level
(2) Lockable open in accordance with 110.25
(3) Open all ungrounded conductors simultaneously
(4) Placed within view of the runway contact conductors
Exception: The runway conductor disconnecting means for electrolytic cell lines shall be permitted to be placed out of view of the runway contact conductors where either of the following conditions are met:
(a) Where a location in view of the contact conductors is impracticable or introduces additional or increased hazards to persons or property

(b) In industrial installations, with written safety procedures, where conditions of maintenance and supervision ensure that only qualified persons service the equipment

Panel Statement: CMP-12 accepts the direction of the Correlating Committee to clarify the panel action with regard to the specific text that is to be added and deleted in 610.31.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

ARTICLE 620 — ELEVATORS, DUMBWAITERS, ESCALATORS, MOVING WALKS, WHEELCHAIR LIFTS, AND STAIRWAY CHAIR LIFTS

12-2 Log #1031 NEC-P12 **Final Action: Reject**
(620.2)

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 12-15a
Recommendation: Reject the addition of the second informational note.
Substantiation: This informational note is unnecessary. Do we really need a note that tells me that a different note is a note? When does it end? Should we add this note in front of all of the informational notes in the Code? "*Note: The following informational note is an informational note. Informational Note: blah blah blah… Note: The preceding informational note was a note that was informational.*"
Panel Meeting Action: Reject
Panel Statement: Informational Note No. 2 is existing and is only being relocated. It is important to recognize that the figure is for information only and not part of the requirements.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

12-3 Log #611 NEC-P12 **Final Action: Reject**
(620.2.Signal Equipment)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 12-15a
Recommendation: Revise text to read as follows:
620.2 Definitions.
Signal Equipment. Includes audible and visual equipment such as chimes, gongs, lights, ~~and~~ displays<u>, and voice output</u> that convey information to the user. **[ROP 12–15a]**
Substantiation: A lot of modern (and not so modern) elevator equipment uses recorded or generated speech to alert passengers.
Panel Meeting Action: Reject
Panel Statement: The text for this definition should be coordinated with the requirements of ASME A17.1 *Safety Code for Elevators and Escalators*.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

12-4 Log #604 NEC-P12 **Final Action: Reject**
(620.2 and 2, Informational Note 1)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 12-15a
Recommendation: Revise text to read as follows:
620.2 Definitions.
Informational Note~~ No. 1~~: The motor controller, motion controller, and operation controller are located in a single enclosure or a combination of enclosures. **[ROP 12–15a]**
~~Informational Note No. 2: Informational Note Figure 620.2 is for information only.~~**[ROP 12–15a]**
Substantiation: If the reader doesn't understand that *Informational Note Figure 620.2* is informational only, then how does this Informational Note help?
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 12-2.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

12-5 Log #748 NEC-P12 **Final Action: Accept**
(620.3(A) and (C))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 12-17
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

12-6 Log #749 NEC-P12 **Final Action: Accept**
(620.4)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 12-18
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

12-7 Log #166 NEC-P12 **Final Action: Accept**
(620.5(B))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 12-18a
Recommendation: The Correlating Committee directs that 620.5 be rewritten in mandatory language to comply with the NEC Style Manual.

In addition, the text as proposed conflicts with the Article 100 definition of "Exposed Live Parts" since exposed live parts are not suitably guarded or insulated.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-12 accepts the direction of the Correlating Committee to review 620.5(B).

See panel action and statement on Comment 12-8 where "exposed" is deleted and 620.5 is rewritten to comply with the NEC Style Manual.

Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

12-8 Log #348 NEC-P12 **Final Action: Accept in Principle**
(620.5(B))

TCC Action: The Correlating Committee directs that the phrase "shall be waived" be replaced with "shall not be required" to comply with the NEC Style Manual.
Submitter: Andy Juhasz, Kone, Inc.
Comment on Proposal No: 12-18a
Recommendation: Revise text to read as follows:

620.5 Working Clearances. Working space shall be provided about controllers, disconnecting means, and other electrical equipemnt. ~~The mimimum working space shall be not less thant hat specified in 110.26(A).~~ The clearance requirements of 110.26(A) shall be waived ~~W~~where conditions of maintenance and supervision ensure that only
qualified persons examine, adjust, service and maintain the equipment, ~~the clearance requirements of 110.26(A) shall be waived as permitted in 620.5(A) through (D)~~ and:
(A) ~~Flexible Connections to Equipment.~~ Electrical equipment in (A)(1) through (A)(4) ~~shall be permitted to be~~ is provided with flexible leads to all external connections so that it can be repositioned to meet the clear working space requirements of 110.26(A):
(1) Controllers and disconnecting means for dumbwaiters, escalators, moving walks, platform lifts and stairway chairlifts installed in the same space witht he driving machine
(23) Controllers and disconnecting means for elevators installed in the hoistway or on the care
(3) Controllers for door operators
(4) Other electrical equipment installed in the hoistway or on the car; or
(B) ~~Guards.~~ Live parts of the electrical equipment are suitably guarded, isolated, or insulated, and the equipment can be examined, adjusted, serviced, or maintained while energized without removal of this protection~~.~~ or

Informational Note: See definition of Exposed in Article 100
(C) ~~Examination, Adjusting, and Servicing.~~ Electrical equipment is not required to be examined, adjusted, serviced, or maintained while energized~~.~~ or
(D) ~~Low Voltage.~~ Uninsulated parts are at a voltage not greater than 30 volts rms, 42 volts peak, or 60 volts dc.

Substantiation: 620.5 has been rewritten in mandatory language to comply with the NEC Style Manual and has not added the word "exposed" so as not to create any conflicts with the definitions in Article 100. This is being submitted on behalf of Andy Juhasz and Tim Croushore to address the comments of the TCC.
Panel Meeting Action: Accept in Principle
Revise text to read as follows:

620.5 Working Clearances. Working space shall be provided about controllers, disconnecting means, and other electrical equipment in accordance with 110.26(A). Where conditions of maintenance and supervision ensure that only qualified persons examine, adjust, service, and maintain the equipment, the clearance requirements of 110.26(A) shall be waived where any of the following conditions exist:
(A) Flexible Connections to Equipment. Electrical equipment in (A)(1) through (A)(4) is provided with flexible leads to all external connections so that it can be repositioned to meet the clear working space requirements of 110.26(A):

(1) Controllers and disconnecting means for dumbwaiters, escalators, moving walks, platform lifts and stairway chairlifts installed in the same space with the driving machine

(2) Controllers and disconnecting means for elevators installed in the hoistway or on the car

(3) Controllers for door operators

(4) Other electrical equipment installed in the hoistway or on the car

(B) Guards. Live parts of the electrical equipment are suitably guarded, isolated, or insulated, and the equipment can be examined, adjusted, serviced, or maintained while energized without removal of this protection
(C) Examination, Adjusting, and Servicing. Electrical equipment is not required to be examined, adjusted, serviced, or maintained while energized
(D) Low Voltage. Uninsulated parts are at a voltage not greater than 30 volts rms, 42 volts peak, or 60 volts dc
Panel Statement: CMP-12 clarifies the submitter's text and removes the informational note. The titles to A, B, C and D are retained.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

12-9 Log #612 NEC-P12 **Final Action: Accept in Principle**
(620.13)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 12-19a
Recommendation: Revise text to read as follows:

620.13 Feeder and Branch-Circuit Conductors. Conductors shall have an ampacity in accordance with 620.13(A) through (D). With generator field control, the conductor ampacity shall be based on the nameplate current rating of the driving motor of the motor-generator set that supplies power to the elevator motor.
Informational Note No. 1: The heating of conductors depends on ~~root-mean-square~~ current values, which, with generator field control, are reflected by the nameplate current rating of the motor-generator driving motor rather than by the rating of the elevator motor, which represents actual but short-time and intermittent full-load current values.
(A) Conductors Supplying Single Motor. Conductors supplying a single motor shall have an ampacity not less than the percentage of motor nameplate current determined from 430.22(A) and (E).
Informational Note: Some elevator motor currents, or those of similar functions, exceed the nameplate value, but because they are inherently intermittent duty ~~and the heating of the motor and conductors is dependent on the root-mean-square (rms) current value~~, conductors are sized for duty cycle service as shown in Table 430.22(E). **[ROP 12–19a]**
(B) Conductors Supplying a Single Motor Controller. Conductors supplying a single motor controller shall have an ampacity not less than the motor controller nameplate current rating, plus all other connected loads. Motor controller nameplate current rating shall be permitted to be derived based on ~~the rms value of the~~ motor current using an intermittent duty cycle and other control system loads, if present. **[ROP 12–19a]**
__OR__
620.13 Feeder and Branch-Circuit Conductors. Conductors shall have an ampacity in accordance with 620.13(A) through (D). With generator field control, the conductor ampacity shall be based on the nameplate current rating of the driving motor of the motor-generator set that supplies power to the elevator motor.
Informational Note No. 1: The heating of conductors depends on ~~root-mean-square~~ rms current values, which, with generator field control, are reflected by the nameplate current rating of the motor-generator driving motor rather than by the rating of the elevator motor, which represents actual but short-time and intermittent full-load current values.
(A) Conductors Supplying Single Motor. Conductors supplying a single motor shall have an ampacity not less than the percentage of motor nameplate current determined from 430.22(A) and (E).
Informational Note: Some elevator motor currents, or those of similar functions, exceed the nameplate value, but because they are inherently

intermittent duty ~~and the heating of the motor and conductors is dependent on the root-mean-square (rms) current value~~, conductors are sized for duty cycle service as shown in Table 430.22(E). **[ROP 12–19a]**

(B) Conductors Supplying a Single Motor Controller. Conductors supplying a single motor controller shall have an ampacity not less than the motor controller nameplate current rating, plus all other connected loads. Motor controller nameplate current rating shall be permitted to be derived based on the rms value of the motor current using an intermittent duty cycle and other control system loads, if present**. [ROP 12–19a]**

Substantiation: ‘rms’ is never referenced in the rest of the text in connection with current, only with voltage. ‘rms’ is not really related to duty cycle as suggested in (A).

__OR__

The dominate form of reference to root-mean-square is rms in the rest of the text.

Panel Meeting Action: Accept in Principle

Revise the informational note to read as follows:

Informational Note: Some elevator motor currents, or those motor currents of similar function, exceed the motor nameplate value. Heating of the motor and conductors is dependent of the root-mean square (rms) current value and the length of operation time. Because this motor application is inherently intermittent duty, conductors are sized for duty cycle service as shown in Table 430.22(E).

Panel Statement: CMP-12 understands the issue of the submitter with regard to the informational note after 620.13(A). CMP-12 revises the text of the informational note.

Number Eligible to Vote: 11

Ballot Results: Affirmative: 11

12-10 Log #349 NEC-P12 **Final Action: Accept**

(Table 620.14)

Submitter: Andy Juhasz, Kone, Inc.

Comment on Proposal No: 12-19b

Recommendation: Add an asterisk in the second column title as follows “Demand Factor<u>*</u>” and revise the Information Note as follows:

~~Informational Note:~~ <u>*</u>Demand factors are based on 50 percent duty cycle (i.e., half time on and half time off)

Substantiation: The note to Table 620.14 has been clarified as shown in the proposal. This is being submitted on behalf of Andy Juhasz and Tim Croushore to address the comments of the TCC.

Panel Meeting Action: Accept

Number Eligible to Vote: 11

Ballot Results: Affirmative: 11

12-11 Log #167 NEC-P12 **Final Action: Accept**

(620.14, Informational Note)

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 12-19b

Recommendation: The Correlating Committee directs the panel clarify the note based upon 2.3.1 and 3.1.1 of the NEC Style Manual with respect to mandatory text.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Panel Statement: CMP-12 accepts the direction of the Correlating Committee to clarify the note.

See panel action on Comment 12-10.

Number Eligible to Vote: 11

Ballot Results: Affirmative: 11

12-12 Log #168 NEC-P12 **Final Action: Accept**

(620.21 Exception (New))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 12-28

Recommendation: The Correlating Committee directs that the panel write the Exception in a complete sentence to comply with the last sentence in 3.1.4.1 of the NEC Style Manual.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Panel Statement: CMP-12 accepts the direction of the Correlating Committee to rewrite the exception in a complete sentence.

See action on Comment 12-13.

Number Eligible to Vote: 11

Ballot Results: Affirmative: 11

12-13 Log #347 NEC-P12 **Final Action: Accept**

(620.21 Exception (New))

Submitter: Andy Juhasz, Kone, Inc.

Comment on Proposal No: 12-28

Recommendation: Revise text to read as follows:

620.21 Wiring Methods. Conductors and optical fibers located in hoistways, in escalator and moving walk wellways, in platform lifts, stairway chairlift runways, machinery spaces, control spaces, in or on cars, in machine rooms and control rooms, not including the traveling cables connecting the car or counterweight and hoistway wiring, shall be installed in rigid metal conduit, intermediate metal conduit, electrical metallic tubing, rigid nonmetallic conduit, or wireways, or shall be Type MC, MI, or AC cable unless otherwise permitted in 620.21(A) through (C).

Exception: <u>Cords and cables of L</u>listed cord and plug connected equipment <u>shall not be required to be installed in a raceway</u>.

(A) Elevators.

(1) Hoistways.

(a) Cables used in Class 2 power-limited circuits shall be permitted to be installed between risers and signal equipment and operating devices, provided the cables are

supported and protected...”.

Substantiation: The exception to 620.21 has been written as a complete sentence. This is being submitted on behalf of Andy Juhasz and Tim Croushore to address the comments of the TCC.

Panel Meeting Action: Accept

Number Eligible to Vote: 11

Ballot Results: Affirmative: 11

12-14 Log #613 NEC-P12 **Final Action: Reject**

(620.21 Exception)

Submitter: James F. Williams, Fairmont, WV

Comment on Proposal No: 12-28

Recommendation: Revise text to read as follows:

620.21 Wiring Methods. Conductors and optical fibers located in hoistways, in escalator and moving walk wellways, in platform lifts, stairway chairlift runways, machinery spaces, control spaces, in or on cars, in machine rooms and control rooms, not including the traveling cables connecting the car or counterweight and hoistway wiring, shall be installed in rigid metal conduit, intermediate metal conduit, electrical metallic tubing, rigid nonmetallic conduit, or wireways, or shall be Type MC, MI, or AC cable unless otherwise permitted in 620.21(A) through (C).

Exception: Listed cord and plug connected equipment <u>may be placed in control spaces, in or on cars, in machine rooms and control rooms</u>. **[ROP 12–28]**

Substantiation: The new exception is the size of a barn door. It would allow microwaves, curling irons, and blenders in elevator shafts with standard cordage. It is completely out of line with the almost 3 pages of requirements for wiring in 620.21.

Panel Meeting Action: Reject

Panel Statement: It is not a matter of whether the equipment can be placed in these spaces. It is a matter of whether the conductors must be placed in a raceway, which has been misinterpreted.

ASME A17.1 does not permit microwaves, curling irons, and blenders in elevator spaces.

See action on Comment 12-13 which writes the exception in a complete sentence.

Number Eligible to Vote: 11

Ballot Results: Affirmative: 11

12-15 Log #750 NEC-P12 **Final Action: Accept**

(620.36)

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 12-32

Recommendation: Continue to Accept.

Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

12-16 Log #169 NEC-P12 **Final Action: Accept**
(620.51(C)(1))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 12-37
Recommendation: The Correlating Committee directs that this proposal be reconsidered and correlated with the action taken on Proposal 12-39.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-12 accepts the direction of the Correlating Committee to reconsider and correlate with the action taken on Proposal 12-39.

See panel action on Comment 12-17.

Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

12-17 Log #350 NEC-P12 **Final Action: Accept**
(620.51(C)(1))

TCC Action: The Correlating Committee understands that the word "enclosed" was not intended to be deleted.
Submitter: Andy Juhasz, Kone, Inc.
Comment on Proposal No: 12-37
Recommendation: Revise text to read as follows:
(1) On Elevators Without Generator Field Control. On elevators without generator field control, the disconnecting means shall be located within sight of the motor field controller. Where the motor controller is located in the elevator hoistway, the disconnecting means required by 620.51(A) shall be located in a machinery space, machine room, control space or control room outside the hoistway; and an additional, fused or non-fused externally operable motor circuit switch that is lockable open in accordance with 110.25 ~~capable of being locked in the open position~~ to disconnect all ungrounded main power-supply conductors shall be located within sight of the motor controller. The additional switch shall be a listed device and shall comply with 620.91(C).
~~The provision for locking or adding a lock to the disconnecting means, required by this section, shall be installed on or at the switch or circuit breaker used as the disconnecting means and shall remain in place with or without the lock installed. Portable means for adding a lock to the switch or circuit breaker shall not be permitted.~~
Driving machines or motion and operation controllers not within sight of the disconnecting means shall be provided with a manually operated switch installed in the control circuit to prevent starting. The manually operated switch(es) shall be installed adjacent to this equipment.
Where the driving machine of an electric elevator or the hydraulic machine of a hydraulic elevator is located in a remote machine room or remote machinery space, a single means for disconnecting all ungrounded main power supply conductors shall be provided and be lockable open in accordance with 110.25. ~~capable of being locked in the open position.~~
Substantiation: Proposal 12-37 has been correlated with proposal 12-39 to show the complete final wording. This is being submitted on behalf of Andy Juhasz and Tim Croushore to address the comments of the TCC.
Panel Meeting Action: Accept
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

12-18 Log #1235 NEC-P12 **Final Action: Reject**
(620.54)

Submitter: Richard E. Loyd, Sun Lakes, AZ
Comment on Proposal No: 2-46
Recommendation: Reconsider and Accept this proposal or accept in part. accept "The disconnecting means shall be an enclosed externally operable fused motor circuit switch or circuit breaker capable of being locked in the open position and shall be located in the machine room or control room for that elevator car".
Substantiation: While attending the Southern section IAEI meeting this change was explained and it seems the proposed text from the submitter is much clearer than the wording revised by the committee.
Panel Meeting Action: Reject
Panel Statement: CMP-12 notes that the submitter is referring to Proposal 12-46.

CMP-12 reaffirms its position to accept the localization of lockable disconnecting means requirements to a new 110.25.

The text is clear as written and is harmonized with like requirements in 620.51(A), 620.51(C)(1), 620.51(C)(2), 620.53, 620.54 and 620.55.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

ARTICLE 625 — ELECTRIC VEHICLE CHARGING SYSTEM

12-19 Log #796 NEC-P12 **Final Action: Accept in Principle**
(625.1, Informational Note 2)

Submitter: Joseph M. Bablo, UL LLC
Comment on Proposal No: 12-52
Recommendation: Revise text to read as follows:
Informational Note No. 2: UL 2594-~~2011~~2012, *Standard for Electric Vehicle Supply Equipment*, is a safety standard for Electric Vehicle Supply Equipment. UL 2202-2009, *Standard for Electric Vehicle Charging System Equipment*, is a safety standard for Electric Vehicle Charging Equipment.
Substantiation: The referenced date in the proposal would not be correct. The actual date for the standard would be 2012.
Panel Meeting Action: Accept in Principle
Revise text to read as follows:
Informational Note No. 2: UL 2594-~~2011~~2013, *Standard for Electric Vehicle Supply Equipment*, is a safety standard for Electric Vehicle Supply Equipment. UL 2202-2009, *Standard for Electric Vehicle Charging System Equipment*, is a safety standard for electric vehicle charging equipment.
Panel Statement: CMP-12 requests that the Correlating Committee verify that the standard has been published. As information, UL 2594-2012 is not yet published and is proposed to have a date of 2013.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.
Comment on Affirmative:
CROUSHORE, T.: This comment should be accepted provided the particular UL standard is published. CMP-12 members stated that they reviewed the draft of the standard but not the published one because it was not available at the time of the meeting. Reference NFPA Regulations Governing Committee Projects, Section 3.3.7. Should this standard not be published at the time of the Correlating Committee meeting, this comment should be rejected.

12-20 Log #776 NEC-P12 **Final Action: Accept in Principle**
(625.2.Cable Management System)

Submitter: Gregory C. Nieminski, Gregory C. Nieminski, LLC
Comment on Proposal No: 12-52
Recommendation: Revise text to read as follows:
Cable Management System. An apparatus designed to control and organize unused lengths of cable or cord at electric vehicle charging sites.
Substantiation: The term "cable management system" has been used in the new Article 62.5.17(C) but is not defined. The term is presently used and defined in Article 626. It is proposed that the same definition be added to 625.2 or, alternatively, that the term be defined commonly in Article 100.
This comment is submitted on behalf of the EPRI Electric Transportation Infrastructure Working Council's NEC Task Force.
Panel Meeting Action: Accept in Principle
Revise text to read as follows:
Cable Management System (Electric Vehicle Supply Equipment). An apparatus designed to control and organize unused lengths of output cable to the electric vehicle.
Panel Statement: CMP-12 edits the submitter's definition to add clarity.
As information to the Correlating Committee, CMP-12 considered and dismissed a single definition in Article 100. A similar, but not identical, definition is placed in Article 626 for that equipment.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-21 Log #480 NEC-P12 **Final Action: Reject**
(625.2.Electric Vehicle and 625.3 (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 12-54
Recommendation: Revise text to read as follows:
Electric Vehicle. An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, electric motorcycles, and the like, primarily powered by an electric motor that draws current from a rechargeable storage battery, fuel cell, photovoltaic array, or other source of electric current. ~~Plug-in hybrid electric vehicles (PHEV) are considered electric vehicles. For the purpose of this article, off-road, self-propelled electric vehicles, such as industrial trucks, hoists, lifts, transports, golf carts, airline ground support equipment, tractors, boats, and the like, are not included.~~
625.3 General Requirements
625.3.1 Plug-in hybrid electric vehicles (PHEV) shall be considered electric vehicles.
625.3.2 For the purpose of this article, off-road, self-propelled electric vehicles, such as industrial trucks, hoists, lifts, transports, golf carts, airline ground support equipment, tractors, boats, and the like, are not included.
625.3.3 Both the electric vehicle connector and the electric vehicle inlet shall be considered a part of the electric vehicle coupler.
625.3.4 For the purposes of this Code, the electric vehicle inlet shall be considered to be part of the of the electric vehicle and not part of the electric vehicle supply equipment.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains a list of examples and such examples are not usually contained in definitions. Moreover, the information included should really be considered a requirement. If the CMP agrees that this is a requirement it should be placed somewhere else in Article 625, and a new section 625.3, on general requirements, is the perfect location, since NEC definitions shall not contain requirements. Moreover, the NEC manual of style does not permit the definition to contain the defined term and the second sentence of the definition contains the term "electric vehicle". The sections in 625.3.3 and 625.3.4 are associated with the comments to proposals 12-55 and 12.56.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Panel Meeting Action: Reject
Panel Statement: CMP-12 rejects changing the definition. The current definition does comply with the NEC Style Manual because it just states what an electrical vehicle is and what it is not. In addition, the submitter's text does not add clarity to the article.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-22 Log #481 NEC-P12 **Final Action: Reject**
(625.2.Electric Vehicle Connector and 625.3 (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 12-55
Recommendation: Revise text to read as follows:
Electric Vehicle Connector. A device that, by insertion into an electric vehicle inlet, establishes an electrical connection to the electric vehicle for the purpose of power transfer and information exchange. ~~This device is part of the electric vehicle coupler~~.
625.3 General Requirements
625.3.1 Plug-in hybrid electric vehicles (PHEV) shall be considered electric vehicles.
625.3.2 For the purpose of this article, off-road, self-propelled electric vehicles, such as industrial trucks, hoists, lifts, transports, golf carts, airline ground support equipment, tractors, boats, and the like, are not included.
625.3.3 Both the electric vehicle connector and the electric vehicle inlet shall be considered a part of the electric vehicle coupler.
625.3.4 For the purposes of this Code, the electric vehicle inlet shall be considered to be part of the of the electric vehicle and not part of the electric vehicle supply equipment.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains a requirement. If the CMP agrees that this is a requirement it should be placed somewhere else in Article 625, and a new section 625.3, on general requirements, is the perfect location, since NEC definitions shall not contain requirements. Moreover, the NEC manual of style does not permit the definition to contain the defined term. The sections in 625.3.1 through 625.3.4 are associated with the comments to proposals 12-54 and 12.56 also.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Panel Meeting Action: Reject
Panel Statement: CMP-12 rejects changing the definition. The current definition does comply with the NEC Style Manual because it just states what an electrical vehicle connector is and what it is not. In addition, the submitter's text does not add clarity to the article.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-23 Log #774 NEC-P12 **Final Action: Accept**
(625.2.Electric Vehicle Connector)

Submitter: Gregory C. Nieminski, Gregory C. Nieminski, LLC
Comment on Proposal No: 12-52
Recommendation: Revise text to read as follows:
~~Electric Vehicle Connector~~ Electric Vehicle Connector
Substantiation: It appears that the term was crossed out inadvertently in the NEC Committee Report on Proposals, A2013 (page 70-658,printed version), and should remain.
This comment is submitted on behalf of the EPRI Electric Transportation Infrastructure Working Council's NEC Task Force.
Panel Meeting Action: Accept
Panel Statement: The submitter's text clarifies that the text of the ROP Draft

is correct. However, the text of the Proposal 12-52 has electric vehicle connector struckthrough. CMP-12 accepts that electric vehicle connector is the intended title for this definition.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-24 Log #482 NEC-P12 **Final Action: Reject**
(625.2.Electric Vehicle Inlet and 625.3 (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 12-56
Recommendation: Revise text to read as follows:
Electric Vehicle Inlet. The device on the electric vehicle into which the electric vehicle connector is inserted for power transfer and information exchange. ~~This device is part of the electric vehicle coupler. For the purposes of this *Code,* the electric vehicle inlet is considered to be part of the electric vehicle and not part of the electric vehicle supply equipment.~~
625.3 General Requirements
625.3.1 Plug-in hybrid electric vehicles (PHEV) shall be considered electric vehicles.
625.3.2 For the purpose of this article, off-road, self-propelled electric vehicles, such as industrial trucks, hoists, lifts, transports, golf carts, airline ground support equipment, tractors, boats, and the like, are not included.
625.3.3 Both the electric vehicle connector and the electric vehicle inlet shall be considered a part of the electric vehicle coupler.
625.3.4 For the purposes of this Code, the electric vehicle inlet shall be considered to be part of the of the electric vehicle and not part of the electric vehicle supply equipment.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains a set of requirements. If the CMP agrees that this is a requirement it should be placed somewhere else in Article 625, and a new section 625.3, on general requirements, is the perfect location, since NEC definitions shall not contain requirements. Moreover, the NEC manual of style does not permit the definition to contain the defined term and the second sentence of the definition contains the term "electric vehicle inlet". The sections in 625.3.1 through 625.3.4 are associated with the comments to proposals 12-54 and 12.55 also.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Panel Meeting Action: Reject
Panel Statement: CMP-12 rejects changing the definition. The current definition does comply with the NEC Style Manual because it just states what an electrical vehicle Inlet is and what it is not. In addition, the submitter's text does not add clarity to the article.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-25 Log #1375 NEC-P12 **Final Action: Hold**
(625.2.Fastened in Place (New))

TCC Action: The Correlating Committee directs that the panel action be reported as "Hold" as this definition introduces a new concept that has not had public review.
Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 12-52
Recommendation: Add new definition:
Fastened In Place: equipment attached to a structure but removable without the use of tools, where the fastening means are specifically designed to facilitate the following:
a. Ready removal for interchange
b. Facilitate maintenance and repair
c. Repositioning to another location
Substantiation: The term or phrase "fastened in place" is not defined and subject to misinterpretation. The definition is needed for consistency throughout article 625.
Panel Meeting Action: Accept in Principle
Add new definition to 625.2 that reads as follows:
Fastened In Place. Equipment attached to a structure either permanently or where the fastening means is specifically designed to facilitate removal for interchange, maintenance and repair, and repositioning to another location.
Panel Statement: CMP-12 agrees with the need to add a definition for "fastened in place" and has revised the submitter's text to comply with the NEC Style Manual. Tools are not requisite for equipment to be fastened in place.
Since "fastened in place" is used several times in Article 625, CMP-12 defines the term to clarify for the users of the code the specific criteria to allow cord and plug connected equipment above 125 volts and 20 amps without permitting portable equipment above 125 volts and 20 amps.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-26 Log #775 NEC-P12 **Final Action: Accept in Principle**
(625.2.Power Supply Cord)

Submitter: Gregory C. Nieminski, Gregory C. Nieminski, LLC
Comment on Proposal No: 12-52
Recommendation: Revise text to read as follows:
Power Supply Cord. An assembly consisting of an attachment plug cap and length of flexible cord that connects the equipment (E SE) to a receptacle.
Substantiation: The term "attachment plug cap" appears only once in Article 625 in this definition. The primary term "attachment plug" is used everywhere else in Article 625 and should be used here for consistency. It is also the predominant term used in the NEC and defined in Article 100:
Attachment Plug (Plug Cap) (Plug). A device that, by insertion in a receptacle, establishes a connection between the conductors of the attached flexible cord and the conductors connected permanently to the receptacle.
Attachment plug cap is a term referring to an older design of an attachment plug that permitted the flexible cord to be knotted for strain relief purposes and covered by a "cap" that was part of the attachment plug assembly. The term is not used in LZ 191. Standard for Attachment Plugs and Receptacles, nor is the method of using a knot for strain relief purposes included in the Standard.
This comment is submitted on behalf of the EPRI Electric Transportation Infrastructure Working Council's NEC Task Force.
Panel Meeting Action: Accept in Principle
Revise text to read as follows:
Power Supply Cord. An assembly consisting of an attachment plug and length of flexible cord that connects the electric vehicle supply equipment (EVSE) to a receptacle.
Panel Statement: CMP-12 revises the submitter's text to remove "cap," adds "electric vehicle supply" and editorially correct EVSE.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-27 Log #797 NEC-P12 **Final Action: Accept in Principle**
(625.10(A) and Exception (New))

Submitter: Joseph M. Bablo, UL LLC
Comment on Proposal No: 12-52
Recommendation: Revise text to read as follows:
625.10 Electric Vehicle Coupler.
The electric vehicle coupler shall comply with 625.10(A) through (F).
(A) Polarization. The electric vehicle coupler shall be polarized ~~unless part of a listed electric vehicle charging system or an electric vehicle supply equipment system~~.
Exception: A coupler that is listed as part of the electric vehicle supply equipment.
Substantiation: The intent of this clause would be that the coupler shall be polarized, but a non-polarized version is acceptable if part of a system that is listed. The word "unless" as indicated in the original proposal would infer that the coupler shall be polarized if part of a system that is not listed and non-polarized if part of a listed system. That is not the intent of the requirement. The proposed wording eliminates this possible interpretation of the clause by adding an exception that is identical to the format used in other parts of the article (see 625.17(A)(1) for example).
Panel Meeting Action: Accept in Principle
Revise text to read as follows:
(A) Polarization. The electric vehicle coupler shall be polarized.
Exception: A coupler that is part of a listed electric vehicle supply equipment.
Panel Statement: CMP-12 accepts the change to (A).
CMP-12 revises the exception for clarity.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-27a Log #CC1202 NEC-P12 **Final Action: Accept**
(625.14)

TCC Action: The Correlating Committee directs that the reference to 625.14 be changed to 625.41 in Table 220.3.
Submitter: Code-Making Panel 12,
Comment on Proposal No: 12-52
Recommendation: Renumber existing 625.14 to 625.41(New).
In Table 220.3 Additional Load Calculation References, change 625.14 to 625.41 in the column titled Section (or Part).
Substantiation: CMP-12 appropriately relocates text from 625.14 to 625.41 (New). 625.14 Rating correctly applies to Part III Installation rather than Part II Equipment Construction.
CMP-12 requests the CC review the correlation of 625.14 to 625.41 with CMP-2.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-28 Log #515 NEC-P12 **Final Action: Reject**
(625.14)

Submitter: Ken Jensen, Portland, OR
Comment on Proposal No: 12-52
Recommendation: Revise 625.14 as follows:
"625.14 Rating. Electrical vehicle supply equipment shall have sufficient rating to supply the load served. Electric vehicle charging loads shall be considered to be continuous loads for the purposes of this article. Where an automatic load management system is used, the maximum electric vehicle supply equipment load on a service or feeder or branch circuit shall be the ~~maximum load permitted~~ setting in use or communicated by the automatic load management system.
Substantiation: The original TIA sentence in question is copied below:
"Where an automatic load management system is used, the maximum electric vehicle supply equipment load on a service or feeder shall be the maximum load permitted by the automatic load management system."
The first use of the word "maximum" is clear but, the second use of the word "maximum" is confusing when applied to Electric Vehicle Supply Equipment. Replacing the words "maximum load permitted" with "setting in use or communicated" clarify the intent of the NEC.
I found there are two (2) ways of understanding or interpreting this "maximum load permitted" wording within TIA 1038 for NEC 625.14.
Today many EVSEs on-board chargers are built to use the standard called "Society of Automotive Engineers J1772". This standard addresses the problem that different premises EVSEs will have different rated ampacities and different electric vehicles will have different loads. SAE J1772 allows many combinations to interconnect with each other by having the premises EVSE communicate or provide to the electric vehicle on-board charger how much ampacity is available from that premises EVSE. Then the electric vehicle on-board charger must adjust or regulate the load so that is less than or equal to the available premises EVSE ampacity.
The following text is copied from two (2) revisions of that standard.
SAE J1772 2001
"5.3.5 EVSE Current Capacity - The EVSE provides the maximum available continuous current capacity, and by inference the rating of the protective circuit breaker, to the EV by modulating the pulse width..."
SAE J1772 2010
"5.3.5 EVSE Current capacity - The EVSE communicates the maximum available continuous current capacity to the EV/HEV by modulating the pilot duty cycle..."
Some EVSEs are built to offer a single fixed large communicated available current. However many EVSEs offer multiple or adjustable settings of communicated available current. One common EVSE I know of offers 15amp or 8amp settings. A second common EVSE I know of offers 12 amp, 16 amp, 24 amp, or 30 amp settings.
Every single one of these different values is a maximum current value. So an EVSE with multiple settings has a group of maximum current values. The group also has a maximum of all the maximum current values.
Which meaning does TIA 1038 NEC 625.14 maximum mean? Is the maximum electric vehicle supply equipment load the real setting of the EVSE?
Is the maximum electric vehicle supply equipment load the largest possible, worst case setting of the EVSE?
Replacing "maximum load permitted" with "setting or communicated" means the NEC 625.14 will allow a versatile installation of low demand low ampacity or medium demand medium ampacity, or high demand high ampacity.
Adding the wording "or branch circuit" to NEC 625.14 text simply reflect a common practice. EVSEs are often installed on a branch circuit.
Panel Meeting Action: Reject
Panel Statement: CMP-12 does not agree that the proposed wording will provide clarity. The use of the term "maximum load" is commonly understood in the NEC and is used in several sections. CMP-12 does not agree with the addition of branch circuit because the automatic load management system pertains only to the sizing of a service or feeder. Sizing of branch circuits are required to be sized for continuous loads.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-29 Log #798 NEC-P12 **Final Action: Accept**
(625.15(B))

Submitter: Joseph M. Bablo, UL LLC
Comment on Proposal No: 12-52
Recommendation: Revise text to read as follows:
625.15 Markings. The electric vehicle supply equipment shall comply with 625.15(A) through (C).
(B) Ventilation Not Required. Where marking is required by ~~625.29(C)~~ 625.52(A), the electric vehicle supply equipment shall be clearly marked by the manufacturer as follows:
VENTILATION NOT REQUIRED
The marking shall be located so as to be clearly visible after installation.
Substantiation: The reference given is part of the old text and was not updated to the new renumbering structure of the rewritten article. The proposed reference would point to the correct clause.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-30 Log #359 NEC-P12 **Final Action: Accept**
(625.17(A)(1) Exception)

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 12-52
Recommendation: Delete the exception.
~~*Exception:* A power supply cord that is listed as a part of the electric vehicle supply equipment.~~
Substantiation: There is no reason to deviate from the requirements of this section. There are already some instances of product not performing and there is not enough experience to be granting exceptions at this time. In addition the product standard is not clear as to this topic. Any and all equipment issues will reflect poorly on the industry and harm the efforts to promote this product.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-31 Log #363 NEC-P12 **Final Action: Accept in Principle**
(625.17(B)(1))

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 12-52
Recommendation: Delete the article:
(B) Connections to Other Receptacle Outlets. Electric vehicle supply equipment that is rated 250 volts maximum and complies with all of the following:
1. ~~It is part of a listed system meeting the requirements of 625.18, 625.19, 625.50 and 625.52.~~
Substantiation: 625.44(B)(1) is redundant and could imply that these requirements do not apply to all EVSE, which they do.
Panel Meeting Action: Accept in Principle
Delete the current 625.44(B)(1).
Existing 625.44(B)(2) through (B)(5) to be renumbered as 625.44(B)(1) through (B)(4).
Panel Statement: CMP-12 notes that the submitter intended to delete 625.44(B)(1) and not 625.17(B)(1).
CMP-12 does not intend to delete Article 625 as the submitter suggested.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-31a Log #CC1201 NEC-P12 **Final Action: Reject**
(625.17(B)(2))

TCC Action: The Correlating Committee directs that this Comment be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative.
Submitter: Code-Making Panel 12,
Comment on Proposal No: 12-52
Recommendation: Revise 625.17(B)(2) to read as follows:
(2) Ampacities as specified in Table 400.5(A)(1) for 14 AWG and smaller, and in the 60 C column of Table 400.5(A)(2) for 12 AWG and larger.
Substantiation: CMP-12 revises 625.17(B)(2) because no rationale has been identified for the current ampacity breakpoint for 8 AWG conductor.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 5 Negative: 6
Ballot Not Returned: 1 Ward, R.
Explanation of Negative:
BROWN, T.: It is my opinion that increasing the ampacities permitted by the present code presents a hazard because this would permit lighter duty cable to be used for the cable which is most exposed and most handled by users.
CLARK, P.: This comment should be rejected. Changing the breakpoint from 8 AWG to 12 AWG will result in a reduction of safety. Type EV cables are specified in Article 400 and Table 400.4. As specified in Table 400.4, EV cord constructions for sizes 12 and 10 AWG are the same as cords in table 400.5(A)(1) and not the heavier duty cords in table 400.5(A)(2). If this revision is implemented it will allow 12 and 10 AWG cords to be utilized at ampacities beyond what they are rated to safely handle.
HOLMES, J.: This comment should be rejected. The insulation types Table 400.5(A)(1) have substantially lower nominal insulation thickness (as much as 15 mils) than the insulations used in Table 400.5(A)(2). Using the lower insulation values at the higher ampacities will create more heat with in the cord and lead to cord insulation breakdown.
KOVACIK, J.: The Panel Action on comment 12-31a should have been Reject. The original text included an exception to using the tables. That

exception allowed the certifying body to evaluate the particular cable as part of a specific system, including all protective measures that are intended to protect that cable and are provided as part of the equipment. Revising the text as shown in the comment would remove the exception and modify the use of the tables such that the 10 AWG and 12 AWG EV cables could be used based on ampacity values in Table 400.5(A)(2). This would not be correct based on information provided by NEMA's 5EVSE section. Rejecting the comment would return the text to the original form where the exception would allow the output cable of a Listed device to be evaluated as part of that Listed device.

LOTTMANN, T.: This comment should be rejected. Changing the breakpoint from 8 AWG to 12 AWG will result in a reduction of safety. Type EV cables are specified in Article 400 and Table 400.4. As specified in Table 400.4, EV cord constructions for sizes 12 and 10 AWG are the same as cords in table 400.5(A)(1) and not the heavier duty cords in table 400.5(A)(2). If this revision is implemented it will allow #12 and #10 AWG cords to be utilized at ampacities beyond what they are rated to safely handle.

WHITE, K.: This comment should be rejected. Changing the breakpoint from 8 AWG to 12 AWG will result in a reduction of safety. Type EV cables are specified in Article 400 and Table 400.4. As specified in Table 400.4, EV cord constructions for sizes 12 and 10 AWG are the same as cords in table 400.5(A)(1) and not the heavier duty cords in table 400.5(A)(2). If this revision is implemented it will allow 12 and 10 AWG cords to be utilized at ampacities beyond what they are rated to safely handle.

Comment on Affirmative:

CROUSHORE, T.: This revision applies to the text in Proposal 12-52 and is shown in the ROP Draft for 625.17(B)(2).

12-32 Log #360 NEC-P12 **Final Action: Accept**
(625.17(B)(2) Exception)

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 12-52
Recommendation: Delete the exception.
~~*Exception:* A power supply cord that is listed as a part of the electric vehicle supply equipment.~~
Substantiation: There is no reason to deviate from the requirements of this section. There are already some instances of product not performing and there is not enough experience to be granting exceptions at this time. In addition the product standard is not clear as to this topic. Any and all equipment issues will reflect poorly on the industry and harm the efforts to promote this product.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-33 Log #361 NEC-P12 **Final Action: Accept in Principle**
(625.17(C)(2))

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 12-52
Recommendation: Revise text to read as follows:
625.17(C)(2) Where the electric vehicle supply equipment or charging system is fixed in place, the useable length of the output cable shall be measured from the cable exit of the electric vehicle supply equipment or charging system to the face of the electric vehicle connector. The term fixed in place shall include devices that are permanently wired as well as devices that are cord and plug connected and fastened in place where the fastening means are specifically designed to facilitate any of the following

a. Ready removal for interchange
b. Facilitate maintenance and repair
c. Repositioning to another location

Substantiation: The existing language could cause confusion. Adding this wording will clarify that the term "fixed in place" can include cord and plug connected devices and that they are not necessarily restricted by 625.17(C)(1).
Panel Meeting Action: Accept in Principle
Panel Statement: CMP-12 accepts the submitter's concept but not the submitter's text. See panel action on Comment 12-43a (Log CC1200).

CMP-12 also refers the submitter to Comment 12-25 for the definition of "fastened in place."

Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-34 Log #170 NEC-P12 **Final Action: Accept**
(625.18)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 12-66
Recommendation: The Correlating Committee directs that the panel clarify the panel statement on this proposal with respect to revised definitions for "Electric Vehicle Coupler" and "Electric Vehicle Interlock."
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-12 accepts the direction of the correlating committee with regard to the panel statement to revise the definitions of electric vehicle coupler and electric vehicle interlock.

The panel statement on Proposal 12-66 should have read as follows: "The panel agrees with the submitter's intent and has revised the definitions of electric vehicle connector and electric vehicle inlet."

Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-35 Log #516 NEC-P12 **Final Action: Reject**
(625.21)

Submitter: Ken Jensen, Portland, OR
Comment on Proposal No: 12-52
Recommendation: A revised 625.21 as follows:
"625.21 Overcurrent Protection. Overcurrent protection for feeders and branch circuits supplying electric vehicle supply equipment shall be sized for continuous duty and shall have a rating of not less than 125 percent of the maximum load of the electric vehicle supply equipment. Where noncontinous loads are supplied from the same feeder or branch circuit, the overcurrent device shall have a rating of not less than the sum of the noncontinous loads plus 125 percent of the continuous loads.
Where an automatic load management system is used to time shift multiple loads into sequential loads, the maximum load of the electric vehicle supply equipment shall be the maximum sequential load, for the purposes of this article.
Substantiation: NEC article 100 defines "Continuous Load" to be 3 hours or more. Real world examples of electric vehicle charge times are more than 3 hours, but less than 24 hours.
NEC 625 should clarify these questions.
May an automatic load management system apply and use time of day control, to prevent multiple simultaneous continuous loads and instead create a single sequential non over lapping (time shipping) continuous load? Should all EVSE loads plan to be simultaneous loads?
Here is an example of these two (2) questions
Assume the following:
A) Two electric vehicles in one garage
B) Two EVSEs with automatic load management
C) Both EVSEs are rated 30 amps available
D) Both EVSEs are on the same circuit
E) Both EVSE have time of day controls
F) One EVSE is adjusted or set to only provide current from 10 PM to 2 AM (4 hours only)
G) One EVSE is adjusted or set to only provide current from 2 AM to 6 AM (4 hours only)
The time of day controls are set to never over lap, so the maximum load permitted by the automatic load management will be a single sequential 30 amp continuous load.
So plan for a 30 amp continuous load.
The real measured load is 30 amps for 8 hours.
The time of day controls may be reset to enable two simultaneous 30 amp continuous loads.
So plan for a 60 amp continuous load.
Which of these is the intent of NEC 625.21?
Panel Meeting Action: Reject
Panel Statement: CMP-12 does not agree with the addition of the proposed wording. The existing wording is well established and applied in several articles throughout the code. The overcurrent protection shall be at least 125% of all continuous loads on a feeder or branch circuit plus 100% of all non-continuous loads. A continuous load is defined as maximum load lasting 3 hours or longer. All loads lasting 3 hours or longer need to be added together and the 125% factor applied to that sum.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-36 Log #783 NEC-P12 **Final Action: Reject**
(625.22)

Submitter: Gregory C. Nieminski, Gregory C. Nieminski, LLC
Comment on Proposal No: 12-71
Recommendation: Revise text to read as follows:

625.22 Personnel Protection System. The electric vehicle supply equipment shall have a listed system of protection against electric shock of personnel. ~~The personnel protection system shall be composed of listed personnel protection devices and constructional features. Where cord-and-plug-connected electric vehicle supply equipment is used, the interrupting device of a listed personnel protection system shall be provided and shall be an integral part of the attachment plug or shall be located in the power supply cable not more than 300 mm (12 in.) from the attachment plug.~~

(A) Where cord-and-plug-connected electric vehicle supply equipment, that is intended to be carried from charging location to charging location, is used, the interrupting device of a listed personnel protection system shall be provided and shall be an integral part of the attachment plug or shall be located in the power supply cable cord not more than 300 mm (12 in.) from the attachment plug.

(B) Where cord-and-plug-connected electric vehicle supply equipment is intended to be installed in a dedicated location for the purpose of charging a vehicle, has a means for temporary mounting and can be dismounted without the use of a tool, the interrupting device of a listed personnel protection system shall be provided and shall be an integral part of the attachment plug or shall be located in the power supply cable cord not more than 1.2 m (4 ft) from the attachment plug.

Substantiation: The panel statement recognizes there are conditions where a longer cord can be used safely.

EVSEs other than portable units are generally intended to be installed in a dedicated location in order to charge a vehicle. Some may be moved or relocated after installation without the use of tools (cf. UL 2594), using a mounting means similar to that used for relocatable power taps described in UL 1363, Standard for Relocatable Power Taps. Since these units would typically be mounted 0.6-0.9 m (2-3 feet) from the floor when in use, this would allow the safe use of a longer than 1 foot unprotected power supply cord yet provide adequate physical protection for the power supply cord against damage.

The term “power supply cable” should be changed to “power supply cord” to align with the new definitions.

This comment is submitted on behalf of the EPRI Electric Transportation Infrastructure Working Council’s NEC Task Force.

Panel Meeting Action: Reject

Panel Statement: There is insufficient technical substantiation to relax the current safety requirements for personnel protection. CMP-12 reaffirms its position that the personnel protection shall be an integral part of the attachment plug or shall be located in the power supply cord not more than 300 mm (12 in.) from the attachment plug. Significant technical substantiation, such as a fact finding report, would be required to justify a change to this established requirement.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 10 Negative: 1

Ballot Not Returned: 1 Ward, R.

Explanation of Negative:

MENIG, J.: I disagree with the panel’s statement that there is insufficient technical substantiation to relax the current safety requirements for personal protection as there is no quantifiable substantiation for the current requirement. I recommend that a study be performed by the Fire Research Foundation. The current requirement regarding portable or 120V cord and plug connected devices, is associated with large, heavy and moveable equipment (vending machines, portable air conditioners) that can be moved frequently resulting in possible hidden damage to the power supply cord. The equipment in this recommendation is substantially dissimilar in its construction and use.

Comment on Affirmative:

HOLMES, J.: CMP-12 should continue to support limiting the amount of unprotected cord on the supply-side of the EVSE.

12-37 Log #799 NEC-P12 **Final Action: Reject**
(625.22)

Submitter: Joseph M. Bablo, UL LLC

Comment on Proposal No: 12-52

Recommendation: Revise text to read as follows:

625.22 Personnel Protection System. The electric vehicle supply equipment shall have a listed system of protection against electric shock of personnel. Where cord-and-plug connected electric vehicle supply equipment is used, the interrupting device of a listed personnel protection system shall be provided and shall be an integral part of the attachment plug or shall be located in the power supply cord not more than 300 mm (12 in.) from the attachment plug, unless the EVSE complies with 625.44(B), in which case the interrupting device may be located within the overall device enclosure.

Substantiation: There is a disconnect between three clauses in the article, and this disconnect causes a problem in the interpretation of the wording in 625.44(B)(4). In order to clarify this intent, the wording is proposed to be added to 625.22. Rationale is as follows:

The intent of 625.44(B)(4) was to allow constructions where the interrupting device of the personnel protection system required by 625.22 was located within the device enclosure, but the power cord was allowed to be longer than the 12 inches required by 625.17(A)(3)(a), due to the other requirements within 625.44(B).

625.17(A)(3)(a) limits the cord length to 12 inches because the interrupting device of the personnel protection system required by 625.22 is located within the device enclosure.

625.17(A)(3)(b) allows the cord length to be 6 feet minimum, 15 feet maximum, provided the interrupting device of the personnel protection system required by 625.22 is located at the attachment plug or within 12 inches of the attachment plug.

The current wording in 625.22 supports this.

625.44(B) states that a product can be cord connected provided it meets all the subclauses (1) through (5). Subclause 4 states that the power cord shall be maximum 6 feet. All this does is limit the overall length of the power cord to 6 feet. However, the intent of this proposal was to allow for a 6 foot cord length when the interrupting device of the personnel protection system required by 625.22 was located within the enclosure. This would be a direct violation to 625.17(A)(3)(a) based on the current wording. The rationale for the wording in 625.44(B)(4) was that a device fixed in place, as required by 625.44(B)(3), would protect the cord by limiting the cord to 6 feet thereby keeping it off the floor and protected from abuse. In so doing, the need to protect the cord by limiting it to 12 inches is no longer required. Therefore, 625.44(B)(4) was proposed to allow a 6 foot cord length on products where the interrupting device of the personnel protection system was located within the device enclosure, but the device was wall mounted and fixed in place.

In order to clarify this intent and allow constructions that were intended to be acceptable, the wording in 625.22 is needed.

Panel Meeting Action: Reject

Panel Statement: CMP-12 does not agree that the intent of 625.44(B) is to allow the length of unprotected supply cord to be longer than 300 mm (12 in.). Significant technical substantiation, such as a fact finding report, would be required to justify a change to this established requirement.

Number Eligible to Vote: 12

Ballot Results: Affirmative: 8 Negative: 3

Ballot Not Returned: 1 Ward, R.

Explanation of Negative:

CROUSHORE, T.: This comment should be accepted. This section provides two options for the location of the listed system of protection against shock of personnel for cord-and-plug connected electric vehicle supply equipment. Option 1 has the protection contained within the plug of a cord-and-plug connected electric vehicle supply equipment. Option 2 has the protection within 300 mm (12 in) from the attachment plug. Accepting this comment would allow Option 2 to allow the protection within 1.8 M (6 feet) from the attachment plug which could place the protection as part of the Electric Vehicle Supply Equipment itself without being a separate device. I believe this is a reasonable optioin to allow the cord to be a maximum of 6 feet rather than 1 foot because there is no technical substantiation to limit the length of the cord to 1 foot. During the task group meetings, there were issues discussed where the safety device that was place at in the cord within 1 foot from the plug caused additional strain on the receptacle due to the weight of the safety device. CMP-12 remains divided on this issue and additional research or additional technical substantiation such as a fact finding report would be needed to document and provide a recommendation for an appropriate solution to this issue.

KOVACIK, J.: The Panel Action on Comment 12-37 should have been Accept. The comment would help resolve a technical inconsistency in requirements between products rated 125V and 250V, and clarify the intent of the action taken by the Panel in the 2011 NEC in TIA 11-2. In 625.44(B), the cord length for 250 V rated products is limited to 6 feet. 625.44(A) does not specify a cord length limit for 125 V rated products; 625.17(A)(3)(b) limits cord length to 6 to 15 feet for products where the interrupting device of the personnel protection system, required by 625.22, is located in the attachment plug or within the first 12 inches of the supply cord.

The current text of the draft 2014 NEC would allow for a 125 V, 16 A, AC Level 1 EV cord set, to be provided with a 15 foot power cord if the interrupting device was located in the attachment plug or within the first 12 inches of the power cord. However, a 250V product in accordance with 625.44(B) would only be allowed to have a 6 foot cord length under the same circumstances; the cord length would be protected in the same manner as the 125 V rated product, but there is no technical reason to only allow a 6 foot cord in this case. The intent of the 6 foot cord length was to protect the cord from physical abuse by not allowing it to touch the floor, based on its location and the fact that the EVSE is fastened in place. The reason the cord would be protected in this manner is that the intent of the change to 625.44(B) was to allow the interrupting device to be located within the EVSE enclosure. Comment 12-37 would clarify that for 250V products complying with 625.44(B) the interrupting device may be located in the device enclosure.

MENIG, J.: I disagree with the panel’s statement that there is insufficient technical substantiation to relax the current safety requirements for personal protection as there is no quantifiable substantiation for the current requirement. I recommend that a study be performed by the Fire Research Foundation. The current requirement regarding “fixed in place” 220V cord and plug connected EVSE, is associated with large, heavy and moveable equipment (vending machines, portable air conditioners) that can be moved frequently resulting in possible hidden damage to the power supply cord. The equipment in this recommendation is substantially dissimilar in its construction and use.

Comment on Affirmative:

HOLMES, J.: CMP-12 should continue to support limiting the amount of unprotected cord on the supply-side of the EVSE.

12-38 Log #1087 NEC-P12 **Final Action: Reject**
(625.22)

Submitter: Joseph C. Engel, Monroeville, PA

Comment on Proposal No: 12-69

Recommendation: Revise text to read as follows:

625.22 Personnel Protection System. The electric vehicle supply equipment shall have a listed system of protection against electric shock for personnel. The personnel protection system shall be composed of listed CLASS A

personnel protection devices and constructional features. Where cord-and-plug connected electric vehicle supply equipment is used, the interrupting device shall be an integral part of the attachment plug or shall be located in the power supply cable not more than 300 mm (12 in.) from the plug.
Informational Note: The INDEX under Ground-fault protection (Personnel) states "*see* Ground-fault circuit interrupters".
ARTICLE 100 defines a Ground-Fault Circuit Interrupter (GFCI) as being a CLASS A device. A CLASS A must trip at 6mA or below.
Substantiation: The Panel's Statement in support of rejecting the addition of the words "CLASS A" has missed the point. While a device can be UL Listed as being either a 6 mA or 30 mA device, NEC allows only a 6 mA "Personnel Protection System". Adding the words "CLASS A" doesn't change the requirement, only further clarifies it. The need for such clarification is obvious when one considers that more than half of the EVSEs installed today are in violation of NEC 2001 and thus could be considered unsafe.
Panel Meeting Action: Reject
Panel Statement: CMP-12 rejects specifying the type of personal protection required. In addition, current product safety requirements specify a CCID, not a GFCI, for use in EVSE. GFCIs are vulnerable to high frequency noise and DC currents that may be present during vehicle charging that may prevent or delay tripping during a fault.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-39 Log #362 NEC-P12 **Final Action: Accept in Principle**
(625.44)

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 12-52
Recommendation: Change the concluding paragraph as follows:
All other electric vehicle supply equipment shall be permanently ~~connected to the premises wiring system~~ wired and fixed in place to the supporting surface, a wall, a pole, or other structure. The electric vehicle supply equipment shall have no exposed live parts.
Substantiation: The last paragraph is revised to clarify what is not allowed to be cord and plug connected and avoids different interpretations in the field.
Panel Meeting Action: Accept in Principle
Revise the last paragraph of 625.44 to read as follows:
All other electric vehicle supply equipment shall be permanently wired and fastened in place to the supporting surface, a wall, a pole or other structure. The electric vehicle supply equipment shall have no exposed live parts.
Panel Statement: CMP-12 agrees with the submitter's text and edits to correlate with the panel action and statement on Comment 12-25.
CMP-12 changes the term "fixed in place" to "fastened in place."
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-40 Log #823 NEC-P12 **Final Action: Reject**
(625.44)

Submitter: Jeffrey L. Holmes, IBEW Local Union 1 JATC
Comment on Proposal No: 12-52
Recommendation: Delete all of part (B) and reword as follows:
(B) All other electric vehicle supply equipment shall be permanently connected and fastened in place.
Substantiation: There was no substantiation for allowing cord and plug connected EVSE up to 50 ampere rating. Most of the larger branch circuits are protected by the equipment (range & dryer), so that the possibility of unplugging the equipment under load is minimized. This would not be the case with this proposal. The supply side of the EVSE could be unplugged, under load, in a constant current status of up to 50 amperes without any safe guards. Treating EVSE as a portable appliance is a safety concern. The TIA and the proposal do not satisfy the intent of Article 625.13. The proposed 625.44 needs to be evaluated for all safety concerns in both commercial and residential applications.
Panel Meeting Action: Reject
Panel Statement: The submitter has not provided data to suggest there is an overall safety concern. Appliances such as stoves, cook tops, clothes dryers are cord and plug connected. In addition to these appliances, campers and RVs are cord and plug connected at these currents.
Users of EVs are very familiar with the process of charging by plugging and unplugging at the vehicle. The vehicle coupler is substantially more convenient (force to plug and unplug) to use than the power cord.
CMP-12 selected a 50 amp maximum rating because of the wide consumer availability of 50 amp NEMA plugs and outlets.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Ward, R.
Explanation of Negative:
HOLMES, J.: Data is not available at this point in time, because cord and plug connections were limited to Level 1(125 volt, 12-16 ampere) EVSE. Allowing cord and plug connections at the voltages and ampere ratings is simply dangerous.

12-41 Log #777 NEC-P12 **Final Action: Accept in Part**
(625.44(A))

Submitter: Gregory C. Nieminski, Gregory C. Nieminski, LLC
Comment on Proposal No: 12-52
Recommendation: Revise text to read as follows:
(A) Connections to 125-Volt, Single Phase, 15 and 20 Ampere Receptacle Outlets. Electric vehicle supply equipment intended for connection to non-locking, 2-pole.3-wire grounding type receptacle outlets rate d at 125 volts, single phase, 15 and 20 amperes or from a supply of less than 50V DC.
Informational Note: Complete details of these configuration can be found in ANSI/NEMA. WD 6-2002 (R2008), National Electrical Manufacturers Association's Wiring Devices-Dimensional Specifications, Figures 5-15, 5-20 and 5-20 ALT.
Substantiation: There are non-grounding type attachment plugs and receptacles available and sold for use with older premise wiring systems not provided with a grounding conductor. These 2-pole, 2-wire non-grounding (NEMA 1-15 and 1-20) type receptacles also exist as a part of a large installed base (pre-1960) of premise wiring systems having non-grounding type receptacles. They are sold only for replacement purposes.
An informational note has been added to identify the correct NEMA configuration for the receptacles.
Locking type receptacles should not be used as they can increase the risk of damage to the receptacle and premise wiring, possibly exposing live parts, if the vehicle were to move while still connected.
This comment is submitted on behalf of the EPRI Electric Transportation Infrastructure Working Council's NEC Task Force.
Panel Meeting Action: Accept in Part
Revise text to read as follows:
(A) Connections to 125-Volt, Single Phase, 15 and 20 Ampere Receptacle Outlets. Electric vehicle supply equipment intended for connection to non-locking, 2-pole.3-wire grounding type receptacle outlets rated at 125 volts, single phase, 15 and 20 amperes or from a supply of less than 50V DC.
Panel Statement: CMP-12 accepts the submitter's text with the exception of the informational note.
CMP-12 does not accept the informational note as it does not provide additional clarity.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-42 Log #778 NEC-P12 **Final Action: Accept in Principle in Part**
(625.44(B)(2))

Submitter: Gregory C. Nieminski, Gregory C. Nieminski, LLC
Comment on Proposal No: 12-52
Recommendation: Revise text to read as follows:
(2) It is intended for connection to non-locking, 2-pole, 3-wire and 3-pole, 4-wire grounding type receptacle outlets rated no more than 50 amperes.
Informational Note: Complete details for these non-locking type, 2-pole, 3-wire and 3-pole, 4-wire grounding type configuration can be found in ANSI/NEMAWD 6-2002 (R2008) National Electrical Manufacturers Association's Wiring Devices-Dimensional Specifications.
Substantiation: There are non-grounding type attachment plugs and receptacles available and sold for use with older premise wiring systems not provided with a grounding conductor. They are intended only for replacement purposes, not new installations (i.e. -NEMA 10-30R, 3-pole, 3-wire clothes dryer receptacle). Other 2-pole, 2-wire and 3-pole, 3-wire, single and three phase receptacles that do not provide a means for grounding are also available.
An informational note has been added to identify the correct NEMA configurations for the receptacles.
Locking type receptacles should not be used as they can increase the risk of damage to the receptacle and premise wiring, possibly exposing live parts, if the vehicle were to move while still connected.
This comment is submitted on behalf of the EPRI Electric Transportation Infrastructure Working Council's NEC Task Force.
Panel Meeting Action: Accept in Principle in Part
Revise text of 625.44(B)(2) to read as follows:
(2) It is intended for connection to a non-locking, 2-pole, 3-wire and 3-pole, 4-wire grounding type receptacle outlet rated no more than 50 amperes.
Panel Statement: CMP-12 accepts the submitter's concept in regard to the text of 625.44(B)(2) and clarifies that the receptacle outlet is a single outlet.
CMP-12 does not accept the informational note as it does not provide additional clarity.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-43 Log #779 NEC-P12 **Final Action: Accept in Principle**
(625.44(B)(2))

Submitter: Gregory C. Nieminski, Gregory C. Nieminski, LLC
Comment on Proposal No: 12-52
Recommendation: Revise text to read as follows:
(2) It is intended for connection to a receptacle outlets rated no more than 50 amperes.
Substantiation: "Receptacle outlets" may imply that there can be more than one outlet on the 50A branch circuit. This would be prohibited by the new Article 219.17 which requires one outlet per circuit.
This comment is submitted on behalf of the EPRI Electric Transportation Infrastructure Working Council's NEC Task Force.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and statement on Comment 12-42.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 10 Negative: 1
Ballot Not Returned: 1 Ward, R.
Explanation of Negative:
HOLMES, J.: Data is not available at this point in time, because cord and plug connections were limited to Level 1(125 volt, 12-16 ampere) EVSE. Allowing cord and plug connections at the voltages and ampere ratings is simply dangerous.

12-43a Log #CC1200 NEC-P12 **Final Action: Accept**
(625.44(B)(3), 625.17(C)(1), and 625.17(C)(2))

TCC Action: The Correlating Committee directs the following editorial corrections:
(1) change "of listed the electric vehicle supply equipment" to "of the listed electric vehicle supply equipment".
(2) change the words "EVSE shall be fastened in place" to "EVSE shall be fastened in place to facilitate any of the following"
The Correlating Committee directs the following subdivision titles be added for compliance with the NEC Style Manual:
625.17(C)(1) Not Fastened in Place.
625.17(C)(2) Fastened in Place.
Submitter: Code-Making Panel 12,
Comment on Proposal No: 12-52
Recommendation: Revise 625.44(B)(3) to read as follows:
(3) EVSE shall be fastened in place.
Revise 625.17(C) to read as follows:
(C) Overall Cord and Cable Length. The overall useable length shall not exceed 7.5 m (25 ft) unless equipped with a cable management system that is part of listed the electric vehicle supply equipment.
(1) Where the electric vehicle supply equipment or charging system is not fastened in place, the cord exposed useable length shall be measured from the face of the attachment plug to the face of the electric vehicle connector.
(2) Where the electric vehicle supply equipment or charging system is fastened in place, the useable length of the output cable shall be measured from the cable exit of the electric vehicle supply equipment or charging system to the face of the electric vehicle connector.
Substantiation: CMP-12 revises 625.44(B)(3), 625.17(C)(1), and 625.17(C)(2) to correlate with the new definition of fastened in place.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-44 Log #364 NEC-P12 **Final Action: Reject**
(625.44(C))

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 12-52
Recommendation: Add text to read as follows:
(C) Connections to Movable Equipment. Electric vehicle supply equipment that is listed as Movable and complies with all of the following:
1. It is listed for connection to receptacle outlets rated no more than 50 amperes
2. EVSE is listed as movable to facilitate the following:
a. Intended to be moved from one position to another between uses
Substantiation: 625.44(C) adds an exception for "Movable" Equipment which is defined in UL2594 and would have to be cord and plug connected by its design.
Panel Meeting Action: Reject
Panel Statement: CMP-12 disagrees with the submitter in that movable equipment as discussed in UL 2594 needs its own special requirements. Movable equipment is but one of many configurations permitted in the UL standard. Addressing each configuration is not necessary because the main requirements are discussed in the existing 625.44.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-45 Log #785 NEC-P12 **Final Action: Reject**
(625.48)

Submitter: Gregory C. Nieminski, Gregory C. Nieminski, LLC
Comment on Proposal No: 12-52
Recommendation: Revise text to read as follows:
Electric vehicle supply equipment and other parts of a system, either on-board or off-board the vehicle, that are ~~identified for and~~ intended to be interconnected to a vehicle and also serve as an optional standby system or an electric power production source or provide for bi-directional power feed shall be listed and marked ~~as~~ "Suitable for Bidirectional Power Feed" ~~suitable for that purpose.~~
When used as an optional standby system, the requirements of Article 702 shall apply, and when used as an electric power production source, the requirements of Article 705 shall apply.
Substantiation: The proposal in 12-52 contained the phrase "as suitable for that purpose", which is vague and unenforceable. Electric vehicle supply equipment intended for bidirectional power feed should be listed and identified by a specific marking to distinguish it from other EVSE that is not suitable for bidirectional power feed.
This comment is submitted on behalf of the EPRI Electric Transportation Infrastructure Working Council's NEC Task Force.
Panel Meeting Action: Reject
Panel Statement: The intent of 625.48 is to permit the bi-directional power flow from the premises wiring to the vehicle and from the vehicle to the premises wiring provided it is done safely.
There are two methods where this can be done safely. It can be done safely as an interconnected electric power production source as discussed in Article 705. It can also be done safely as an optional standby system as discussed in Article 702. Any bi-directional system would need to comply with one or the other or both sets of requirements to be permitted by 625.48. The text of existing 625.48 requires listing for the capabilities of optional standby, or interconnected power production, or both.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-46 Log #780 NEC-P12 **Final Action: Accept**
(625.52)

Submitter: Gregory C. Nieminski, Gregory C. Nieminski, LLC
Comment on Proposal No: 12-52
Recommendation: Revise text to read as follows:
(4) Power supply cord length for electric vehicle supply equipment fastened in place is limited to ~~6 ft (1.8 m)~~ 1.8 m (6 ft).
Substantiation: Metric units should be the primary dimension with the English units in parentheses per the style manual.
This comment is submitted on behalf of the EPRI Electric Transportation Infrastructure Working Council's NEC Task Force.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

12-47 Log #781 NEC-P12 **Final Action: Accept in Principle**
(625.52)

Submitter: Gregory C. Nieminski, Gregory C. Nieminski, LLC
Comment on Proposal No: 12-52
Recommendation: Add missing Tables 625.52(B)(1) and 625.52(B)(2) after 625.52(B)(4) Supply Circuits:

See Tables 625.52(B)(1) and 625.52(B)(2) on Page 314

Substantiation: It appears that the Tables 625.2952(DB)(1) and 625.2952(DB)(2) were not included in the printed version of NEC Committee Report on Proposals, A2013, and should be added. This may be a printing error and should be corrected to include these two Tables in the recommended text provided by CMP 12, following 625.52(B)(4).
This comment is submitted on behalf of the EPRI Electric Transportation Infrastructure Working Council's NEC Task Force.
Panel Meeting Action: Accept in Principle
Tables 625.52(B)(1) and (B)(2), in the ROP Draft, are printed out of order. Relocate Table 625.52(B)(1) before Table 625.52(B)(2).
Revise the column heading from "DC Less Than 50V" to read "DC Greater Than or Equal to 50V" in both tables.
Panel Statement: The tables are on page 70-578 of the A2013 ROP Draft. In the ROP Draft, the two tables, 625.52(B)(1) and (B)(2), are printed out of order.
CMP-12 edits the column headings.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

Table 625.~~29~~52(~~D~~B)(1) Minimum Ventilation Required in Cubic Meters per Minute (m^3/min) for Each of the Total Number of Electric Vehicles That Can Be Charged at One Time

Branch-Circuit Ampere Rating	Branch-Circuit Voltage							
		Single Phase			3 Phase			
	DC Less Than 50 V[17]	120 V	208 V	240 V or 120/240 V	208 V or 208Y/120 V	240 V	480 V or 480Y/277 V	600 V or 600Y/347 V
15	0.5	1.1	1.8	2.1	—	—	—	—
20	0.6	1.4	2.4	2.8	4.2	4.8	9.7	12
30	0.9	2.1	3.6	4.2	6.3	7.2	15	18
40	1.2	2.8	4.8	5.6	8.4	9.7	19	24
50	1.5	3.5	6.1	7.0	10	12	24	30
60	1.8	4.2	7.3	8.4	13	15	29	36
100	2.9	7.0	12	14	21	24	48	60
150		—	—	—	31	36	73	91
200		—	—	—	42	48	97	120
250		—	—	—	52	60	120	150
300		—	—	—	63	73	145	180
350		—	—	—	73	85	170	210
400		—	—	—	84	97	195	240

Table 625.~~29~~52(~~D~~B)(2) Minimum Ventilation Required in Cubic Feet per Minute (cfm) for Each of the Total Number of Electric Vehicles That Can Be Charged at One Time

Branch-Circuit Ampere Rating	Branch-Circuit Voltage							
		Single Phase			3 Phase			
	DC Less Than 50 V (17)	120 V	208 V	240 V or 120/240 V	208 V or 208Y/120 V	240 V	480 V or 480Y/277 V	600 V or 600Y/347 V
15	15.4	37	64	74				
20	20.4	49	85	99	148	171	342	427
30	30.8	74	128	148	222	256	512	641
40	41.3	99	171	197	296	342	683	854
50	51.3	123	214	246	370	427	854	1066
60	61.7	148	256	296	444	512	1025	1281
100	102.5	246	427	493	740	854	1708	2135
150		—	—	—	1110	1281	2562	3203
200		—	—	—	1480	1708	3416	4270
250		—	—	—	1850	2135	4270	5338
300		—	—	—	2221	2562	5125	6406
350		—	—	—	2591	2989	5979	7473
400		—	—	—	2961	3416	6832	8541

12-48 Log #782 NEC-P12 **Final Action: Accept in Principle**
(625.52)

Submitter: Gregory C. Nieminski, Gregory C. Nieminski, LLC
Comment on Proposal No: 12-52
Recommendation: Revise Table Heads as follows:

Table 625.52(B)(1) and 625.52(B)(2) Change Table headings to include references for DC voltages:

Branch-Circuit Ampere Rating	Branch-Circuit Voltage		
	DC Less Than 50 V	**Single Phase Alternating Current Or Direct Current**	**3 Phase Alternating Current**
	(17)		

(The remainder of the table and values would be unchanged)

Substantiation: Although the two tables have been expanded to include a column for up to 50 volts DC, the proposed Article 625-4 acknowledges DC voltages up to 600 volts. The remaining Single Phase columns in both Tables 625.52(B)(1) and 625.52(B)(2) should be revised to include references for DC voltages above 50 volts DC. This can be done by changing the headings to add Alternating Current or Direct Current in the Single Phase column heading and Alternating Current in the 3-Phase column heading, as was proposed in Proposal Number 12-76 that was "Accepted in Principal". The additional DC voltage values proposed in Proposal Number 12-76 could be added as well at the Panel's discretion.

This comment is submitted on behalf of the EPRI Electric Transportation Infrastructure Working Council's NEC Task Force.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and statement on Comment 12-47 which meets the intent of the submitter.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 11
Ballot Not Returned: 1 Ward, R.

ARTICLE 626 — ELECTRIFIED TRUCK PARKING SPACES

12-48a Log #CC1203 NEC-P12 **Final Action: Accept**
(626.2)

Submitter: Code-Making Panel 12,
Comment on Proposal No: 12-52
Recommendation: Revise the definition in 626.2 to read as follows:
Cable Management System (Electrified Truck Parking Spaces). An apparatus designed to control and organize unused lengths of cable or cord at electrified truck parking spaces.
Substantiation: CMP-12 revises the definition to properly define the difference between a Cable Management System for Electrified Truck Parking Spaces and for Electric Vehicle Output Cable.

As information to the Correlating Committee, CMP-12 considered and dismissed a single definition in Article 100. A similar, but not identical, definition is placed in Article 625 for that equipment.

This definition is revised to correlate with the revised definition of Comment 12-20.
Panel Meeting Action: Accept
Number Eligible to Vote: 11
Ballot Results: Affirmative: 10
Ballot Not Returned: 1 Ward, R.

12-49 Log #483 NEC-P12 **Final Action: Reject**
(626.2.Cord Connector and 626.4 (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 12-81
Recommendation: Revise text to read as follows:
Cord Connector. A device that, by inserting it into a truck flanged surface inlet, establishes an electrical connection to the truck for the purpose of providing power for the on-board electric loads and may provide a means for information exchange. ~~This device is part of the truck coupler.~~
626.4 General Requirements
626.4.1 Cord connectors shall be considered a part of the truck coupler.
626.4.2 Truck flanged surface inlets shall be considered a part of the truck coupler.
626.4.3 For the purposes of this article, the truck flanged surface inlet is considered to be part of the truck and not part of the electrified truck parking space supply equipment.

Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains a requirement. If the CMP agrees that this is a requirement it should be placed somewhere else in Article 626, and a new section under 625.4, on general requirements, is the perfect location, since NEC definitions shall not contain requirements. Moreover, the NEC manual of style does not permit the definition to contain the defined term. The sections 626.4.2 and 626.4.3 are associated with the comment to proposal 12-82.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Panel Meeting Action: Reject
Panel Statement: CMP-12 rejects changing the definition. The current definition does comply with the NEC Style Manual because it just states what a cord connector is. In addition, the submitter's text does not add clarity to the article.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 10
Ballot Not Returned: 1 Ward, R.

12-50 Log #484 NEC-P12 **Final Action: Reject**
(626.2.Truck Flanged Surface Inlet)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 12-82
Recommendation: Revise text to read as follows:
Truck Flanged Surface Inlet. The device(s) on the truck into which the cord connector(s) is inserted to provide electric energy and other services. ~~This device is part of the truck coupler. For the purposes of this article, the truck flanged surface inlet is considered to be part of the truck and not part of the electrified truck parking space supply equipment.~~
626.4 General Requirements
626.4.1 Cord connectors shall be considered a part of the truck coupler.
626.4.2 Truck flanged surface inlets shall be considered a part of the truck coupler.
626.4.3 For the purposes of this article, the truck flanged surface inlet is considered to be part of the truck and not part of the electrified truck parking space supply equipment.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains a requirement. If the CMP agrees that this is a requirement it should be placed somewhere else in Article 626, and a new section under 625.4, on general requirements, is the perfect location, since NEC definitions shall not contain requirements. Moreover, the NEC manual of style does not permit the definition to contain the defined term. The section 626.4.1 is associated with the comment to proposal 12-81.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Panel Meeting Action: Reject
Panel Statement: CMP-12 rejects changing the definition. The current definition does comply with the NEC Style Manual because it just states what a truck flanged surface Inlet is and is not. In addition, the submitter's text does not add clarity to the article.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 10
Ballot Not Returned: 1 Ward, R.

12-51 Log #1376 NEC-P12 **Final Action: Accept**
(626.5)

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 12-79
Recommendation: Delete the following text:
626.5 ~~The equipment located in the electrified truck parking spaces shall be permitted to be used for charging electric vehicles. Additional electric vehicle supply equipment (EVSE) shall be permitted to be located in these spaces~~.
Substantiation: NEMA opposes the panel action on proposal 12-79 (626.1) that creates a new 626.5 Electric Vehicle Charging article.
This proposal could create a safety issue as the wording of the proposed article 626.5 allow EV charging equipment in electrified truck parking spaces without demanding that it satisfies all the relevant requirements of article 625.
Panel Meeting Action: Accept
Panel Statement: CMP-12 accepts the recommendation of the submitter which deletes 626.5 in its entirety. CMP-12 recognizes the potential confusion of requirements as discussed by the submitter with regard to placing this text in 626.5. However, CMP-12 notes that electric vehicle supply equipment (EVSE) is not restricted to be located in electrified truck parking spaces. Rather, EVSE is permitted to be located within electrified truck parking spaces as long as the requirements in Article 625 for the installation of the EVSE are met.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 10
Ballot Not Returned: 1 Ward, R.

12-52 Log #784 NEC-P12 **Final Action: Accept**
(626.24(B)(1))

Submitter: Gregory C. Nieminski, Gregory C. Nieminski, LLC
Comment on Proposal No: 12-86
Recommendation: We support the panel action to reject Proposal 12-86.
Substantiation: We agree with the panel's comment reaffirming its intent to have a maximum of 3 receptacles on two different branch circuits. The original intent of the original article requiring two single receptacles was to minimize the number of connections from the truck parking space supply equipment to the truck or trucks in adjacent parking spaces. Each receptacle was intended to be connected to its own individual branch circuit.
Serious injury can occur to the operator or repairman if one of the multiple supply sources is not disconnected or its branch circuit is not opened during repair or maintenance. Minimizing the number of circuits connected to the truck will reduce the risk of such hazard.
This comment is submitted on behalf of the EPRI Electric Transportation Infrastructure Working Council's NEC Task Force.
Panel Meeting Action: Accept
Panel Statement: Accepting this comment continues to reject Proposal 12-86. There is no change to the current 626.24(B)(1) of the 2011 edition of the NEC.
Number Eligible to Vote: 11
Ballot Results: Affirmative: 10
Ballot Not Returned: 1 Ward, R.

ARTICLE 630 — ELECTRIC WELDERS

12-53 Log #614 NEC-P12 **Final Action: Accept in Principle**
(630.13)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 12-93
Recommendation: Revise text to read as follows:
630.13 Disconnecting Means. A disconnecting means shall be provided in the supply circuit for each arc welder that is not equipped with ~~a~~ an integral disconnect ~~mounted as an integral part of the welder~~ ~~and~~. Each external disconnect shall be marked to identify what arc welder it disconnects.
Substantiation: Text is extremely awkward.
Panel Meeting Action: Accept in Principle
Revise text of 630.13 to read as follows:
630.13 Disconnecting Means. A disconnecting means shall be provided in the supply circuit for each arc welder that is not equipped with a disconnect mounted as an integral part of the welder. The disconnecting means identity shall be marked in accordance with 110.22(A).
Panel Statement: CMP-12 agrees with the submitter that the text of the revised 630.13 is awkward. CMP-12 also agrees with the intent of the submitter of the proposal to identify the disconnecting means for each arc welder.
CMP-12 revises the first sentence of existing (NEC 2011) 630.13 and adds one additional sentence at the end of 630.13.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

ARTICLE 640 — AUDIO SIGNAL PROCESSING, AMPLIFICATION, AND REPRODUCTION EQUIPMENT

12-54 Log #575 NEC-P12 **Final Action: Accept**
(640.9, Informational Note 2)

Submitter: Thomas M. Burke, UL LLC
Comment on Proposal No: 12-19
Recommendation: Revise the Information Note 2 associated with requirements for listing of amplifiers to add a reference to the new standard, UL 62368-1.
Informational Note No. 2: Examples of requirements for listing amplifiers used in residential, commercial, and professional use are found in ANSI/UL 813-1996, *Commercial Audio Equipment*; ANSI/UL 1419-2011, *Professional Video and Audio Equipment*; ANSI/UL 1492-2010, *Audio-Video Products and Accessories*; and ANSI/UL 6500-2006, *Audio/Video and Musical Instrument Apparatus for Household,*
Commercial, and Similar Use; and UL 62368-1-2012, *Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements.*
Substantiation: This is one in a series of proposals to update NFPA 70 to add a reference to UL 62368-1.
ANSI/UL 62368-1, Audio/video, information and communication technology equipment – Part 1: Safety requirements, was published on February 17, 2012. This new standard will eventually replace (later this decade) both, UL 60065, Audio, Video, and Similar Electronic Apparatus-Safety Requirements, and UL 60950-1, Information Technology Equipment Safety - Part 1: General Requirements. In the meantime, multiple references to UL 6500 and UL 60950-1 in the body of the Code should be supplemented by a reference to UL 62368-1 since similar equipment complying with, and Listed to both standards will be installed per the Code. In fact, equipment already is being Listed to UL 62368-1.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

ARTICLE 645 — INFORMATION TECHNOLOGY EQUIPMENT

12-55 Log #171 NEC-P12 **Final Action: Accept**
(645)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 12-109
Recommendation: The Correlating Committee directs that this proposal be reconsidered and reviewed in its entirety for compliance with the NEC Style Manual.
Numbering between Parts should start, at minimum, with the next decade in accordance with the NEC Style Manual.
The Correlating Committee directs the panel to reconsider the titles for both Parts II and Parts III to improve clarity.
The term "power grounding" should also be reconsidered since it is not defined in the NEC.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-12 accepts the direction of the Correlating Committee to reconsider and review the proposal in its entirety.
See panel action and statement on Comment 12-56.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

12-56 Log #389 NEC-P12 **Final Action: Reject**
(645)

Submitter: Stanley Kaufman, CableSafe, Inc.
Comment on Proposal No: 12-109
Recommendation: Continue CMP 12 action to Accept In Principle and modify the text as shown:
ARTICLE 645
Information Technology Equipment
Informational Note: Text that is followed by a reference in brackets has been extracted from NFPA 75-2009, *Standard for the Protection of Information Technology Equipment*. Only editorial changes were made to the extracted text to make it consistent with this *Code*.
I. General
645.1 Scope. This article covers equipment, power-supply wiring, equipment interconnecting wiring, and grounding of information technology equipment and systems in an information technology equipment room.
Informational Note: For further information, see NFPA 75-2009, *Standard for the Protection of Information Technology Equipment*, which covers the requirements for the protection of information technology equipment and information technology equipment areas.

645.2 Definitions.

Abandoned Supply Circuits and Interconnecting Cables. Installed supply circuits and interconnecting cables that are not terminated at equipment and not identified for future use with a tag.

Critical Operations Data System. An information technology equipment system that requires continuous operation for reasons of public safety, emergency management, national security, or business continuity.

Information Technology Equipment (ITE). Equipment and systems rated 600 volts or less, normally found in offices or other business establishments and similar environments classified as ordinary locations, that are used for creation and manipulation of data, voice, video, and similar signals that are not communications equipment as defined in Part I of Article 100 and do not process communications circuits as defined in 800.2.

Informational Note: For information on listing requirements for both information technology equipment and communications equipment, see UL 60950-1-2011, *Information Technology Equipment - Safety - Part 1: General Requirements*.

Information Technology Equipment Room. A room within the information technology equipment area that contains the information technology equipment. [**75:**3.3.9]

Remote Disconnect Control. An electric device and circuit that controls a disconnecting means through a relay or equivalent device.

Zone. A physically identifiable area (such as barriers or separation by distance) within an information technology equipment room, with dedicated power and cooling systems for the information technology equipment or systems.

645.3 Other Articles. Circuits and equipment shall comply with 645.3(A) through (H), as applicable.

(A) Spread of Fire or Products of Combustion. The provisions of 300.21, 770.26, 800.26, and 820.26 shall apply to penetrations of the fire-resistant room boundary.

(B) Other Spaces Used for Environmental Air (Plenums). The provisions of 300.22(C)(1), 725.154(A), 760.53(B)(2), 760.154(A), 770.113(C), 800.113(C), and 820.113(C) and Tables 770.154(A), 800.154(A) and 820.154(A) shall apply to the space over a suspended ceiling used for environmental air handling purposes in ~~wiring and cabling in a plenum (other space used for environmental air) above~~ an information technology equipment room.

(C) Grounding. The non–current-carrying conductive members of optical fiber cables in an information technology equipment room shall be grounded in accordance with the provisions of 770.114.

(D) Electrical Classification of Data Circuits. The provisions of 725.121(A)(4) shall apply to the electrical classification of listed information technology equipment signaling circuits. The provisions of 725.139(D)(1) and 800.133(A)(1)(b) shall apply to the electrical classification of Class 2 and Class 3 circuits in the same cable with communications circuits.

(E) Fire Alarm Equipment. The provisions of Parts I, II, and III of Article 760 shall apply to fire alarm systems equipment installed in an information technology equipment room.

(F) Communications Equipment. The provisions of Parts I, II, III, IV, and V of Article 800 shall apply to communications equipment installed in an information technology equipment room. Article 645 shall apply to the powering of communications equipment in an information technology equipment room.

Informational Note: See Part I of Article 100, Definitions, for a definition of communications equipment.

(G) Community Antenna Television and Radio Distribution Systems Equipment. The provisions of Parts I, II, III, IV, and V of Article 820 shall apply to community antenna television and radio distribution systems equipment installed in an information technology equipment room. Article 645 shall apply to the powering of community antenna television and radio distribution systems equipment installed in an information technology equipment room.

(H) Cables Not in Information Technology Equipment Room. Cables extending beyond the information technology equipment room shall be subject to the applicable requirements of this *Code*.

645.4 Special Requirements for Information Technology Equipment Room. This article shall be permitted to provide alternate wiring methods within the information technology room and under the raised floor to the provisions of Chapter 3 ~~Chapters 1 through 4~~ for power wiring, Parts I and III of Article 725 for signaling wiring and Parts I and V of Article 770 for optical fiber cabling when all of the following conditions are met:

(1) Disconnecting means complying with 645.32 ~~645.30~~ are provided.

(2) A heating/ventilating/air-conditioning (HVAC) system is provided in one of the methods identified in 645.4(2)(a) or (b).

(a) a separate HVAC system that is dedicated for information technology equipment use and is separated from other
areas of occupancy

(b) an HVAC system that serves other occupancies and:

(1) also serves the information technology equipment room; and

(2) provides fire/smoke dampers at the point of penetration of the room boundary; and

(3) activates the damper operation upon initiation by smoke detector alarms, by operation of the disconnecting means required by 645.32 ~~645.30~~, or both.

Exception: Where information technology equipment is installed in a critical operations data system in compliance with 645.32(B) ~~645.10(B)~~, a procedure shall be permitted that controls the cessation of the air circulation within the room or zone.

Informational Note: For further information, see NFPA 75-2009, *Standard for the Protection of Information Technology Equipment*, Chapter 10, 10.1, 10.1.1, 10.1.2, and 10.1.3.

(3) All information technology and communications equipment installed in the room is listed.

(4) The room is occupied by, and accessible to, only those personnel needed for the maintenance and functional operation of the installed information technology equipment.

(5) The room is separated from other occupancies by fire-resistant-rated walls, floors, and ceilings with protected openings.

Informational Note: For further information on room construction requirements, see NFPA 75-2009, *Standard for the Protection of Information Technology Equipment*, Chapter 5.

(6) Only electrical equipment and wiring associated with the operation of the information technology room is installed in the room.

Informational Note: HVAC systems, communications systems, and monitoring systems such as telephone, fire alarm systems, security systems, water detection systems, and other related protective equipment are examples of equipment associated with the operation of the information technology room.

~~(7) If a raised floor is present, the raised floor is of approved construction, and the area under the floor is accessible.~~

~~(8) If a raised floor in present, ventilation in the underfloor area is used for the information technology equipment room only, except as provided in 645.4(2). The ventilation system shall also be so arranged, with approved smoke detection devices, that upon the detection of fire or products of combustion in the underfloor space, the circulation of air will cease.~~

~~(9) If a raised floor is present, openings for cords and cables protect cords and cables against abrasion and minimize the entrance of debris beneath the floor.~~

II Wiring Methods

645.20 Equipment Grounding and Bonding. All exposed non–current-carrying metal parts of an information technology system shall be bonded to the equipment grounding conductor in accordance with the provisions of Parts V, VI and VII of Article 250 or shall be double insulated. Where signal reference structures are installed, they shall be bonded to the equipment grounding conductor provided for the information technology equipment. Any auxiliary grounding electrode(s) installed for information technology equipment shall be installed in accordance with the provisions of 250.54.

Informational Note No. 1: The bonding requirements in the product standards governing this listed equipment ensure that it complies with Article 250.

Informational Note No. 2: Where isolated grounding-type receptacles are used, see 250.146(D) and 406.3(D).

645.21 System Grounding. Separately derived power systems shall be installed in accordance with the provisions of Part II or Article 250. Power systems derived within listed information technology equipment that supply information technology systems through receptacles or cable assemblies supplied as part of this equipment shall not be considered separately derived for the purpose of applying 250.30.

~~**645.15 Grounding.** All exposed non–current-carrying metal parts of an information technology system shall be bonded to the equipment grounding conductor or shall be double insulated. Where signal reference structures are installed, they shall be bonded to the equipment grounding conductor provided for the information technology equipment. Any auxiliary grounding electrode(s) installed for information technology equipment shall be installed in accordance with Section 250.54.~~

~~Informational Note: The bonding requirements in the product standards governing this listed equipment ensure that it complies with Article 250.~~

~~**645.25**~~ **645.22 Engineering Supervision.** As an alternative to the feeder and service load calculations required by Parts III and IV of Article 220, feeder and service load calculations for new or existing loads shall be permitted to be used if provided by qualified persons under engineering supervision.

~~**645.26**~~ **645.23 Ampacity of Branch-Circuit Conductors.** The branch-circuit conductors supplying one or more units of information technology equipment shall have an ampacity not less than 125 percent of the total connected load.

~~645.16~~ **645.24 Equipment Marking.** Each unit of an information technology system supplied by a branch circuit shall be provided with a manufacturer's nameplate, which shall also include the input power requirements for voltage, frequency, and maximum rated load in amperes.

~~**645.18**~~ **645.25 Abandoned Supply Circuits and Interconnecting Cables.** The accessible portion of abandoned supply circuits and interconnecting cables shall be removed unless contained in a raceway.

~~**645.19**~~ **645.26 Installed Supply Circuits and Interconnecting Cables Identified for Future Use.**

(1) Supply circuits and interconnecting cables identified for future use shall be marked with a tag of sufficient durability to withstand the environment involved.

(2) Supply circuit tags and interconnecting cable tags shall have the following information:

(1) ~~a.~~ Date identified for future use

(2) ~~b.~~ Date of intended use

(3) ~~c.~~ Information relating to the intended future use

~~**645.13**~~ **645.27 Physical Protection of Supply circuits and Interconnecting Cables.** Where exposed to physical damage, supply circuits and interconnecting cables shall be protected.

~~645.14~~ 645.28 Securing in Place. Power cables; communications cables; connecting cables; interconnecting cables; and associated boxes, connectors, plugs, and receptacles that are listed as part of, or for, information technology equipment shall not be required to be secured in place.

~~II. Power Circuits~~

~~645.20~~ 645.30 Uninterruptible Power Supplies (UPSs). Except for installations and constructions covered in 645.30(1) ~~645.20(1)~~ or (2), UPS systems installed within the information technology equipment room, and their supply and output circuits, shall comply with 645.32 ~~645.30~~. The disconnecting means shall also disconnect the battery from its load.

(1) Installations qualifying under the provisions of Article 685

(2) Power sources limited to 750 volt-amperes or less derived either from UPS equipment or from battery circuits integral to electronic equipment

~~645.21~~ 645.31 Power Distribution Units. Power distribution units that are used for information technology equipment shall be permitted to have multiple panelboards within a single cabinet, if the power distribution unit is utilization equipment listed for information technology application.

~~**645.22 Power Systems Grounding.** Power systems derived within listed information technology equipment that supply information technology systems through receptacles or cable assemblies supplied as part of this equipment shall not be considered separately derived for the purpose of applying 250.30~~

~~Informational Note: Where isolated grounding-type receptacles are used, see 250.146(D) and 406.3(D).~~

~~645.30~~ 645.32 Disconnecting Means. An approved means shall be provided to disconnect power to all electronic equipment in the information technology equipment room or in designated zones within the room. There shall also be a similar approved means to disconnect the power to all dedicated HVAC systems serving the room or designated zones and shall cause all required fire/smoke dampers to close. The installation of remote disconnect controls shall be in accordance with (A) through (B).

Exception No. 1: Installations qualifying under the provisions of Article 685.

(A) Remote Disconnect Controls.

(1) Remote disconnect means shall be located at approved locations readily accessible in case of fire to authorized personnel and emergency responders.

(2) The remote disconnect controls for the control of electronic equipment power and HVAC systems shall be grouped and identified. A single means to control both systems shall be permitted.

(3) Where multiple zones are created, each zone shall have an approved means to confine fire or products of combustion to within the zone.

(4) Additional means to prevent unintentional operation of remote disconnect controls shall be permitted.

Informational Note: For further information, see NFPA 75-2009, *Standard for the Protection of Information Technology Equipment.*

(B) Critical Operations Data Systems. Remote disconnecting controls shall not be required for critical operations data systems when all of the following conditions are met:

(1) An approved procedure has been established and maintained for removing power and air movement within the room or zone.

(2) Qualified personnel are continuously available to meet emergency responders and to advise them of disconnecting methods.

(3) A smoke-sensing fire detection system is in place.

Informational Note: For further information, see *NFPA 72*-2010, *National Fire Alarm and Signaling Code*.

(4) An approved fire suppression system suitable for the application is in place.

(5) ~~Signal wiring under a raised floor is in compliance with~~ 645.32. Cables installed under a raised floor, other than branch-circuit wiring and power cords are installed in compliance with 645.36(A) and 645.36(A), (B) or (C), or in compliance with 300.22(C), 725.154 (A), 770.113(C) and Table 770.154(a), 800.113(C) and Table 800.154(a), or 820.113(C) and Table 820.154(a).

~~645.23~~ 645.33 Selective Coordination. Critical Operations Data System(s) overcurrent devices shall be selectively coordinated with all supply side overcurrent protective devices.

~~645.27~~ 645.34 Power-Supply Cords. Information technology equipment shall be permitted to be connected to a branch circuit by a power-supply cord.

(1) Power-supply cords shall not exceed 4.5 m (15 ft).

(2) Power cords shall be listed and a type permitted for use on listed information technology equipment or shall be constructed of listed flexible cord and listed attachment plugs and cord connectors of a type permitted for information technology equipment.

Informational Note: One method of determining if cords are of a type permitted for the purpose is found in UL 60950-1-2011 ~~2007~~, *Safety of Information Technology Equipment - Safety - Part 1: General Requirements.*

~~645.28~~ 645.35 Interconnecting Cables. Separate information technology equipment units shall be permitted to be interconnected by means of listed cables and cable assemblies. The 4.5 m (15 ft) limitation in 645.34(1) ~~645.27(1)~~ shall not apply to interconnecting cables.

~~645.29~~ 645.36 Under Raised Floors. Power cables, connecting cables, interconnecting cables, cord-and-plug connections, and receptacles associated with the information technology equipment shall be permitted to be installed under a raised floor ~~shall comply with (1) through (4):~~ provided the conditions of 645.36(A)are met. The installation of branch circuit conductors shall be in accordance with the provisions of 645.36(B). The installation of electrical supply cords, data cables, interconnecting cables and grounding conductors shall be in accordance with the provisions of 645.36(C). The installation of optical fiber cables shall be in accordance with the provisions of 645. 36(D):

(A) Conditions

(1) The raised floor is of approved construction, and the area under the floor is accessible.

(2) Ventilation in the underfloor area is used for the information technology equipment room only, except as provided in 645.4(2). The ventilation system is arranged, with approved smoke detection devices, that upon the detection of fire or products of combustion in the underfloor space, the circulation of air will cease.

(3) Openings in raised floors for cords and cables protect cords and cables against abrasion and minimize the entrance of debris beneath the floor.

(B) Installation Requirements for Branch Circuit Supply Conductors Under a Raised Floor.

(1) The provisions of 300.11 shall apply

(2) The provisions of 300.22(C) shall apply.

Exception No. 1 Rigid metal conduit with an overall nonmetallic covering, rigid nonmetallic conduit, electrical nonmetallic tubing, metal wireway without metal covers, nonmetallic wireway, surface nonmetallic raceway, liquidtight flexible metal conduit, liquidtight flexible nonmetallic conduit and associated nonmetallic boxes or enclosures shall be permitted to be installed under a raised floor.

Exception No. 2: Type MI cable with an overall nonmetallic covering and Type MC cable with an overall nonmetallic covering shall be permitted to be installed under a raised floor.

~~(1) The branch-circuit supply conductors to receptacles or field-wired equipment are in rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, electrical metallic tubing electrical nonmetallic tubing, metal wireway, nonmetallic wireway, surface metal raceway with metal cover, surface nonmetallic raceway, flexible metal conduit, liquidtight flexible metal conduit, or liquidtight flexible nonmetallic conduit, Type MI cable, Type MC cable, or Type AC or Type TC cable and associated metallic and nonmetallic boxes or enclosures. These supply conductors shall be installed in accordance with the requirements of 300.11.~~

(C) Installation Requirements for Electrical Supply Cords, Data Cables, Interconnecting Cables and Grounding Conductors Under a Raised Floor. The following cords, cables and conductors shall be permitted to be installed under a raised floor.

(1~~2~~) Supply cords of listed information technology equipment in accordance with 645.34 ~~645.27~~ ~~shall be permitted.~~

(2~~3~~) Interconnecting cables ~~shall be~~ enclosed in a raceway

(3~~4~~) Equipment grounding conductors

~~III. Signaling Circuits~~

~~**645.31 Under Raised Floors- General.** The following wiring cables shall be permitted:~~

~~(1) Cable type designations shown in Table 645.31~~

(2~~4~~)Listed Type DP cable having adequate fire-resistant characteristics suitable for use under raised floors of an information technology equipment room

Informational Note No. 1: One method of defining fire resistance is by establishing that the cables do not spread fire to the top of the tray in the "UL Flame Exposure, Vertical Tray Flame Test" in UL 1685-2011 ~~2000~~, Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables. The smoke measurements in the test method are not applicable.

Another method of defining fire resistance is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA "Vertical Flame Test — Cables in Cable Trays," as described in CSA C22.2 No. 0.3-M- 2001, Test Methods for Electrical Wires and Cables.

Informational Note No. 2: Informational Note: For information on listing requirements for communications raceways and cable routing assemblies, see UL 2024-2011, Signaling, Optical Fiber and Communications Raceways and Cable Routing Assemblies.

~~(2) Listed interconnecting cables, enclosed in a raceway, that interconnect separate information technology equipment units.~~

~~Renumber Table 645.5 to 645.31~~

(5) Cable type designations shown in Table 645.36

Table ~~645.5~~ 645.36 Cable Types Permitted Under Raised Floors

Article	Plenum	Riser	General Purpose
336			TC
725	CL2P & CL3P	CL2R & CL3R	CL2, CL3 & PLTC
727			ITC
760	NPLFP & FPLP	NPLFR & FPLR	NPLF & FPL
~~770~~	~~OFNP & OFCP~~	~~OFNR & OFCR~~	~~OFN & OFC~~
800	CMP	CMR	CM & CMG
820	CATVP	CATVR	CATV

645.32 Under Raised Floors in a Critical Operations Data System. Signal wiring under a raised floor in a critical operations data system shall be in compliance with 300.22(C), 725.154(A), 770.113(C) and Table 770.154(a), 800.113(C) and Table 800.154(a), or 820.113(C) and Table 820.154(a).
(A) Installation Requirements for Optical Fiber Cables Under a Raised Floor. Optical fiber cables under a raised floor shall be installed in accordance with the provisions of 770.113(C) and Table 770.154(a).
Exception: Types ORNR, OFCR, OFN and OFC shall be permitted to be installed under a raised floor.

Substantiation: This is one of several Comments prepared by the CMP 12 Article 645 Task Group consisting of CMP 12 members Tom Brown, Tim Croushore, Tom Hedges, Bob Johnson, Stan Kaufman, John Kovacik, Todd Lottmann and Jose Salazar.

The Task Group was appointed by CMP 12 Chairman Croushore to review the reorganization. In addition, the task group took on the assignment of making recommendations to implement the Correlating Committee directives:

Reconsider and review the proposal in its entirety for compliance with the NEC Style Manual.

Renumber so that numbering between Parts should start, at minimum, with the next decade in accordance with the NEC Style Manual.

Reconsider the titles for both Parts II and Parts III to improve clarity.

Reconsidered the term "power grounding" since it is not defined in the NEC.

The Task Group's recommended text improves clarity by reorganizing Article 645 into two parts, Part I, General and Part II, Wiring Methods. The text as proposed and accepted in principle had three parts, Part I, General, Part II, Power Circuits and Part III, Signaling Circuits. Clarity is improved by having Part II, Wiring Methods cover both power and signaling because some of the wring methods, DP Cable, for example, can be used for powering or signaling. Doing so also complies with the Correlating Committee directive to reconsider the titles for Parts II and III.

The recommended text for 645.2, Definitions, restores the informational note associated with Information Technology Equipment. It had been inadvertently omitted from the proposal. With the restoration of the informational note, the recommended text for 645.2 is identical to the text in the 2011 NEC except that the reference to UL 60950 has been updated from 2007 to 2011.

The recommended text for 645.3 revises the panel action by adding "the provisions of" in several more places. See panel action on proposals 12-110a and 12-111. The recommended text for 645.3 is in compliance with the NEC Style Manual. 645.3(B) was revised to improve clarity.

The recommended revision to the introductory paragraph of 645.4, which replaces "Chapters 1 through 4" with "Chapter 3" clarifies the intent of 645.4 and reflects the titles of the Articles. The title of Chapter 1 is "General"; Chapter 2, "Wiring and Protection"; Chapter 3, "Wiring Methods; and Chapter 4 "Equipment for General Use".

The intent of Article 645 is to provide "alternate wiring methods" that are commonly found in Chapter 3 of the National Electrical Code. Article 645 provides an option to Chapter 3 wiring methods when the facility and installation meets the qualification requirements contained within Article 645 to allow such an option. The non-wiring method requirements contained in Article 645 do supplement or modify the requirements contained within Chapters 1, 2, and 4 of the NEC as per 90.3.

The recommended text for 645.4 deletes 645.4(7), (8) and (9) since it recommends moving these required conditions back to the section on wiring under raised floors (645.36(A)).

The recommended text for 645.4 revises several cross-references to coordinate with the renumbering of the referenced sections.

New Part II, Wiring Methods begins with 645.20 in compliance with the Correlating Committee directive on numbering. Part II begins with grounding and bonding and divides the grounding requirements into two logical sections, one for equipment grounding and bonding and one for systems grounding, and adds requirements for separately derived power systems. The recommended text for 645.20, Equipment Grounding and Bonding and 645.21 System Grounding replaces 645.15 Grounding and 645.22 Power Systems Grounding in the text accepted at the ROP meeting and thereby complies with the Correlating committee directive to reconsider the term "power grounding".

The recommended text for 645.20 complies with the NEC Style Manual prohibition of references to entire Articles by specifying the relevant parts of Article 250 that should apply. The accepted text from the Panel action on Proposal 12-139 continues to be included in the recommended text.

The renumbering includes reordering the sections so that the planning sections on engineering calculations (645.22 Engineering supervision) and sizing of conductors (645.23 Ampacity of Branch-Circuit Conductors) are encountered before the installation sections. Note that the title of 645.23 is expanded from Branch-Circuit Conductors to Ampacity of Branch-Circuit Conductors to have the title of the section better describe the contents of the section.

Likewise, the title of the next section (645.24 Equipment Marking) has been expanded from "Marking" to reflect that what this section is about, equipment marking and not circuit or cable marking.

The numbering within 645.26, Installed Supply Circuits and Interconnecting Cables Identified for Future Use, has been revised to comply with the NEC Style Manual. See 645.19 in the NEC ROP Preprint, where the editor made this change.

The title of the Physical Protection section (645.27), has been expanded to Physical Protection of Supply circuits and Interconnecting Cables to accurately reflect the actual content of the section.

Other than renumbering to comply with the Correlating Committee directive, the sections on securing in place, UPSs and PDUs are unchanged. The cross-references to other sections are changed wherever necessary.

Within the renumbered section on disconnecting means (645.32), section 645.32(B)(5) on signal wiring has been restored to the text in 645.10(B)(5) in the 2011 NEC (with cross-references renumbered as necessary).

Section 645.33 Selective Coordination has been placed immediately after the section on disconnecting means because relates to critical operations data systems, which is directly above it in the recommended text.

In 645.34 Power-Supply Cords, the reference to UL 60950 in the informational note, has been updated from 2007 to 2011.

The section on Interconnecting Cables is unchanged except for the renumbering of the section and renumbering of the cross-reference to the length limitation on power-supply cords.

The text for the section on wiring under raised floors has been revised to clearly state the conditions that must be satisfied before wiring is permitted under a raised floor (645.36(A)) and installation requirements are clearly labeled as installation requirements.

The recommended text for 645.4 is clear that the provisions of Chapter 3 apply to power wiring and Article 645 is permitted to provide alternate wiring methods to Chapter 3. The recommended text for the installation requirements for branch circuit conductors under a raised floor states the two sections of Chapter 3 that apply (300.11 and 300.22(C)) and then introduces the alternate wiring methods as exceptions.

The first exception covers permitted raceways and second exception covers permitted cables. Exception No. 1 includes all the raceways permitted in 645.5(E)(2) but not permitted by 300.22(C)(1) in the 2011 NEC.

The text of the Exception No. 2 correlates with CMP 3 action on proposal 3-84 which added additional prohibitions on the use of plastic jacked metal-sheathed cables in air plenums (other spaces used for environmental air). Specifically, the revision to 300.22(C)(1) permits Type MI cable without an overall nonmetallic covering, but not Type MI cable with an overall nonmetallic covering. Since Article 645 in the 2011 NEC permits Type MI cable with or without an overall nonmetallic covering, the recommended text for 645.36(B) Exception No. 2 permits plastic jacketed Type MI cable, i.e.; MI Cable with an overall nonmetallic covering.

The existing text of 300.22(C)(1) in the 2011 NEC and in the accepted text for the 2014 NEC, only permits Type MC cable without an overall nonmetallic covering, but not Type MC cable with an overall nonmetallic covering. Since Article 645 in the 2011 NEC permits Type MC cable with or without an overall nonmetallic covering, the recommended text for 645.36(B) Exception No. 2 permits plastic jacketed Type MC cable, i.e.; MC Cable with an overall nonmetallic covering.

The recommended text for 645.36(C) covers all the electrical cables and conductors permitted for electrical supply cords, data cables, interconnecting cables and grounding conductors. Type TC has been restored to Table 645.36 (renumbered Table 645.5) because it was inadvertently omitted in the processing of proposal 12-109. Optical fiber cables are deleted form Table 645.36 to avoid any possible misconception that they are substitutes for any of the electrical cables in the table.

The recommended text for 645.36(D) follows the same style as the recommended text for branch circuit conductors (645.36(B)), calling for compliance with the appropriate sections in Article 770 and then permitting other cables by exception.

IF THIS COMMENT IS ACCEPTED ARTICLE 645 WILL READ AS FOLLOWS:

ARTICLE 645

Information Technology Equipment

Informational Note: Text that is followed by a reference in brackets has been extracted from NFPA 75-2009, *Standard for the Protection of Information Technology Equipment*. Only editorial changes were made to the extracted text to make it consistent with this *Code*.

I. General

645.1 Scope. This article covers equipment, power-supply wiring, equipment interconnecting wiring, and grounding of information technology equipment and systems in an information technology equipment room.

Informational Note: For further information, see NFPA 75-2009, *Standard for the Protection of Information Technology Equipment*, which covers the requirements for the protection of information technology equipment and information technology equipment areas.

645.2 Definitions.

Abandoned Supply Circuits and Interconnecting Cables. Installed supply circuits and interconnecting cables that are not terminated at equipment and not identified for future use with a tag.

Critical Operations Data System. An information technology equipment system that requires continuous operation for reasons of public safety, emergency management, national security, or business continuity.

Information Technology Equipment (ITE). Equipment and systems rated 600 volts or less, normally found in offices or other business establishments and similar environments classified as ordinary locations, that are used for creation and manipulation of data, voice, video, and similar signals that are not communications equipment as defined in Part I of Article 100 and do not process communications circuits as defined in 800.2.

Informational Note: For information on listing requirements for both information technology equipment and communications equipment, see UL 60950-1-2011, *Information Technology Equipment - Safety - Part 1: General Requirements*.

Information Technology Equipment Room. A room within the information technology equipment area that contains the information technology equipment. [**75:**3.3.9]

Remote Disconnect Control. An electric device and circuit that controls a disconnecting means through a relay or equivalent device.

Zone. A physically identifiable area (such as barriers or separation by distance) within an information technology equipment room, with dedicated power and cooling systems for the information technology equipment or systems.

645.3 Other Articles. Circuits and equipment shall comply with 645.3(A) through (H), as applicable.

(A) Spread of Fire or Products of Combustion. The provisions of 300.21, 770.26, 800.26, and 820.26 shall apply to penetrations of the fire-resistant room boundary.

(B) Other Spaces Used for Environmental Air (Plenums). The provisions of 300.22(C)(1), 725.154(A), 760.53(B)(2), 760.154(A), 770.113(C), 800.113(C), and 820.113(C) and Tables 770.154(A), 800.154(A) and 820.154(A) shall apply to the space over a suspended ceiling used for environmental air handling purposes in an information technology equipment room.

(C) Grounding. The non–current-carrying conductive members of optical fiber cables in an information technology equipment room shall be grounded in accordance with the provisions of 770.114.

(D) Electrical Classification of Data Circuits. The provisions of 725.121(A)(4) shall apply to the electrical classification of listed information technology equipment signaling circuits. The provisions of 725.139(D)(1) and 800.133(A)(1)(b) shall apply to the electrical classification of Class 2 and Class 3 circuits in the same cable with communications circuits.

(E) Fire Alarm Equipment. The provisions of Parts I, II, and III of Article 760 shall apply to fire alarm systems equipment installed in an information technology equipment room.

(F) Communications Equipment. The provisions of Parts I, II, III, IV, and V of Article 800 shall apply to communications equipment installed in an information technology equipment room. Article 645 shall apply to the powering of communications equipment in an information technology equipment room.

Informational Note: See Part I of Article 100, Definitions, for a definition of communications equipment.

(G) Community Antenna Television and Radio Distribution Systems Equipment. The provisions of Parts I, II, III, IV, and V of Article 820 shall apply to community antenna television and radio distribution systems equipment installed in an information technology equipment room. Article 645 shall apply to the powering of community antenna television and radio distribution systems equipment installed in an information technology equipment room.

(H) Cables Not in Information Technology Equipment Room. Cables extending beyond the information technology equipment room shall be subject to the applicable requirements of this *Code*.

645.4 Special Requirements for Information Technology Equipment Room. This article shall be permitted to provide alternate wiring methods within the information technology room and under the raised floor to the provisions of Chapter 3 for power wiring, Parts I and III of Article 725 for signaling wiring and Parts I and V of Article 770 for optical fiber cabling when all of the following conditions are met:

(1) Disconnecting means complying with 645.32 are provided.

(2) A heating/ventilating/air-conditioning (HVAC) system is provided in one of the methods identified in 645.4(2)(a) or (b).

(a) a separate HVAC system that is dedicated for information technology equipment use and is separated from other areas of occupancy

(b) an HVAC system that serves other occupancies and:

(1) also serves the information technology equipment room; and

(2) provides fire/smoke dampers at the point of penetration of the room boundary; and

(3) activates the damper operation upon initiation by smoke detector alarms, by operation of the disconnecting means required by 645.32, or both.

Exception: Where information technology equipment is installed in a critical operations data system in compliance with 645.32(B), a procedure shall be permitted that controls the cessation of the air circulation within the room or zone.

Informational Note: For further information, see NFPA 75-2009, *Standard for the Protection of Information Technology Equipment*, Chapter 10, 10.1, 10.1.1, 10.1.2, and 10.1.3.

(3) All information technology and communications equipment installed in the room is listed.

(4) The room is occupied by, and accessible to, only those personnel needed for the maintenance and functional operation of the installed information technology equipment.

(5) The room is separated from other occupancies by fire-resistant-rated walls, floors, and ceilings with protected openings.

Informational Note: For further information on room construction requirements, see NFPA 75-2009, *Standard for the Protection of Information Technology Equipment*, Chapter 5.

(6) Only electrical equipment and wiring associated with the operation of the information technology room is installed in the room.

Informational Note: HVAC systems, communications systems, and monitoring systems such as telephone, fire alarm systems, security systems, water detection systems, and other related protective equipment are examples of equipment associated with the operation of the information technology room.

II Wiring Methods

645.20 Equipment Grounding and Bonding. All exposed non–current-carrying metal parts of an information technology system shall be bonded to the equipment grounding conductor in accordance with the provisions of Parts V, VI and VII of Article 250 or shall be double insulated. Where signal reference structures are installed, they shall be bonded to the equipment grounding conductor provided for the information technology equipment. Any auxiliary grounding electrode(s) installed for information technology equipment shall be installed in accordance with the provisions of 250.54.

Informational Note No. 1: The bonding requirements in the product standards governing this listed equipment ensure that it complies with Article 250.

Informational Note No. 2: Where isolated grounding-type receptacles are used, see 250.146(D) and 406.3(D).

645.21 System Grounding. Separately derived power systems shall be installed in accordance with the provisions of Part II or Article 250. Power systems derived within listed information technology equipment that supply information technology systems through receptacles or cable assemblies supplied as part of this equipment shall not be considered separately derived for the purpose of applying 250.30.

645.22 Engineering Supervision. As an alternative to the feeder and service load calculations required by Parts III and IV of Article 220, feeder and service load calculations for new or existing loads shall be permitted to be used if provided by qualified persons under engineering supervision.

645.23 Ampacity of Branch-Circuit Conductors. The branch-circuit conductors supplying one or more units of information technology equipment shall have an ampacity not less than 125 percent of the total connected load.

645.24 Equipment Marking. Each unit of an information technology system supplied by a branch circuit shall be provided with a manufacturer's nameplate, which shall also include the input power requirements for voltage, frequency, and maximum rated load in amperes.

645.25 Abandoned Supply Circuits and Interconnecting Cables. The accessible portion of abandoned supply circuits and interconnecting cables shall be removed unless contained in a raceway.

645.26 Installed Supply Circuits and Interconnecting Cables Identified for Future Use.

(1) Supply circuits and interconnecting cables identified for future use shall be marked with a tag of sufficient durability to withstand the environment involved.

(2) Supply circuit tags and interconnecting cable tags shall have the following information:

(1) Date identified for future use

(2) Date of intended use

(3) Information relating to the intended future use

645.27 Physical Protection of Supply circuits and Interconnecting Cables. Where exposed to physical damage, supply circuits and interconnecting cables shall be protected.

645.28 Securing in Place. Power cables; communications cables; connecting cables; interconnecting cables; and associated boxes, connectors, plugs, and receptacles that are listed as part of, or for, information technology equipment shall not be required to be secured in place.

645.30 Uninterruptible Power Supplies (UPSs). Except for installations and constructions covered in 645.30(1) or (2), UPS systems installed within the information technology equipment room, and their supply and output circuits, shall comply with 645.32. The disconnecting means shall also disconnect the battery from its load.

(1) Installations qualifying under the provisions of Article 685

(2) Power sources limited to 750 volt-amperes or less derived either from UPS equipment or from battery circuits integral to electronic equipment

645.31 Power Distribution Units. Power distribution units that are used for information technology equipment shall be permitted to have multiple panelboards within a single cabinet, if the power distribution unit is utilization equipment listed for information technology application.

645.32 Disconnecting Means. An approved means shall be provided to disconnect power to all electronic equipment in the information technology equipment room or in designated zones within the room. There shall also be a similar approved means to disconnect the power to all dedicated HVAC systems serving the room or designated zones and shall cause all required fire/smoke dampers to close. The installation of remote disconnect controls shall be in accordance with (A) through (B).

Exception No. 1: Installations qualifying under the provisions of Article 685.

(A) Remote Disconnect Controls.

(1) Remote disconnect means shall be located at approved locations readily accessible in case of fire to authorized personnel and emergency responders.

(2) The remote disconnect controls for the control of electronic equipment power and HVAC systems shall be grouped and identified. A single means to control both systems shall be permitted.

(3) Where multiple zones are created, each zone shall have an approved means to confine fire or products of combustion to within the zone.

(4) Additional means to prevent unintentional operation of remote disconnect controls shall be permitted.

Informational Note: For further information, see NFPA 75-2009, *Standard for the Protection of Information Technology Equipment*.

(B) Critical Operations Data Systems. Remote disconnecting controls shall not be required for critical operations data systems when all of the following conditions are met:

(1) An approved procedure has been established and maintained for removing power and air movement within the room or zone.

(2) Qualified personnel are continuously available to meet emergency responders and to advise them of disconnecting methods.

(3) A smoke-sensing fire detection system is in place.

Informational Note: For further information, see *NFPA 72*-2010, *National Fire Alarm and Signaling Code*.

(4) An approved fire suppression system suitable for the application is in place.

(5) Cables installed under a raised floor, other than branch-circuit wiring and power cords are installed in compliance with 645.36(A) and 645.36(A), (B) or (C), or in compliance with 300.22(C), 725.154 (A), 770.113(C) and Table 770.154(a), 800.113(C) and Table 800.154(a), or 820.113(C) and Table 820.154(a).

645.33 Selective Coordination. Critical Operations Data System(s) overcurrent devices shall be selectively coordinated with all supply side overcurrent protective devices.

645.34 Power-Supply Cords. Information technology equipment shall be permitted to be connected to a branch circuit by a power-supply cord.

(1) Power-supply cords shall not exceed 4.5 m (15 ft).

(2) Power cords shall be listed and a type permitted for use on listed information technology equipment or shall be constructed of listed flexible cord and listed attachment plugs and cord connectors of a type permitted for information technology equipment.

Informational Note: One method of determining if cords are of a type permitted for the purpose is found in UL 60950-1-2011, *Safety of Information Technology Equipment - Safety - Part 1: General Requirements*.

645.35 Interconnecting Cables. Separate information technology equipment units shall be permitted to be interconnected by means of listed cables and cable assemblies. The 4.5 m (15 ft) limitation in 645.34(1) shall not apply to interconnecting cables.

645.36 Under Raised Floors. Power cables, connecting cables, interconnecting cables, cord-and-plug connections, and receptacles associated with the information technology equipment shall be permitted to be installed under a raised floor provided the conditions of 645.36(A) are met. The installation of branch circuit conductors shall be in accordance with the provisions of 645.36(B). The installation of electrical supply cords, data cables, interconnecting cables and grounding conductors shall be in accordance with the provisions of 645.36(C). The installation of optical fiber cables shall be in accordance with the provisions of 645. 36(D):

(A) **Conditions**

(1) The raised floor is of approved construction, and the area under the floor is accessible.

(2) Ventilation in the underfloor area is used for the information technology equipment room only, except as provided in 645.4(2). The ventilation system is arranged, with approved smoke detection devices, that upon the detection of fire or products of combustion in the underfloor space, the circulation of air will cease.

(3) Openings in raised floors for cords and cables protect cords and cables against abrasion and minimize the entrance of debris beneath the floor.

(B) Installation Requirements for Branch Circuit Supply Conductors Under a Raised Floor.

(1) The provisions of 300.11 shall apply.

(2) The provisions of 300.22(C) shall apply.

Exception No. 1: Rigid metal conduit with an overall nonmetallic covering, rigid nonmetallic conduit, electrical nonmetallic tubing, metal wireway without metal covers, nonmetallic wireway, surface nonmetallic raceway, liquidtight flexible metal conduit, liquidtight flexible nonmetallic conduit and associated nonmetallic boxes or enclosures shall be permitted to be installed under a raised floor.

Exception No. 2: Type MI cable with an overall nonmetallic covering and Type MC cable with an overall nonmetallic covering shall be permitted to be installed under a raised floor.

(C) Installation Requirements for Electrical Supply Cords, Data Cables, Interconnecting Cables and Grounding Conductors Under a Raised Floor. The following cords, cables and conductors shall be permitted to be installed under a raised floor.

(1) Supply cords of listed information technology equipment in accordance with 645.34

(2) Interconnecting cables enclosed in a raceway

(3) Equipment grounding conductors

(4) Listed Type DP cable having adequate fire-resistant characteristics suitable for use under raised floors of an information technology equipment room

Informational Note No. 1: One method of defining fire resistance is by establishing that the cables do not spread fire to the top of the tray in the "UL Flame Exposure, Vertical Tray Flame Test" in UL 1685-2011, Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables. The smoke measurements in the test method are not applicable.

Another method of defining fire resistance is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA "Vertical Flame Test — Cables in Cable Trays," as described in CSA C22.2 No. 0.3-M- 2001, Test Methods for Electrical Wires and Cables.

Informational Note No. 2: Informational Note: For information on listing requirements for communications raceways and cable routing assemblies, see UL 2024-2011, Signaling, Optical Fiber and Communications Raceways and Cable Routing Assemblies.

(5) Cable type designations shown in Table 645.36

Table 645.36 Cable Types Permitted Under Raised Floors

Article	Plenum	Riser	General Purpose
336			TC
725	CL2P & CL3P	CL2R & CL3R	CL2, CL3 & PLTC
727			ITC
760	NPLFP & FPLP	NPLFR & FPLR	NPLF & FPL
800	CMP	CMR	CM & CMG
820	CATVP	CATVR	CATV

(D) Installation Requirements for Optical Fiber Cables Under a Raised Floor. Optical fiber cables under a raised floor shall be installed in accordance with the provisions of 770.113(C) and Table 770.154(a).

Exception: Types ORNR, OFCR, OFN and OFC shall be permitted to be installed under a raised floor.

Panel Meeting Action: Reject

Panel Statement: CMP-12 does not agree that the reorganization of Article 645 will add significant enough clarity to justify this change. The current organization of Article 645 is well understood and the major changes proposed will require a significant effort to understand the new location of requirements and update documentation, listing documents, and training information. The merit proposed by this reorganization does not outweigh the effort resulting from the changes.

The result of the voting on this comment rejects Proposal 12-109. The panel actions on the following proposals shall remain as balloted in the A2013 ROP: Proposals 12-110a, 12-111, 12-112, 12-114, 12-127, 12-128, 12-131, 12-132, 12-134, 12-137, 12-138, 12-139, 12-142, and 12-143.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 11 Negative: 2

Explanation of Negative:

BROWN, T.: No information or data was presented to support the rationalization that re-organization of Article 645 presented any significant burden to the manufacturer's of equipment covered by this article. Since most product information is made available online or in digital format, there is little or no printing cost associated with the proposed changes. Equipment manufacturer's have an obligation to routinely update their user documentation. Including these types of reorganization changes, which would require little additional effort on their part.

KAUFMAN, S.: I disagree with the panel position that the reorganization will not add sufficient clarity to justify the change. The panel accepted virtually all the changes that were processed as separate proposals (in the ROP stage) and comments (in the ROC stage). I regret not having submitted the changes to the underfloor wiring wiring section as a separate comment because that part of Article 645 is the most confusing and most in need of reorganization.

12-56a Log #CC1204 NEC-P12 **Final Action: Reject**
(645.2)

TCC Action: The Correlating Committee directs that the action be reported as "Reject" because it adds requirements into an Informational Note.

Submitter: Code-Making Panel 12,

Comment on Proposal No: 12-136

Recommendation: Add new text following the definition of Critical Operations Data System to read as follows:

Informational Note: The designation of Critical Operations Data System does not necessarily imply the site requires a Critical Operations Power System, nor does the use of a Critical Operations Power System imply the installation is a Critical Operations Data System.

Substantiation: CMP-12 adds an informational note to 645.2 Critical Operations Data System for clarity.

Panel Meeting Action: Accept

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

12-57 Log #576 NEC-P12 **Final Action: Hold**
(645.2, Informational Note)

TCC Action: The Correlating Committee directs that the action on Comment 12-57 be reported as a "Hold" because the comment contains new material that has not had public review

Submitter: Thomas M. Burke, UL LLC

Comment on Proposal No: 12-109

Recommendation: It appears that the Informational Note associated with the definition of Information Technology Equipment (ITE) will be kept, although it is not reflected in the draft ROP. If it will be kept, a reference also should be added to the new standard, UL 62368-1.

Informational Note: For information on listing requirements for both information technology equipment and communications equipment, see UL 60950-1-2007, *Information Technology Equipment - Safety - Part 1: General Requirements*; or UL 62368-1-2012, *Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements.*

Substantiation: This is one in a series of proposals to update NFPA 70 to add a reference to UL 62368-1.

ANSI/UL 62368-1, Audio/video, information and communication technology equipment – Part 1: Safety requirements, was published on February 17, 2012. This new standard will eventually replace (later this decade) both, UL 60065, Audio, Video, and Similar Electronic Apparatus-Safety Requirements, and UL 60950-1, Information Technology Equipment Safety - Part 1: General Requirements. In the meantime, multiple references to UL 60950-1 in the body of the Code should be supplemented by a reference to UL 62368-1 since similar equipment complying with, and Listed to both standards will be installed per the Code. In fact, equipment already is being Listed to UL 62368-1.

Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

12-58 Log #312 NEC-P12 **Final Action: Accept in Principle**
(645.3(B) and 645.32 (New))

TCC Action: The Correlating Committee directs that the words "the provisions of" be replaced with the word "sections." Although the NEC Style Manual does not permit the use of the word "Section", when section numbers are used in the beginning of a sentence it is appropriate to use the word "Section."

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 12-109
Recommendation: In 645.3(B) make the following changes:

(B) Plenums. The provisions of ~~Sections~~ 300.22(C)(1), 725.135(B) ~~725.154(A),~~ 760.53(B)(2), 760.135(B) ~~760.154(A),~~ 770.113(C), 800.113(C), and 820.113(C) and Tables 725.154, 760.154, 770.154(A), 800.154(A) and 820.154(A) shall apply to wiring and cabling in a plenum (other space used for environmental air) above an information technology equipment room.

In 645.32 (645.10(B) renumbered by CMP-12 action on proposal 12-109)

645.32 Under Raised Floors in a Critical Operations Data system. Signal wiring under a raised floor in a critical operations data system shall be in compliance with 300.22(C), 725.135(B) and Table 725.154 ~~(A),~~ 770.113(C) and Table 770.154(a), 800.113(C) and Table 800.154(a), or 820.113(C) and Table 820.154(a).

Substantiation: This is a correlating comment to our comments on proposal 3-144a and 3-154a to reorganize 725.154 and move the installation requirements out of 725.154 into a new section 725.135. If those comments are accepted, the references to 725.154(A) will need to be changed to correlate.

Panel Meeting Action: Accept in Principle

Revise 645.3(B) to read as follows:

(B) Plenums. The provisions of 300.22(C)(1), 725.135(B), 760.53(B)(2), 760.135(B), 770.113(C), 800.113(C), and 820.113(C) and Tables 725.154, 760.154, 770.154(A), 800.154(A) and 820.154(A) shall apply to wiring and cabling in a plenum (other space used for environmental air) above an information technology equipment room.

Revise 645.10(B)(5) to read as follows:

(5) Cables installed under a raised floor, other than branch circuit wiring and power cords installed in compliance with 645.5(E)(2) or (E)(3), or in compliance with 300.22(C), 725.135(B) and Table 725.154, 770.113(C) and Table 770.154(a), 800.113(C) and Table 800.154(a), or 820.113(C) and Table 820.154(a).

Panel Statement: CMP-12 accepts the submitter's text with regard to 645.3(B) and edits the text for 645.10(B)(5) to correlate with CMP-3 action on Comments 3-57, 3-63, 3-101 and 3-104. CMP-12 also revises 645.5(D)(2) and (D)(3) to 645.5(E)(2) and (E)(3) to point to the correct location. The panel is aware that errata was issued for 645.10(B)(5) numbered 70-11-1 item 20.

Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

12-59 Log #390 NEC-P12 **Final Action: Accept in Principle**
(645.4)

Submitter: Stanley Kaufman, CableSafe, Inc.
Comment on Proposal No: 12-112
Recommendation: Change the panel action from Accept to Accept in Principle and modify the text as shown:

This article shall be permitted to provide alternate wiring methods within the information technology room and under the raised floor to the provisions of Chapter 3 ~~Chapters 1 through 4~~ for power wiring, Parts I and III of Article 725 for signaling wiring, and Parts I and V of Article 770 for optical fiber cabling when all of the following conditions are met:

Substantiation: The recommended revision provides clarity and reflects the titles of the Articles. The title of Chapter 1 is "General"; Chapter 2, "Wiring and Protection"; Chapter 3, "Wiring Methods; and Chapter 4 "Equipment for General Use".

The intent of Article 645 is to provide "alternate wiring methods" that are commonly found in Chapter 3 of the National Electrical Code. Article 645 provides an option to Chapter 3 wiring methods when the facility and installation meets the qualification requirements contained within Article 645 to allow such an option. The non-wiring method requirements contained in Article 645 do supplement or modify the requirements contained within Chapters 1, 2, and 4 of the NEC as per 90.3.

This is one of several Comments prepared by the CMP 12 Article 645 Task Group consisting of CMP 12 members Tom Brown, Tim Croushore, Tom Hedges, Bob Johnson, Stan Kaufman, John Kovacik, Todd Lottmann and Jose Salazar.

Panel Meeting Action: Accept in Principle

Revise the first paragraph of 645.4 to read as follows:

645.4 Special Requirements for Information Technology Equipment Room. This article shall be permitted to provide alternate wiring methods to the provisions of Chapter 3 for power wiring, Parts I and III of Article 725 for signaling wiring, and Parts I and V of Article 770 for optical fiber cabling when all of the following conditions are met:

Panel Statement: CMP-12 revises the submitter's text to remove reference to "under the raised floor" and remove reference to "the information technology room". CMP-12 revises the text to make it concise.

Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

12-60 Log #1458 NEC-P12 **Final Action: Reject**
(645.4(2) Exception)

Submitter: Thomas J. Wysocki, Guardian Services, Inc.
Comment on Proposal No: 12-114
Recommendation: Delete text as follows:

~~*Exception: Where information technology equipment is installed in a critical operations data system in compliance with 645.10(B), a procedure shall be permitted that controls the cessation of the air circulation within the room or zone.*~~

Substantiation: Assuming my comment on Proposal 12-109 Paragraph 645.4 (8) to delete "The ventilation system shall also be so arranged, with approved smoke detection devices, that upon the detection of fire or products of combustion in the underfloor space, the circulation of air will cease." is accepted, the proposed 645.4 (2) Exception will not be pertinent.

Panel Meeting Action: Reject

Panel Statement: The rationale for 645 permitting non-plenum cables in the raised floor plenum is that there are fire protection requirements in the article. Conformance to NFPA 75 is not required by Article 645. All references to NFPA 75, *Standard for the Fire Protection of Information Technology Equipment*, are in informational notes only. The NEC Style Manual prohibits references to other standards in the mandatory text. The panel, in its action on Proposal 12-114, provided the relief that the submitter seeks for installations with a high level of fire protection, i.e., critical operations data systems.

Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

12-61 Log #1459 NEC-P12 **Final Action: Reject**
(645.4(8))

Submitter: Thomas J. Wysocki, Guardian Services, Inc.
Comment on Proposal No: 12-109
Recommendation: Revise text to read as follows:

(8) If a raised floor is present, ventilation in the underfloor area is used for the information technology equipment room only, except as provided in 645.4(2). ~~The ventilation system shall also be so arranged, with approved smoke detection devices, that upon the detection of fire or products of combustion in the underfloor space, the circulation of air will cease.~~

Substantiation: The text indicated for deletion deals with control of air circulation within the IT room and is outside the scope of NFPA 70 and sets forth a requirement which is often technically undesirable in modern information technology rooms.

The basis of the comment is twofold:

1) Responsibility for the protection of IT facilities is the scope of NFPA 75. Within that scope NFPA 75 covers risk considerations, construction, and operating (performance) requirements – control of airflow within an IT facility is the province of NFPA 75.

Acceptance of this comment would remove a conflict in requirements between NFPA 75 and NFPA 70 and clarify the demarcation between "what" (NFPA 75) must be done in IT facilities and "how" (NFPA 70) to accomplish the electrical installation.

The operating characteristics (performance) of an information technology equipment room are the province of NFPA 75. NFPA 70 addresses the "how" of accomplishing the functions required by NFPA 75 for operation of IT equipment and the utilities serving the IT facility. Several decisions of the Standards Council point to the responsibility of NFPA 75 with respect to control of combustible in IT facilities.

Standards Council decision 89-50 (April 1991) affirmed that the Committee on Electronic Computer Systems (NFPA 75) has responsibility for combustibles under the raised floor of a computer room. NFPA 90A 2012 Edition recognizes this fact and states the following with respect to materials installed within a raised floor plenum in a computer/data processing room:

4.3.11.5.5.5 Raised floors, intermachine cables, electrical wires, listed plenum optical fiber, communications and signaling raceways, and optical-fiber cables in computer/data processing rooms where these rooms are designed and installed in accordance with NFPA 75, Standard for the Protection of Information Technology Equipment, shall be permitted. (NFPA 90A 2012 Edition)

On March 6, 2012, the NFPA Standards Council issued a TIA which removed the paragraph 10.4.4 of NFPA 75 Edition 2009 which had extracted the exact verbiage of NFPA 70 645.5D(3) Edition 2005 (NFPA 70 645.5E(4) Edition 2011), verbiage which is now in the proposed NFPA 70 645.4(8). The NFPA 75 technical committee was clear in its intent that cessation of airflow in the underfloor space upon detection of fire or smoke under the raised floor should not be a general requirement for operation of an IT facility.

2) There is no technical basis for shutting down airflow in an IT facility upon detection of smoke or fire under a raised floor. The original basis for adding the sentence in question was not technical – rather it was an attempt to alleviate a problem related to application of building codes to underfloor spaces (NFPA 70 May 2001 ROP 12 – 100).

On the contrary in modern IT facilities, there is good technical basis not to shut down airflow upon detection of smoke or fire under the raised floor. In considering the technical merit of the 2012 TIA, the NFPA 75 technical committee took note of the following:

Today's IT servers run applications that are critical to business continuity and frequently have life safety implications. Unplanned shutdown of the IT equipment can cause loss of control over life support systems, emergency response systems, security systems and loss of essential data in process. Therefore, it may be undesirable – or even dangerous – to automatically shut down equipment that is not directly involved in a fire.

Modern server racks contain multiple processing units which can create a large amount of heat. If air conditioning equipment used to cool the servers is shut down, temperatures can increase by as much as 40 degrees in a matter of minutes, potentially causing more damage than the heat of a small electronic fire. Therefore, it is desirable to maintain cooling air flow for as long as possible.

Thermal overheat devices are built in to individual servers to immediately depower overheating components in an attempt to prevent permanent damage to entire server. If a single server or single server rack is shut down by thermal protective devices, other servers would generally remain available to maintain functionality. But if the room or area environmental cooling air suddenly would cease due to initiation of a fire detector under a raised floor, all equipment in the area could shut down on thermal overload. This would cause the uncontrolled loss of all function provided by the IT equipment and this can have serious consequences.

Fire suppression systems used in IT facilities are often designed to detect and extinguish fire in its incipient stage while cooling air flow through the facility is maintained and servers remain running. If depowering of equipment is required as part of the fire protection, such depowering is generally done in a planned, programmed sequence to minimize loss of data. When an IT facility is providing support or control related to life safety or security, the depowering sequence typically includes provision to transfer support or control functions to a backup IT facility. Determination of when it is safe to shut off ventilation to the IT equipment is part of the planned depowering sequence.

In IT facilities protected by automatic gaseous extinguishing systems, the activation of more than one detector is usually required to confirm existence of fire and thereby release the fire extinguishing gas. Air flow is taken into account in locating smoke detectors.

Cessation of normal air flow upon activation of a single smoke detector can delay the activation of additional smoke detectors in the IT facility and thereby delay release of automatic gaseous extinguishing agent in facilities equipped with such systems. The subject of airflow and its effect on fire detection in IT facilities and telecommunications facilities is the subject of ongoing research by the FPRF with the advice of a joint task group of NFPA 75 and NFPA 76 technical committee representatives. Again control of airflow is a subject for the occupancy standards rather than the NEC.

Furthermore, very recent research indicates that, for the type of fire typical in IT facilities, extinguishment may actually be aided by continuous flow of air through the fire zone. The airflow helps cool the fire zone and, because of the typically smoldering nature of these fires in their early stages, can reduce the amount of heat available to be carried by conduction to nearby materials. This is complex research to be made public shortly. The results of this research are further indication of the wisdom of the NFPA 75 technical committee's refusal to place a general requirement for cessation of airflow in the IT protection standard. Indeed the subject of airflow control in IT facilities is in the province and scope of the NFPA 75 technical committee, the membership of which includes persons closely involved with leading-edge IT technology and fire protection methods for such technology.

Upon detection of smoke or fire anywhere within the IT facility, personnel will be alerted to the danger by the fire alarm system. Personnel are given the opportunity for appropriate evacuation or response to the alarm. Cessation of airflow through the raised floor is not necessary. If personnel are not present, the features of the automatic fire protection systems are permitted to function per their design.

Panel Meeting Action: Reject

Panel Statement: The rationale for Article 645 permitting non-plenum cables in the raised floor plenum is that there are fire protection requirements in the Article. Conformance to NFPA 75 is not required by Article 645. All references to NFPA 75, *Standard for the Fire Protection of Information Technology Equipment*, are in informational notes only. The NEC Style Manual prohibits references to other standards in the mandatory text. The panel, in its action on Proposal 12-114, provided the relief that the submitter seeks for installations with a high level of fire protection, i.e., critical operations data systems.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

12-62 Log #1570 NEC-P12 **Final Action: Accept**
(645.5(10))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.

Comment on Proposal No: 12-133

Recommendation: Accept the proposal in principle. Revise text to read as follows:

The disconnecting means shall ~~be implemented by~~ comply with either (A) or (B).

Substantiation: This wording meets the panel objection, but retains the part of the proposal that eliminates phrasing that does not occur elsewhere in the NEC and replaces it with much more familiar and user-friendly language.

Panel Meeting Action: Accept

Panel Statement: CMP-12 notes that the submitter intended to refer to the last sentence of the first paragraph of 645.10.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

12-63 Log #577 NEC-P12 **Final Action: Accept**
(645.5(B))

Submitter: Thomas M. Burke, UL LLC

Comment on Proposal No: 12-109

Recommendation: Revise the Informational Note associated with 645.27(2) to reference the new standard UL 62368-1.

Informational Note: One method of determining if cords are of a type permitted for the purpose is found in UL 60950-1-2007, *Safety of Information Technology; or* UL 62368-1-2012, *Audio/Video, Information and Communication Technology Equipment – Part 1: Safety requirements.*

Substantiation: This is one in a series of proposals to update NFPA 70 to add a reference to UL 62368-1.

ANSI/UL 62368-1, Audio/video, information and communication technology equipment – Part 1: Safety requirements, was published on February 17, 2012. This new standard will eventually replace (later this decade) both, UL 60065, Audio, Video, and Similar Electronic Apparatus-Safety Requirements, and UL 60950-1, Information Technology Equipment Safety - Part 1: General Requirements. In the meantime, multiple references to UL 60950-1 in the body of the Code should be supplemented by a reference to UL 62368-1 since similar equipment complying with, and Listed to both standards will be installed per the Code. In fact, equipment already is being Listed to UL 62368-1.

Panel Meeting Action: Accept

Panel Statement: CMP12 notes the submitter intended to refer to the informational note associated with 645.5(B).

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

12-64 Log #172 NEC-P12 **Final Action: Accept**
(645.5(E)(3))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 12-128

Recommendation: The Correlating Committee directs that the panel clarify the panel action on this proposal as the accepted revision does not appear in the panel action on Proposal 12-109.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Panel Statement: CMP-12 accepts the direction of the Correlating Committee to review the panel action on Proposal 12-109.

See panel action and statement on Comment 12-56, which rejected Proposal 12-109.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

12-65 Log #1446 NEC-P12 **Final Action: Reject**
(645.10(B))

Submitter: Ralph Transue, The RJA Group, Inc.

Comment on Proposal No: 12-136

Recommendation: Add and Article 708 after "Chapters 1 through 4".

Substantiation: I submitted proposal 12-136 because some users may associate a critical operations data system with Article 708, Critical Operations Power Systems. Applying Article 708 to a data center would apply many

untenable requirements to the data center, so many that the user would choose to opt out of Article 645. The text recommended by this comment is based on Dr. Stanley Kaufman's affirmative ballot statement on proposal 12-136.
Panel Meeting Action: Reject
Panel Statement: CMP-12 understands that the comment is related to 645.4 and not 645.10(B).
CMP-12 disagrees that adding the submitter's text to 645.4 provides relief from Article 708. Only Chapters 1 through 4 of the NEC are modified by Article 645.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

12-66 Log #173 NEC-P12 **Final Action: Accept**
(645.10(B)(5))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 12-137
Recommendation: The Correlating Committee directs that the panel clarify the panel action on this proposal with respect to the location of the revised text.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-12 accepts the direction of the Correlating Committee to review the panel action on Proposal 12-137.
See panel action and statement on Comment 12-58. The panel is aware that errata was issued for 645.10(B)(5) numbered 70-11-1 item 20.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

12-67 Log #391 NEC-P12 **Final Action: Reject**
(645.10(B)(5))

Submitter: Stanley Kaufman, CableSafe, Inc.
Comment on Proposal No: 12-137
Recommendation: Change the panel action from Accept to Accept in Principle with the Panel statement "See panel action on Comment 12-xxx on Proposal 12-109.
Substantiation: In the Standards Council issued errata No. 70-11-1, item 20 fixed the renumbering of 645(D)(2) and 645(D)(3), so no action is required on that part of the Proposal.
The recommendation in the Proposal to improve clarity by adding the word "are" should be accepted in principle with reference to the Panel action on the Comment submitted on Proposal 12-109 by the CMP 12 Article 645 Task Group.
This is one of several Comments prepared by the CMP 12 Article 645 Task Group consisting of CMP 12 members Tom Brown, Tim Croushore, Tom Hedges, Bob Johnson, Stan Kaufman, John Kovacik, Todd Lottmann and Jose Salazar.
Panel Meeting Action: Reject
Panel Statement: Proposal 12-109 was rejected by the action on Comment 12-56 and the issue was corrected in Comment 12-66.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

12-68 Log #388 NEC-P12 **Final Action: Accept in Principle**
(645.15)

TCC Action: The Correlating Committee directs that the words "the provisions of" be deleted in all instances in the panel action.
In the Informational Note 2, delete the word "Sections."
Submitter: Stanley Kaufman, CableSafe, Inc.
Comment on Proposal No: 12-138
Recommendation: Change the panel action from Accept to Accept in Principle and modify the text of 645.15 as shown:
645.20 ~~**645.15**~~ **Equipment Grounding and Bonding.** All exposed non–current-carrying metal parts of an information technology system shall be bonded to the equipment grounding conductor in accordance with the provisions of Parts V, VI and VII of Article 250 or shall be double insulated. ~~Power systems derived within listed information technology equipment that supply information technology systems through receptacles or cable assemblies supplied as part of this equipment shall not be considered separately derived for the purpose of applying 250.30.~~ Where signal reference structures are installed, they shall be bonded to the equipment grounding conductor provided for the information technology equipment. Any auxiliary grounding electrode(s) installed for information technology equipment shall be installed in accordance with the provisions of 250.54.
Informational Note No. 1: The bonding requirements in the product standards governing this listed equipment ensure that it complies with Article 250.
Informational Note No. 2: Where isolated grounding-type receptacles are used, see Sections 250.146(D) and 406.3(D).
645.21 System Grounding. Separately derived power systems shall be installed in accordance with the provisions of Part II or Article 250. Power systems derived within listed information technology equipment that supply information technology systems through receptacles or cable assemblies supplied as part of this equipment shall not be considered separately derived for the purpose of applying 250.30.
Substantiation: The panel action on Proposal 12-138 to delete the reference to the entire Article 250 in order to comply with the NEC Style Manual prohibition on references to entire Articles provided less information than leaving the text unchanged. The preferred route to complying with the NEC Style Manual prohibition on references to entire Articles is to refer to specific Parts or sections within an Article; that's what this Comment recommends.
The recommendation divides the grounding requirements into two logical sections, one for equipment grounding and bonding and one for systems grounding, and adds requirements for separately derived power systems
The accepted text from the Panel action on Proposal 12-139 is included in the recommended text.
This is one of several Comments prepared by the CMP 12 Article 645 Task Group consisting of CMP 12 members Tom Brown, Tim Croushore, Tom Hedges, Bob Johnson, Stan Kaufman, John Kovacik, Todd Lottmann and Jose Salazar.
The sections are renumbered to coordinate with the Task Groups' Comment on Proposal 12-109.
Panel Meeting Action: Accept in Principle
Add new 645.14 to read as follows:
645.14 System Grounding. Separately derived power systems shall be installed in accordance with the provisions of Part I and II of Article 250. Power systems derived within listed information technology equipment that supply information technology systems through receptacles or cable assemblies supplied as part of this equipment shall not be considered separately derived for the purpose of applying 250.30.
Revise 645.15 to read as follows:
645.15 Equipment Grounding and Bonding. All exposed non–current-carrying metal parts of an information technology system shall be bonded to the equipment grounding conductor in accordance with the provisions of Parts I, V, VI, VII, and VIII of Article 250 or shall be double insulated. Where signal reference structures are installed, they shall be bonded to the equipment grounding conductor provided for the information technology equipment. Any auxiliary grounding electrode(s) installed for information technology equipment shall be installed in accordance with the provisions of 250.54.
Informational Note No. 1: The bonding requirements in the product standards governing this listed equipment ensure that it complies with Article 250.
Informational Note No. 2: Where isolated grounding-type receptacles are used, see Sections 250.146(D) and 406.3(D).
Panel Statement: CMP-12 agrees with the recommendation to divide the grounding requirements into two logical sections, one for equipment grounding and bonding and one for systems grounding. CMP-12 notes this will be a revision to the text in 645.15 of the 2011 NEC and the addition of a new section 645.14. In addition CMP-12 has revised the list of parts called out in reference to Article 250 to include Part I and Part VIII.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

ARTICLE 646 — MODULAR DATA CENTERS (PROPOSED)

12-69 Log #174 NEC-P12 **Final Action: Accept**
(646X (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 12-147
Recommendation: The Correlating Committee advises that new articles and article scope statements are the responsibility of the Correlating Committee and the Correlating Committee Accepts the panel action.
The Correlating Committee directs that the new Article be reviewed to satisfy all NEC Style Manual requirements.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-12 accepts the direction of the Correlating Committee to clarify the wording to satisfy NEC Style Manual requirements in Article 646.
See panel action and statement on Comment 12-71.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

12-70 Log #1379 NEC-P12 **Final Action: Reject**
(646)

Submitter: Dennis R. Julian, Integrated Design Group Inc.
Comment on Proposal No: 12-147
Recommendation: Delete all text in Article 646 after paragraph 64X.4.
Substantiation: The text to be deleted mainly duplicates existing code requirements. Because it is a duplication of many specific requirements, it is confusing and may be contradictory to requirements in the code. In some aspects it is slightly different which may lead to confusion. A modular data center should follow the same code requirements as a data center. Any specific differences should be listed in this article. Because only parts of the code are repeated, it will lead to unintended consequences. For instance, Article 645

has exceptions for EPO requirements that are not repeated in Article 646. The requirement for EPO includes shutting down the entire MDC whether it includes raised floor areas or not and also includes the electrical and UPS areas. Stating similar requirements in multiple locations will allow for mis-interpretations and mis-applications as the two references are interchanged.

Panel Meeting Action: Reject

Panel Statement: New article 646 references parts of the NEC that are applicable to MDC constructions and includes changes and additions that are unique to such constructions. In some cases information is included to clarify what specifically in another article is applicable to an MDC. For example, 646.6 addresses supply conductors and overcurrent protection, 646.7 short-circuit current rating, and 646.3(N), disconnect requirements. Additionally, 646.3 states: "Wherever the requirements of other articles of this Code and Article 646 differ, the requirements of Article 646 shall apply."

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

12-71 Log #1467 NEC-P12 **Final Action: Accept in Principle**
(646 (New))

TCC Action: The Correlating Committee directs that the words "the provisions of" be replaced with the word "section" in 646.3(A), 646.3(B), and two locations in 646.3(D).

Although the NEC Style Manual does not permit the use of the word "Section", when section numbers are used in the beginning of a sentence it is appropriate to use the word "Section."

Submitter: John R. Kovacik, UL LLC

Comment on Proposal No: 12-147

Recommendation: Revise the Panel Meeting Action to Accept-in–Principle, Proposal 12-147 as follows;

ARTICLE 646

Modular Data Centers

~~Informational Note: Text that is followed by a reference in brackets has been extracted from NFPA 75-2009, Standard for the Protection of Information Technology Equipment. Only editorial changes were made to the extracted text to make it consistent with this Code.~~

I. General

646.1 Scope. This article covers modular data centers.

Informational Note 1: Modular data centers include the installed information technology equipment (ITE) ~~IT~~ and support equipment, electrical supply and distribution, wiring and protection, working space, grounding, HVAC and the like, located in ~~or associated with a modular data center~~ an equipment enclosure.

Informational Note 2: For further information, see NFPA 75-2013~~2009~~, Standard for the Protection of Information Technology Equipment, which covers the requirements for the protection of information technology equipment and systems in an information technology equipment ~~areas~~ room.

646.2 Definitions. ~~**See Article 100.**~~ The definitions in 645.2 shall apply. For the purposes of this article, the following additional definitions ~~apply~~ applies.

Modular Data Center (MDC). Prefabricated units rated 600 volts or less, consisting of an outer enclosure housing multiple racks of information technology equipment (ITE) (e.g. servers) and various support equipment such as electrical service and distribution equipment, HVAC systems and the like. ~~Some configurations may have the support equipment housed in a separate equipment enclosure.~~

Informational Note 1: A typical construction may use a standard ISO shipping container or other structure as the outer enclosure, racks or cabinets of ITE, service entrance equipment and power distribution components, power storage such as a UPS and an air or liquid cooling system. Modular data centers are intended for fixed installation either indoors or outdoors based on their construction and resistance to environmental conditions. MDCs can be configured as an all-in-one system housed in a single equipment enclosure or as a system with the support equipment housed in separate equipment enclosures.

Informational Note 2: For information on listing requirements for both information technology equipment and communications equipment, see UL 60950-1-~~2007~~ 2011, Information Technology Equipment - Safety - Part 1: General Requirements and UL 62368-1-2012, Audio/video, information and communication technology equipment - Part 1: Safety requirements.

Informational Note 3: Modular Data Centers as defined in this article are sometimes referred to as Containerized Data Centers.

Informational Note 4: Equipment enclosures housing only support equipment (e.g. HVAC or power distribution equipment) that are not part of a specific Modular Data Center are not considered a modular data center as defined in this article.

646.3 Other Articles. Circuits and equipment shall ~~also~~ comply with 646.3(A) through (N), the following, as applicable. Wherever the requirements of other articles of this Code and Article 646 differ, the requirements of Article 646 shall apply.

(A) Spread of Fire or Products of Combustion. The provisions of ~~Sections~~ 300.21, 770.26, 800.26, and 820.26 shall apply to penetrations of a fire-resistant room boundary, if provided.

(B) Plenums. The provisions of ~~Sections~~ 300.22(C)(1), 725.154(A), 760.53(B)(2), 760.154(A), 770.113(C), 800.113(C), and 820.113(C) and Tables 725.154(a), 760.154(a),770.154(a), 800.154(a) and 820.154(a) shall apply to wiring and cabling in a plenum (other space used for environmental air). Environmentally controlled working space, aisles and equipment areas in an MDC are not considered a plenum.

(C) Grounding. Grounding and bonding of a modular data center shall comply with Article 250. The non–current-carrying conductive members of optical fiber cables in an MDC shall be grounded in accordance with 770.114. Grounding and bonding of communications protectors, cable shields and non–current-carrying metallic members of cable shall comply with Part IV of Article 800.

(D) Electrical Classification of Data Circuits. The provisions of ~~Section~~ 725.121(A)(4) shall apply to the electrical classification of listed information technology equipment signaling circuits. The provisions of ~~Section~~ 725.139(D)(1) and 800.133(A)(1)(b) shall apply to the electrical classification of Class 2 and Class 3 circuits in the same cable with communications circuits.

(E) Fire Alarm Equipment. ~~The provisions of P~~parts I, II, and III of Article 760 shall apply to fire alarm systems equipment installed in a MDC, when provided.

(F) Communications Equipment. ~~The provisions of P~~parts I, II, III, IV, and V of Article 800 shall apply to communications equipment installed in an MDC.

Informational Note: See Part I of Article 100, Definitions, for a definition of communications equipment.

(G) Community Antenna Television and Radio Distribution Systems Equipment. ~~The provisions of P~~parts I, II, III, IV, and V of Article 820 shall apply to community antenna television and radio distribution systems equipment installed in an MDC.

(H) Storage Batteries. Installation of storage batteries shall comply with Article 480.

Exception: Batteries that are part of listed and labeled equipment and installed in accordance with the listing requirements.

(I) **Surge-Protective Devices (SPDs).** Where provided, surge protective devices shall be listed and labeled and installed in accordance with Article 285.

(J) Lighting. Lighting shall be installed in accordance with Article 410.

(K) Power Distribution Wiring and Protection. Power distribution wiring and wiring protection within a MDC shall comply with Article 210 for branch circuits and Article 215 for feeder circuits.

(L) Wiring Methods and Materials.

(1) Unless modified elsewhere in this article, wiring methods and materials for power distribution shall comply with Chapter 3. Wiring shall be suitable for its use and installation and shall be listed and labeled.

Exception: This requirement shall not apply to wiring that is part of listed and labeled equipment.

(2) The following wiring methods shall not be permitted:

a) Integrated Gas Spacer Cable: Type IGS (Article 326)

b) Concealed Knob-and-Tube Wiring (Article 394)

c) Messenger-Supported Wiring (Article 396)

d) Open Wiring on Insulators (Article 398)

e) Outdoor Overhead Conductors over 600 Volts (Article 399)

(3) Wiring under raised floors. Areas under a raised floor that are constructed and used for ventilation as described in 645.5(E) shall be permitted to use the wiring methods described in 645.5(E).

(4) Installation of wiring for remote-control, signaling, and power limited circuits shall comply with Part III Article 725.

(5) Installation of optical fiber cables shall comply with Part V of Article 770.

(6) Installation of wiring for fire alarm systems shall comply with Parts II and III of Article 760.

(7) Installation of communications wires and cables, raceways, and cable routing assemblies shall comply with Part V of Article ~~Chapter~~ 800.

(8) Alternate wiring methods as permitted by Article 645 shall be ~~are~~ permitted for MDCs provided all of the conditions stated in 645.4 are met.

(M) Service equipment. For an MDC that is designed such that it may be powered from a separate electrical service, the service equipment for control and protection of services and their installation shall comply with Article 230. The service equipment and their arrangement and installation shall permit the installation of the service entrance conductors in accordance with Article 230. Service equipment shall be listed and labeled and marked as being suitable for use as service equipment.

(N) Disconnecting Means. An approved means shall be provided to disconnect power to all electronic equipment in the MDC in accordance with Section 645.10. There shall also be a similar approved means to disconnect the power to all dedicated HVAC systems serving the MDC and shall cause all required fire/smoke dampers to close.

646.4 Applicable Requirements. All modular data centers shall:

~~(A)~~ (1) ~~B~~be listed and labeled and comply with 646.3(N) and 646.5 through 646.9, or,

Informational Note: One way to determine applicable listing requirements is to refer to UL Subject 2755, Outline of Investigation for Modular Data Centers.

~~(B)~~ (2) ~~C~~comply with the provisions of this article.

646.5 Nameplate Data. A permanent nameplate shall be attached to ~~the~~ each equipment enclosure of an MDC and shall be plainly visible after installation. The nameplate shall include the ~~following~~ information in 646.5(1) through (6), as applicable:

(1) Supply voltage, number of phases, frequency, and full load current. The full-load current shown on the nameplate shall not be less than the sum of the

full-load currents required for all motors and other equipment that may be in operation at the same time under normal conditions of use. Where unusual type loads, duty cycles, and so forth require oversized conductors or permit reduced-size conductors, the required capacity shall be included in the marked full-load current. Where more than one incoming supply circuit is to be provided, the nameplate shall state the preceding information for each circuit.

Informational Note 1: See 430.22(E) and 430.26 for duty cycle requirements. Informational Note 2: For listed equipment, the full-load current shown on the nameplate may be the maximum measured, 15 minute, average full load current.

(2) For MDCs powered by a separate service, the ~~S~~short-circuit current rating of the service equipment provided as part of the MDC.

Informational Note: This rating may be part of the service equipment marking.

(3) For MDCs powered by a separate service, if the required service as determined by Parts III and IV of Article 220 is less than the rating of the service panel used, the required service shall be included on the nameplate.

Informational Note: Branch circuits supplying ITE loads are assumed to be loaded no less than 80% of the branch circuit rating with a 100% duty cycle. As an alternative to the feeder and service load calculations required by Parts III and IV of Article 220, feeder and service load calculations for new, future or existing loads ~~shall be~~ may be permitted to be used if performed by qualified persons under engineering supervision.

(4) Electrical diagram number(s) or the number of the index to the electrical drawings.

(5) For MDC equipment enclosures that are not powered by a separate service, feeder or branch circuit, a reference to the powering equipment.

(6) The manufacturer's name or trademark

646.6 Supply Conductors and Overcurrent Protection.

(A) Size. The size of the supply conductor shall be such as to have an ampacity not less than 125 percent of the full load current rating~~, of all resistance heating loads plus 125 percent of the full-load current rating of the highest rated motor plus the sum of the full-load current ratings of all other connected motors and apparatus, based on their duty cycle, that may be in operation at the same time~~.

Informational Note No. 1: See the 0–2000-volt ampacity tables of Article 310 for ampacity of conductors rated 600 volts and below.

Informational Note No. 2: See 430.22(E) and 430.26 for duty cycle requirements.

(B) Overcurrent Protection. Where overcurrent protection for supply conductors is furnished as part of the MDC, overcurrent protection for each supply circuit shall comply with 646.6(B)(1) through (B)(2):

(1) Service Equipment — Overcurrent Protection. Service conductors shall be provided with overcurrent protection in accordance with 230.90 through 230.95.

(2) Taps and Feeders. Where overcurrent protection for supply conductors is furnished as part of the MDC as permitted by 240.21, the overcurrent protection shall comply with the following:

(1) The overcurrent protection shall consist of a single circuit breaker or set of fuses.

(2) The MDC shall be marked "overcurrent protection provided at MDC supply terminals".

(3) ~~and t~~The supply conductors shall be considered either as feeders or as taps ~~as covered by 240.21~~ and be provided with overcurrent protection complying with 240.21.

~~The rating or setting of the overcurrent protective device for the circuit supplying the MDC shall not be greater than 125 percent of the full-load current rating. the sum of the largest rating or setting of the branch-circuit short-circuit and ground-fault protective device provided with the machine, plus 125 percent of the full-load current rating of all resistance heating loads, plus the sum of the full-load currents of all other motors and apparatus that could be in operation at the same time.~~

~~*Exception: Where one or more instantaneous trip circuit breakers or motor short-circuit protectors are used for motor branch-circuit short-circuit and ground-fault protection as permitted by 430.52(C), the procedure specified in 670.4(C) for determining the maximum rating of the protective device for the circuit supplying the machine shall apply with the following provision: For the purpose of the calculation, each instantaneous trip circuit breaker or motor short-circuit protector shall be assumed to have a rating not exceeding the maximum percentage of motor full load current permitted by Table 430.52 for the type of machine supply circuit protective device employed.*~~

~~Where no branch-circuit short-circuit and ground-fault protective device is provided with the MDC, the rating or setting of the overcurrent protective device shall be based on 430.52 and 430.53, as applicable.~~

646.7 Short-Circuit Current Rating. ~~Modular data centers shall not be installed where the available fault current exceeds its short-circuit current rating as marked on the MDC service equipment.~~

(A) Service Equipment. Service equipment of a modular data center that connects directly to a service shall have a short-circuit current rating not less than the available fault current of the service.

(B) MDCs Connected to Branch Circuits and Feeders. Modular Data Centers that connect to a branch circuit or a feeder circuit shall have a short-circuit current rating not less than the available fault current of the branch circuit or feeder. The short circuit current rating of the MDC shall be based on the short-circuit current rating of a listed and labeled MDC or the short-circuit current rating established utilizing an approved method.

Informational Note 1: UL 508A-2001, Standard for Industrial Control Panels, Supplement SB, is an example of an approved method.

Informational Note 2: This requirement does not apply to listed and labeled equipment connected to branch circuits located inside of the MDC equipment enclosure.

(C) MDCs Powered from Separate MDC System Enclosures Connected to Power Modules. Modular Data Centers equipment enclosures that are powered from a separate MDC system enclosure connect to a power module that is part of the specific MDC system, shall have a short-circuit current rating coordinated with the powering module in accordance with 110.10. not less than the available fault current at the output of the power module. The short circuit current rating of the MDC shall be based on the short-circuit current rating of a listed and labeled MDC or the short-circuit current rating established utilizing an approved method.

Informational Note: UL 508A-2001, Standard for Industrial Control Panels, Supplement SB, is an example of an approved method for determining short circuit current ratings.

646.8 Field Wiring Compartments. A field-wiring compartment in which service or branch circuit connections are to be made shall comply with 646.8 (A) through (C):

~~a)~~ (A) Permit the connection of the supply wires after the MDC is installed;

~~b)~~ (B) Permit the connection to be introduced and connected easily; and

~~c)~~ (C) Be located so that the connections may be readily inspected after the MDC is installed

646.9 Flexible Power Cords and Cables for Connecting Equipment Enclosures of an MDC System.

(A) Uses Permitted. Flexible power cords and cables shall be permitted to be used for connections between equipment enclosures of an MDC system~~. Flexible cords or cables shall not be used for connection to the branch circuit or electrical service~~ where not subject to physical damage.

Informational Note: ~~For~~ One example of flexible power cords~~s~~ usage for connections between equipment enclosures of an MDC system is ~~may be used~~ between an MDC enclosure containing only servers and one containing power distribution equipment.

(B) Uses Not Permitted. Flexible power cords ~~or~~ and cables shall not be used for connection to external sources of power.

Informational Note: Examples of external sources of power are electrical services, feeders and premises branch circuits.

~~**(B)**~~**(C) Listing.** Where flexible power cords or cables are used, they shall be listed as suitable for extra-hard usage. Where used outdoors, flexible power cords and cables shall

also be listed as suitable for wet locations and shall be sunlight resistant. ~~Extra-hard usage flexible cords or cables shall be permitted for use as permanent wiring between MDC enclosures only where not subject to physical damage.~~

~~**(C)**~~**(D) Single-Conductor Cable.** Single-conductor power cable shall be permitted to be used only in sizes 2 AWG or larger.

II. Equipment

646.10 Electrical Supply and Distribution. Equipment used for the electrical supply and distribution in a modular data center including fittings, devices, luminaires, apparatus, machinery, and the like shall comply with ~~the appropriate requirements for its use and installation and shall be listed and labeled~~ Parts I and II of Article 110.

~~**646.11 Premises transformers.** Premise transformers installed in the MDC area shall be of the dry type or type filled with a noncombustible dielectric medium.~~

~~**646.12 Service entrance transformers.** Service entrance transformers shall not be permitted in an MDC.~~

~~*Exception: Service entrance transformers shall be permitted in a separate module or structure intended to house only service entrance equipment and power distribution and control equipment for the MDC.*~~

646.11 Distribution Transformers

(A) Utility-Owned Transformers. Service entrance Utility-owned distribution transformers shall not be permitted in an MDC.

(B) Non-Utility-Owned Premises Transformers. Non-utility-owned Ppremises distribution transformers installed in the vicinity of an MDC shall be of the dry type or type filled with a noncombustible dielectric medium. Such transformers shall be installed in accordance with the requirements of Article 450. Non-utility-owned Ppremises distribution transformers shall not be permitted in an MDC.

(C) Power Transformers. Power transformers that supply power only to the MDC shall be permitted to be installed in the MDC equipment enclosure. Only dry-type transformers shall be permitted to be installed in the MDC equipment enclosure. Such transformers shall be installed in accordance with the requirements of Article 450.

646.~~13~~ 12 Receptacles. At least one 125 volt AC, 15 or 20-ampere rated duplex convenience outlet shall be provided in each work area of the MDC to facilitate the ~~connection~~ powering of test and measurement equipment that may be required during routine maintenance and servicing without having to route flexible power cords through or across doorways, around line-ups of equipment or the like.

646.~~14~~ 13 Other Electrical Equipment. Electrical equipment that is an integral part of the MDC including lighting, control, power, HVAC (heating, ventilation and air-conditioning), emergency lighting, alarm circuits, and the like shall comply with the ~~appropriate~~ requirements for its use and installation and shall be listed and labeled.

646.~~15~~ 14 Installation and Use. Listed and labeled equipment shall be installed and used in accordance with any instructions or limitations included in the listing.

III. Lighting

646.~~16~~ 15 General Illumination. Illumination shall be provided for all workspaces~~.~~ and ~~A~~areas that are used for exit access and exit discharge~~, shall be illuminated to values of at least 1 ft.-candle (10.8 lux), measured at the floor.~~The illumination shall be arranged so that the failure of any single lighting unit does not result in a~~n~~ a complete loss of illumination ~~level of less than 0.2 ft.-candle (2.2 lux)~~.

Informational Note: See NFPA 101-2009, Life Safety Code, Section 7.8 for information on illumination of means of egress.

646.~~17~~ 16 Emergency Lighting. Areas that are used for exit access and exit discharge shall be provided with emergency lighting. Emergency lighting systems shall be listed and labeled equipment, installed in accordance with the manufacturer's instructions.

Informational Note: See NFPA 101-2009, Life Safety Code, Section 7.9 for information on emergency lighting.

646.~~18~~ 17 Emergency lighting circuits. No appliances and no lamps, other than those specified as required for emergency use, shall be supplied by emergency lighting circuits. These branch circuits supplying emergency lighting shall be installed to provide service from storage batteries, generator set, UPS, separate service, fuel cell or unit equipment. No other equipment shall be connected to these circuits, unless the emergency lighting system includes a back-up system, where only the lighting is supplied by battery circuits under power failure conditions. All boxes and enclosures (including transfer switches, generators, and power panels) for emergency circuits shall be marked to identify them as components of an emergency circuit or system.

IV. Work Space

646.~~19~~ 18 General. ~~Access and working space shall be provided and maintained about all electrical equipment to permit ready and safe operation and maintenance of such equipment.~~ Space about electrical equipment shall comply with 110.26. ~~The egress requirements for large equipment in 110.26(C)(2) and personnel door requirements in 110.26(C)(3) shall apply to an MDC even if the rating of the MDC is not 1200 amperes or more or if the MDC does not contain overcurrent devices, switching devices or control devices in areas that service personnel may occupy.~~

~~Exception - The depth of the workspace shall not be required to need not comply with Table 110.26(A)(1) if the equipment is marked "WARNING" and "De-energize Equipment before Servicing" or the equivalent.~~

646.19 Entrance to and Egress from Working Space. For equipment over 1.8 m (6 ft) wide or deep, there shall be one entrance to and egress from the required working space not less than 610 mm (24 in.) wide and 2.0 m (6½ ft) high at each end of the working space. The door(s) shall open in the direction of egress and be equipped with panic bars, pressure plates, or other devices that are normally latched but open under simple pressure. A single entrance to and egress from the required working space shall be permitted where either of the conditions in 646.20(1) or 646.20(2) is met.

(1) Unobstructed Egress. Where the location permits a continuous and unobstructed way of egress travel, a single entrance to the working space shall be permitted.

(2) Extra Working Space. Where the depth of the working space is twice that required by 110.26(A)(1), a single entrance shall be permitted. It shall be located such that the distance from the equipment to the nearest edge of the entrance is not less than the minimum clear distance specified in Table 110.26(A)(1) for equipment operating at that voltage and in that condition.

646.20 Working space for ITE.

(A) Low Voltage Circuits. The working space ~~depth in front of~~ about ITE where any live parts that may be exposed during routine servicing operate at not greater than 30 volts rms, 42 volts peak, or 60 volts dc shall not be required to comply with the workspace requirements of 646.19.

(B) Other Circuits. Any areas of ITE that require servicing of parts that are greater than 30 volts rms, 42 volts peak, or 60 volts dc shall comply with the workspace requirements of 646.19.

Informational Note 1: For example, field wiring compartments for ac mains connections, power distribution units, and the like.

Informational Note 2: it is assumed that ITE operates at voltages not exceeding 600 V.

646.21 Work areas and working space around batteries. Working space around a battery system shall comply with paragraph 110.26. Working clearance shall be measured from the edge of the battery rack.

646.22 Work space for routine service and maintenance. ~~Adequate w~~Work. space shall be provided ~~for~~ to facilitate routine servicing and maintenance (those tasks involving operations which can ~~safely~~ be accomplished by employees and where extensive disassembly of equipment is not required). Routine servicing and maintenance shall be able to be performed without exposing the worker to a risk of electric shock or personal injury.

Informational Note: An example of such routine maintenance is cleaning or replacing an air filter.

Substantiation: This comment was prepared by a CMP-12 Task Group that was formed to address concerns pertaining to Proposal 12-147.

The Task Group including the following members:

Task Group - Chair: John Kovacik

Members: Tim Croushore, Jeff Holmes, Philip Clark, Todd Konieczny, Jeff Menig, Bob Johnson, Ken White, Stan Kaufman, Steve McCluer and Randy Ivans.

The following changes were made to the Panel Meeting Action to Accept-in-Principle, Proposal 12-147. These changes take into account all of the comments expressed in the ROP balloting and comments from task group members. The revisions are organized by Sections of the Article. Section numbers below are from the original ROP proposal.

The opening note was deleted since there are no such references in this proposed Article.

646.1 Scope

Revised to help differentiate between an MDC as covered by this article (equipment in an enclosure) and a traditional computer room. Also updated the reference.

646.2 Definitions - Modular Data Center (MDC)

Revised and added information to help clarify what an MDC, as covered by this article, really is. Updated references.

646.3

Clarification information added and editorial corrections

646.4

Added a reference to appropriate requirements for the listing of MDCs. This standard was not published at the time of the original proposal.

646.5

Revised to make it clear that each equipment enclosure needs a nameplate. Added information on measuring full load current. Added required information relating to how an equipment enclosure that is not connected to a service, feeder or branch circuit receives its power.

646.6

Revised for clarity. Added a provision for service conductors since an MDC might be provided with service equipment. It was determined that overcurrent protection provisions could be referenced directly to 230.90-230.95 for service conductors and 240.21 for taps and feeders. It is intended to make sure the overcurrent protection provided in the MDC is suitable to protect the feeder or tap conductors.

646.7

This was split up to cover connections directly to a service, connection to a feeder or branch circuit and connection to a power module that is part of the MDC system. The short circuit ratings requirements for feeders and branch circuits are taken from NFPA 70, 409.110(4). An MDC enclosure that is powered from another MDC enclosure in the system (such as a system with an ITE module enclosure being powered from a separate power module enclosure) would not require a short circuit current rating since it does not connect directly to a service, feeder or branch circuit. Overcurrent and short circuit protection would be coordinated between the two modules. 110.10 addresses this and is referenced.

646.8

Editorial corrections.

646.9

Edited for clarity.

646.10

Parts I and II of Article 110 provide the necessary guidance on requirements for equipment and installations. Edited to eliminate possible conflicts with the NEC style manual regarding possibly vague or unenforceable terms.

646.11 and original 646.12

Edited for clarity and combined into one section. This revision clarifies the requirements for transformers in and around an MDC. The original 646.12 was eliminated as part of this revision.

646.13

Renumbered to 646.12. "Work Area" is used throughout the NEC and Life Safety Code without definition. Additional explanatory text was added for clarity.

646.14

Renumbered to 646.13. Edited to eliminate possible conflicts with the NEC style manual regarding possibly vague or unenforceable terms.

646.15

Renumbered to 646.14.

646.16

Renumbered to 646.15.Took out illumination level requirements and added informational note referencing NFPA 101.

646.17

Renumbered to 646.16. Took out illumination level requirements and added informational note referencing NFPA 101.

646.18

Renumbered to 646.17.

646.19

Renumbered to 646.18. Eliminated exception. Revised for clarity. Split out egress requirements. Took out reference to 110.26 for egress requirements and added appropriate text from 110.26 (B) and (C) into a new paragraph now numbered 646.19.

646.20.

Edited for clarity and editorial corrections

646.21

No changes.

646.22

Edited to eliminate possible conflicts with the NEC style manual regarding possibly vague or unenforceable terms.

Panel Meeting Action: Accept in Principle

This version of Article 646 incorporates all of the revisions to Proposal 12-147 the Panel has accepted via Comments 12-71, 12-74, 12-77 and 12-80.

ARTICLE 646

Modular Data Centers

I. General

646.1 Scope. This article covers modular data centers.

Informational Note 1: Modular data centers include the installed information technology equipment (ITE) and support equipment, electrical supply and distribution, wiring and protection, working space, grounding, HVAC and the like, located in an equipment enclosure.

Informational Note 2: For further information, see NFPA 75-2013, *Standard* for the Protection of Information Technology Equipment, which covers the requirements for the protection of information technology equipment and systems in an information technology equipment room.

646.2 Definitions. The definitions in 645.2 shall apply. For the purposes of this article, the following additional definition applies.

Modular Data Center (MDC). Prefabricated units rated 600 volts or less, consisting of an outer enclosure housing multiple racks or cabinets of information technology equipment (ITE) (e.g. servers) and various support equipment such as electrical service and distribution equipment, HVAC systems and the like.

Informational Note 1: A typical construction may use a standard ISO shipping container or other structure as the outer enclosure, racks or cabinets of ITE, service entrance equipment and power distribution components, power storage such as a UPS and an air or liquid cooling system. Modular data centers are intended for fixed installation either indoors or outdoors based on their construction and resistance to environmental conditions. MDCs can be configured as an all-in-one system housed in a single equipment enclosure or as a system with the support equipment housed in separate equipment enclosures.

Informational Note 2: For information on listing requirements for both information technology equipment and communications equipment, see UL 60950-1- 2011, Information Technology Equipment - Safety - Part 1: General Requirements and UL 62368-1-2012, Audio/video, information and communication technology equipment - Part 1: Safety requirements.

Informational Note 3: Modular Data Centers as defined in this article are sometimes referred to as Containerized Data Centers.

Informational Note 4: Equipment enclosures housing only support equipment (e.g. HVAC or power distribution equipment) that are not part of a specific Modular Data Center are not considered a modular data center as defined in this article.

646.3 Other Articles. Circuits and equipment shall ~~also~~ comply with 646.3(A) through (N) as applicable. Wherever the requirements of other articles of this Code and Article 646 differ, the requirements of Article 646 shall apply.

(A) Spread of Fire or Products of Combustion. The provisions of 300.21, 770.26, 800.26, and 820.26 shall apply to penetrations of a fire-resistant room boundary, if provided.

(B) Plenums. The provisions of 300.22(C)(1), 725.154(A), 760.53(B)(2), 760.154(A), 770.113(C), 800.113(C), and 820.113(C) and Tables 725.154(a), 760.154(a),770.154(a), 800.154(a) and 820.154(a) shall apply to wiring and cabling in other spaces used for environmental air (plenums).

Informational Note: Environmentally controlled working space, aisles and equipment areas in an MDC are not considered a plenum.

(C) Grounding. Grounding and bonding of a modular data center shall comply with Article 250. The non–current-carrying conductive members of optical fiber cables in an MDC shall be grounded in accordance with 770.114. Grounding and bonding of communications protectors, cable shields and non–current-carrying metallic members of cable shall comply with Part IV of Article 800.

(D) Electrical Classification of Data Circuits. The provisions of 725.121(A)(4) shall apply to the electrical classification of listed information technology equipment signaling circuits. The provisions of 725.139(D)(1) and 800.133(A)(1)(b) shall apply to the electrical classification of Class 2 and Class 3 circuits in the same
cable with communications circuits.

(E) Fire Alarm Equipment. The provisions of Parts I, II, and III of Article 760 shall apply to
fire alarm systems equipment installed in a MDC, when provided.

(F) Communications Equipment. The provisions of Parts I, II, III, IV, and V of Article 800
shall apply to communications equipment installed in an MDC.

Informational Note: See Part I of Article 100, Definitions, for a definition of communications equipment.

(G) **Community Antenna Television and Radio Distribution Systems Equipment.** The provisions of Parts I, II, III, IV, and V of Article 820 shall apply to community antenna television and radio distribution systems equipment installed in an MDC.

(H) Storage Batteries. Installation of storage batteries shall comply with Article 480.

Exception: Batteries that are part of listed and labeled equipment and installed in accordance with the listing requirements.

(I) Surge-Protective Devices (SPDs). Where provided, surge protective devices shall be listed and labeled and installed in accordance with Article 285.

(J) Lighting. Lighting shall be installed in accordance with Article 410.

(K) Power Distribution Wiring and Protection. Power distribution wiring and wiring protection within a MDC shall comply with Article 210 for branch circuits and Article 215 for feeder circuits.

(L) Wiring Methods and Materials.

(1) Unless modified elsewhere in this article, wiring methods and materials for power distribution shall comply with Chapter 3. Wiring shall be suitable for its use and installation and shall be listed and labeled.

Exception: This requirement shall not apply to wiring that is part of listed and labeled equipment.

(2) The following wiring methods shall not be permitted:

a) Integrated Gas Spacer Cable: Type IGS (Article 326)
b) Concealed Knob-and-Tube Wiring (Article 394)
c) Messenger-Supported Wiring (Article 396)
d) Open Wiring on Insulators (Article 398)
e) Outdoor Overhead Conductors over 600 Volts (Article 399)

(3) Wiring under raised floors. Areas under a raised floor that are constructed and used for ventilation as described in 645.5(E) shall be permitted to use the wiring methods described in 645.5(E).

(4) Installation of wiring for remote-control, signaling, and power limited circuits shall comply with Part III Article 725.

(5) Installation of optical fiber cables shall comply with Part V of Article 770.

(6) Installation of wiring for fire alarm systems shall comply with Parts II and III of Article 760.

(7) Installation of communications wires and cables, raceways, and cable routing assemblies shall comply with Part V of Article 800.

(8) Alternate wiring methods as permitted by Article 645 shall be permitted for MDCs provided all of the conditions stated in 645.4 are met.

(M) Service equipment. For an MDC that is designed such that it may be powered from a separate electrical service, the service equipment for control and protection of services and their installation shall comply with Article 230. The service equipment and their arrangement and installation shall permit the installation of the service entrance conductors in accordance with Article 230. Service equipment shall be listed and labeled and marked as being suitable for use as service equipment.

(N) Disconnecting Means. An approved means shall be provided to disconnect power to all electronic equipment in the MDC in accordance with Section 645.10. There shall also be a similar approved means to disconnect the power to all dedicated HVAC systems serving the MDC and shall cause all required fire/smoke dampers to close.

646.4 Applicable Requirements. All modular data centers shall:

(1) be listed and labeled and comply with 646.3(N) and 646.5 through 646.9, or,

Informational Note: One way to determine applicable listing requirements is to refer to UL Subject 2755, Outline of Investigation for Modular Data Centers.

(2) comply with the provisions of this article.

646.5 Nameplate Data. A permanent nameplate shall be attached to each equipment enclosure of an MDC and shall be plainly visible after installation. The nameplate shall include the information in 646.5(1) through (6), as applicable:

(1) Supply voltage, number of phases, frequency, and full load current. The full-load current shown on the nameplate shall not be less than the sum of the full-load currents required for all motors and other equipment that may be in operation at the same time under normal conditions of use. Where unusual type loads, duty cycles, and so forth require oversized conductors or permit reduced-size conductors, the required capacity shall be included in the marked full-load current. Where more than one incoming supply circuit is to be provided, the nameplate shall state the preceding information for each circuit.

Informational Note 1: See 430.22(E) and 430.26 for duty cycle requirements.

Informational Note 2: For listed equipment, the full-load current shown on the nameplate may be the maximum measured, 15 minute, average full load current.

(2) For MDCs powered by a separate service, the short-circuit current rating of the service equipment provided as part of the MDC.

Informational Note: This rating may be part of the service equipment marking.

(3) For MDCs powered by a separate service, if the required service as determined by Parts III and IV of Article 220 is less than the rating of the service panel used, the
required service shall be included on the nameplate.

Informational Note: Branch circuits supplying ITE loads are assumed to be loaded no less than 80% of the branch circuit rating with a 100% duty cycle. As an alternative to the feeder and service load calculations required by Parts III and IV of Article 220, feeder and service load calculations for new, future or existing loads may be permitted to be used if performed by qualified persons under engineering supervision.

(4) Electrical diagram number(s) or the number of the index to the electrical drawings.

(5) For MDC equipment enclosures that are not powered by a separate service, feeder or branch circuit, a reference to the powering equipment.

(6) The manufacturer's name or trademark

646.6 Supply Conductors and Overcurrent Protection.

(A) Size. The size of the supply conductor shall be such as to have an ampacity not less than 125 percent of the full load current rating.

Informational Note No. 1: See the 0–2000-volt ampacity tables of Article 310

for ampacity of conductors rated 600 volts and below.
Informational Note No. 2: See 430.22(E) and 430.26 for duty cycle requirements.
(B) Overcurrent Protection. Where overcurrent protection for supply conductors is furnished as part of the MDC, overcurrent protection for each supply circuit shall comply with 646.6(B)(1) through (B)(2):
(1) Service Equipment — Overcurrent Protection. Service conductors shall be provided with overcurrent protection in accordance with 230.90 through 230.95.
(2) Taps and Feeders. Where overcurrent protection for supply conductors is furnished as part of the MDC as permitted by 240.21, the overcurrent protection shall comply with the following:
(1) The overcurrent protection shall consist of a single circuit breaker or set of fuses.
(2) The MDC shall be marked "overcurrent protection provided at MDC supply terminals".
(3) The supply conductors shall be considered either as feeders or as taps and be provided with overcurrent protection complying with 240.21.
646.7 Short-Circuit Current Rating.
(A) Service Equipment. Service equipment of a modular data center that connects directly to a service shall have a short-circuit current rating not less than the available fault current of the service.
(B) MDCs Connected to Branch Circuits and Feeders. Modular Data Centers that connect to a branch circuit or a feeder circuit shall have a short-circuit current rating not less than the available fault current of the branch circuit or feeder. The short circuit current rating of the MDC shall be based on the short-circuit current rating of a listed and labeled MDC or the short-circuit current rating established utilizing an approved method.
Informational Note 1: UL 508A-2001, Standard for Industrial Control Panels, Supplement SB, is an example of an approved method.
Informational Note 2: This requirement does not apply to listed and labeled equipment connected to branch circuits located inside of the MDC equipment enclosure.
(C) MDCs Powered from Separate MDC System Enclosures. Modular Data Center~~s~~ equipment enclosures that are powered from a separate MDC system enclosure that is part of the specific MDC system, shall have a short-circuit current rating coordinated with the powering module in accordance with 110.10
Informational Note: UL 508A-2001, Standard for Industrial Control Panels, Supplement SB, is an example of an approved method for determining short circuit current ratings.
646.8 Field Wiring Compartments. A field-wiring compartment in which service or feeder connections are to be made shall be readily accessible, and comply with 646.8 (A) through (C):
(A) Permit the connection of the supply wires after the MDC is installed;
(B) Permit the connection to be introduced and readily connected ~~easily~~; and
(C) Be located so that the connections may be readily inspected after the MDC is installed.
646.9 Flexible Power Cords and Cables for Connecting Equipment Enclosures of an MDC System.
(A) **Uses Permitted.** Flexible power cords and cables shall be permitted to be used for connections between equipment enclosures of an MDC system where not subject to physical damage.
Informational Note: One example of flexible power cord~~s~~ usage for connections between equipment enclosures of an MDC system is between an MDC enclosure containing only servers and one containing power distribution equipment.
(**B**) **Uses Not Permitted.** Flexible power cords and cables shall not be used for connection to external sources of power.
Informational Note: Examples of external sources of power are electrical services, feeders and premises branch circuits.
(**C**) **Listing.** Where flexible power cords or cables are used, they shall be listed as suitable
for extra-hard usage. Where used outdoors, flexible power cords and cables shall
also be listed as suitable for wet locations and shall be sunlight resistant.
(**D**) **Single-Conductor Cable.** Single-conductor power cable shall be permitted to be used only in sizes 2 AWG or larger.
II. Equipment
646.10 Electrical Supply and Distribution. Equipment used for the electrical supply and distribution in a modular data center including fittings, devices, luminaires, apparatus, machinery, and the like shall comply with Parts I and II of Article 110.
646.11 Distribution Transformers
(A) Utility-Owned Transformers. Utility-owned distribution transformers shall not be permitted in an MDC.
(B) Non-Utility-Owned Premises Transformers. Non-utility-owned premises distribution transformers installed in the vicinity of an MDC shall be of the dry type or type filled with a noncombustible dielectric medium. Such transformers shall be installed in accordance with the requirements of Article 450. Non-utility-owned premises distribution transformers shall not be permitted in an MDC.
(C) Power Transformers. Power transformers that supply power only to the MDC shall be permitted to be installed in the MDC equipment enclosure. Only dry-type transformers shall be permitted to be installed in the MDC equipment enclosure. Such transformers shall be installed in accordance with the requirements of Article 450.
646.12 Receptacles. At least one 125 volt AC, 15 or 20-ampere rated duplex convenience outlet shall be provided in each work area of the MDC to facilitate the powering of test and measurement equipment that may be required during routine maintenance and servicing without having to route flexible power cords through or across doorways, around line-ups of equipment or the like.
646.13 Other Electrical Equipment. Electrical equipment that is an integral part of the MDC including lighting, control, power, HVAC (heating, ventilation and air-conditioning), emergency lighting, alarm circuits, and the like shall comply with the requirements for its use and installation and shall be listed and labeled.
646.14 Installation and Use. Listed and labeled equipment shall be installed and used in accordance with any instructions or limitations included in the listing.
III. Lighting
646.15 General Illumination. Illumination shall be provided for all Workspaces and areas that are used for exit access and exit discharge.
The illumination shall be arranged so that the failure of any single lighting unit does not result in a complete loss of illumination.
Informational Note: See NFPA 101-2009, Life Safety Code, Section 7.8 for information on illumination of means of egress.
646.16 Emergency Lighting. Areas that are used for exit access and exit discharge shall be provided with emergency lighting. Emergency lighting systems shall be listed and labeled equipment, installed in accordance with the manufacturer's instructions.
Informational Note: See NFPA 101-2009, Life Safety Code, Section 7.9 for information on emergency lighting.
646.17 Emergency lighting circuits. No appliances and no lamps, other than those specified as required for emergency use, shall be supplied by emergency lighting circuits. These branch circuits supplying emergency lighting shall be installed to provide service from storage batteries, generator set, UPS, separate service, fuel cell or unit equipment. No other equipment shall be connected to these circuits, unless the emergency lighting system includes a back-up system, where only the lighting is supplied by battery circuits under power failure conditions. All boxes and enclosures (including transfer switches, generators, and power panels) for emergency circuits shall be marked to identify them as components of an emergency circuit or system.
IV. Work Space
646.18 General. Space about electrical equipment shall comply with 110.27.
646.19 Entrance to and Egress from Working Space. For equipment over 1.8 m (6 ft) wide or deep, there shall be one entrance to and egress from the required working space not less than 610 mm (24 in.) wide and 2.0 m (6½ ft) high at each end of the working space. The door(s) shall open in the direction of egress and be equipped with panic bars, pressure plates, or other devices that are normally latched but open under simple pressure. A single entrance to and egress from the required working space shall be permitted where either of the conditions in 646.20(1) or 646.20(2) is met.
(1) Unobstructed Egress. Where the location permits a continuous and unobstructed way of egress travel, a single entrance to the working space shall be permitted.
(2) Extra Working Space. Where the depth of the working space is twice that required by 110.27 (A)(1), a single entrance shall be permitted. It shall be located such that the distance from the equipment to the nearest edge of the entrance is not less than the minimum clear distance specified in Table 110.27(A)(1) for equipment operating at that voltage and in that condition.
646.20 Working space for ITE.
(A) Low Voltage Circuits. The working space about ITE where any live parts that may be exposed during routine servicing operate at not greater than 30 volts rms, 42 volts peak, or 60 volts dc shall not be required to comply with the workspace requirements of 646.19.
(B) Other Circuits. Any areas of ITE that require servicing of parts that are greater than 30 volts
rms, 42 volts peak, or 60 volts dc shall comply with the workspace requirements
of 646.19.
Informational Note 1: For example, field wiring compartments for ac mains connections, power distribution units, and the like.
Informational Note 2: it is assumed that ITE operates at voltages not exceeding 600 V.
646.21 Work areas and working space around batteries. Working space around a battery system shall comply with paragraph 110.27. Working clearance shall be measured from the edge of the battery rack.
646.22 Work space for routine service and maintenance. Work space shall be provided to facilitate routine servicing and maintenance (those tasks involving operations which can be accomplished by employees and where extensive disassembly of equipment is not required). Routine servicing and maintenance shall be able to be performed without exposing the worker to a risk of electric shock or personal injury.
Informational Note: An example of such routine maintenance is cleaning or replacing an air filter.
Panel Statement: CMP-12 has revised the submitter's text and as follows:
(a) 646.2 added "or cabinets" in the definition of MDC to clarify what may be housed by an MDC.
(b) 646.3(B) deleted the last sentence of 646.3(B) as it is not mandatory text and moves it to an Informational Note.

(c) 646.3(B) revised to be consistent with the text of 300.22(C) regarding the reference to plenums.
(d) 646.8(B) replaced "easily" with "readily" to eliminate a vague term, and
This action correlates with the actions on Comments 12-74, 12-77 and 12-80.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

12-72 Log #485 NEC-P12 **Final Action: Accept in Principle**
(646.2.Modular Data Center)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 12-147
Recommendation: Revise text to read as follows:
646.2 Definitions. See Article 100. The definitions in 645.2 shall apply. For the purposes of this article, the following additional definitions apply.
Modular Data Center (MDC). Prefabricated units rated 600 volts or less, consisting of an outer enclosure housing information technology equipment (ITE) and various support equipment such as electrical service and distribution equipment, HVAC systems and the like. ~~Some configurations may have the support equipment housed in a separate enclosure.~~
Informational Note 1: A typical construction may use a standard ISO shipping container or other structure as the outer enclosure, racks or cabinets of ITE, service entrance equipment and power distribution components, power storage such as a UPS and an air or liquid cooling system. Modular data centers are intended for fixed installation either indoors or outdoors based on their construction and resistance to environmental conditions.
Informational Note 2: Some modular data center configurations may have the support equipment housed in a separate enclosure.
Informational Note 3: For information on listing requirements for both information technology equipment and communications equipment, see UL 60950-1-2007, *Information Technology Equipment - Safety - Part 1: General Requirements*.
Substantiation: The second sentence in this definition is clearly a piece of non-enforceable information and is best placed in an Informational Note. I understand that the NEC Manual of Style does not require definitions to be in single sentences but it also requires conciseness and it is best to include any additional information not intended for actual code use in such informational notes.
If the CMP believes that this information needs to be part of the definition, it might want to revise the definition, for example as follows:
Modular Data Center (MDC). Prefabricated units rated 600 volts or less, consisting of an outer enclosure housing information technology equipment (ITE) and various support equipment such as electrical service and distribution equipment, HVAC systems and the like, which are potentially housed in a separate enclosure,.
Panel Meeting Action: Accept in Principle
Panel Statement: The submitter's recommendation has been addressed in Comment 12-71, Section 646.2. The definition of MDC has been revised to meet the submitter's intent.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

12-73 Log #605 NEC-P12 **Final Action: Reject**
(646.2.Premises Transformer and Service Entrance Transformer (New))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 12-147
Recommendation: Revise text to read as follows:
646.2 Definitions.
Premises Transformer. A transformer that is fed by premises wiring.
Service Entrance Transformer. A transformer that feeds the service equipment.
Substantiation: 646.2, 646.11, & 646.12: The premises and service entrance transformers are new, undefined terms.
Panel Meeting Action: Reject
Panel Statement: No substantiation has been provided for the proposed definitions. Further, the definitions are considered unnecessary as the meaning of these terms has been clarified in Comment 12-71, Section 646.11.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

12-74 Log #606 NEC-P12 **Final Action: Accept in Principle in Part**
(646.8)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 12-147
Recommendation: Revise text to read as follows:
646.8 Field Wiring Compartments. ~~.~~A field-wiring compartment in which service or feeder ~~branch circuit~~ connections are to be made shall be readily accessible.~~:~~
~~(1) Permit the connection of the supply wires after the MDC is installed;~~
~~(2) Permit the connection to be introduced and connected easily; and~~
~~(3) Be located so that the connections may be readily inspected after the MDC is installed~~
Substantiation: 646.8 Typos delete extra period, delete the colon following *shall*. I believe the size of these MDCs is such that they will be fed from feeders or services. I believe that – internally – they will have branch circuit OCPDs.
Panel Meeting Action: Accept in Principle in Part
Revise 646.8 to read as follows:
646.8 Field Wiring Compartments. A field-wiring compartment in which service or feeder ~~branch circuit~~ connections are to be made shall be readily accessible, and comply with 646.8 (A) through (C).
Panel Statement: CMP-12 accepts revisions to 646.8 with the addition of the word "and" ahead of "comply with".
CMP-12 does not accept the deletion of list items 1, 2 and 3 (now A, B and C in Comment 12-71). These are necessary to clarify the requirement in 646.8.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

12-75 Log #607 NEC-P12 **Final Action: Accept in Principle**
(646.9(A))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 12-147
Recommendation: Revise text to read as follows:
646.9 Flexible Power Cable.
(A) Flexible cable shall be permitted to be used for connections between enclosures of a MDC system. Flexible cords or cables shall not be used for ~~connection to the branch circuit or electrical service~~. the external (not from another MDC) power feed.
Substantiation: 646.9 I believe the size of these MDCs is such that they will be fed from feeders or services. I believe that – internally – they will have branch circuit OCPDs.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and statement on Comment 12-71.
The submitter's recommendation has been addressed in Comment 12-71, Section 646.9. The text has been revised to meet the submitter's intent.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

12-76 Log #608 NEC-P12 **Final Action: Accept in Principle**
(646.11)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 12-147
Recommendation: Revise text to read as follows:
646.11 Premises Transformers. Premise transformers installed in the MDC area shall be of the dry type or ~~type~~ filled with a noncombustible dielectric medium.
Substantiation: 646.2, 646.11, & 646.12: The *premises* and *service entrance transformers* are new, undefined terms.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and statement on Comment 12-71.
The submitter's recommendation has been addressed in Comment 12-71. The meaning of premises transformers was clarified in 646.11(B) and (C).
CMP-12 notes that the term "noncombustible dielectric medium" is not used in the NEC and the new Article 646.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

12-77 Log #1525 NEC-P12 **Final Action: Reject**
(646.19)

TCC Action: The Correlating Committee directs that the Action on this comment be reported as "Reject" . The change from 110.26 to 110.27 was not accepted because of the Action on Comment 1-81. The remainder of the Comment 12-77 was not accepted as direct text but was incorporated into Comment 12-71.
Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 12-147
Recommendation: Revise text to read as follows:
646.19 General. Access and working space shall be provided and maintained about all electrical equipment to permit ready and safe operation and maintenance of such equipment. Space about electrical equipment shall comply with ~~110.26~~ 110.27. The egress requirements for large equipment in ~~110.26~~ 110.27 (C)(2) and personnel door requirements in ~~110.26~~ 110.27 (C)(3) shall apply to an MDC even if the rating of the MDC is not 1200 amperes or more or if the MDC does not contain overcurrent devices, switching devices or control devices in areas that service personnel may occupy.
Exception: The depth of the workspace shall not be required to comply with Table ~~110.26~~ 110.27 (A)(1) if the equipment is marked "WARNING" and "De-energize Equipment before Servicing" or the equivalent. 110.26 has been moved to 110.27.
Substantiation: 110.26 has been moved to 110.27.
Panel Meeting Action: Accept
Panel Statement: Note to Correlating Committee: There is a need to review this action for proper correlation with CMP-1 actions on Article 110.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9 Negative: 1

Explanation of Negative:

CROUSHORE, T.: Comment 12-77 - should have been an Accept in Principle and referred back to Comment 12-71 for the recommended text of the complete Article 646. CMP-12 accepted the concept of renumbering 110.26 to 110.27. However, none of the exact text of the comment (including the suggested Exception) appears word for word in the intended text of Comment 12-71.

12-78 Log #609 NEC-P12 **Final Action: Accept in Principle**
(646.19 Exception)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 12-147
Recommendation: Revise text to read as follows:

646.19 General.

Exception: The depth of the workspace shall not be required to comply with Table 110.2~~6~~7(A)(1) if the equipment is marked with a warning sign which shall meet the requirements in 110.26 and shall read as follows:

"*WARNING~~" and "~~De-energize Equipment before Servicing*" ~~*or the equivalent.*~~

Substantiation: 646.19 <except>: The note refers to a non-existing paragraph. The standard way of defining labels and signs should be used. I have serious doubts that such a warning label will be heeded in the high pressure 24/365 environment these MDCs are used in. **This is a serious safety issue.**

Panel Meeting Action: Accept in Principle

Panel Statement: See action and statement on Comment 12-71.

The submitter's recommendation has been addressed in Comment 12-71, Section 646.18 (renumbered from the original 646.19). The exception has been deleted.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

12-79 Log #610 NEC-P12 **Final Action: Reject**
(646.20)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 12-147
Recommendation: Revise text to read as follows:

646.20 Working Space for ITE.

(A) The working space depth in front of ITE where any live parts that may be exposed during routine servicing operate at not greater than 30 volts rms, 42 volts peak, or 60 volts dc; with a fault current less than 200 Amperes shall not be required to comply with 646.19.

(B) Any areas of ITE that require servicing of parts that are greater than 30 volts rms, 42 volts peak, or 60 volts dc; or with a fault current of 200 Amperes or more shall comply with the workspace requirements of 646.19.

Substantiation: 646.20: The "safe" voltages in this section should also and safe amperages. I have no direct information about safe amperages but I have worked on ITE that had low voltage high amperage uninsulated bus bars. Because of the increased efficiencies of DC distribution and reduced cooling requirements, I believe it will become more prevalent in the future. See, for example:
http://hightech.lbl.gov/documents/data_centers/CEC-TB-40.pdf

Panel Meeting Action: Reject

Panel Statement: The recommendation is outside the scope of the NEC and more appropriate for NFPA 70E, *Standard for Electrical Safety in the Workplace*. Also, there is no substantiation for the addition of the 200 amp value.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

12-80 Log #1526 NEC-P12 **Final Action: Reject**
(646.21)

TCC Action: The Correlating Committee directs that the Action on this comment be reported as "Reject" because, per the Action on Comment 1-81, 110.26 was not changed to 110.27.

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 12-147
Recommendation: Revise text to read as follows:

646.21 Work Areas and Working Space Around Batteries.

Working space around a battery system shall comply with paragraph ~~110.26~~ 110.27. Working clearance shall be measured from the edge of the battery rack.

Substantiation: 110.26 has been moved to 110.27.

Panel Meeting Action: Accept

Panel Statement: Note to Correlating Committee: There is a need to review this action for proper correlation with CMP-1 actions on Article 110.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

12-81 Log #384 NEC-P12 **Final Action: Accept in Principle**
(646.26 Exception)

Submitter: Jeffrey L. Holmes, IBEW Local Union 1 JATC
Comment on Proposal No: 12-147
Recommendation: Delete exception entirely.

Substantiation: Working space is truly a safety requirement and should never be disregarded for convenience or to save money. These installations will need to be maintained, adjusted or components replaced. Ignoring worker safety should not be condoned.

Panel Meeting Action: Accept in Principle

Panel Statement: See action and statement on Comment 12-71.

CMP-12 understands the submitter is referring to 646.19 in the original proposal. The submitter's recommendation has been addressed in Comment 12-71, Section 646.18 (renumbered from the original 646.19). The exception has been deleted.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

12-82 Log #426 NEC-P12 **Final Action: Accept in Principle**
(646.26(C) (New))

Submitter: Robert A. Jones, Independent Electrical Contractors, Inc.
Comment on Proposal No: 12-147
Recommendation: Delete the following text:

~~**(C)** Adequate work space shall be provided for minor servicing and maintenance (those tasks involving operations which can be safely accomplished by employees and where extensive disassembly of equipment is not required). Minor servicing and maintenance shall be able to be performed without exposing the worker to a risk of electric shock or personal injury.~~

Substantiation: This requirement is unenforceable. The NEC Style Manual lists "adequate" as a possibly unenforceable and vague term in Table 3.2.1. "Minor servicing and maintenance" is not defined. Checking for proper voltage will expose the worker to a risk of electrical shock.

Panel Meeting Action: Accept in Principle

Panel Statement: See action and statement on Comment 12-71.

The submitter's recommendation has been addressed in Comment 12-71, Section 646.22. The term "adequate" has been deleted. "Routine servicing and maintenance" is understood and the requirement does not specify the need to check for proper voltage.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

12-83 Log #425 NEC-P12 **Final Action: Accept in Principle**
(646.26(D) (New))

Submitter: Robert A. Jones, Independent Electrical Contractors, Inc.
Comment on Proposal No: 12-147
Recommendation: Revise text to read as follows:

(D) Space about electrical equipment shall comply with 110.26. Section 110.26(C) shall apply to an MDC regardless of the ampere rating of the MDC. ~~*Exception - The depth of the workspace need not comply with Table 110.26(A)(1) if the equipment is marked* "WARNING" and "De-energize Equipment before Servicing" or the equivalent.~~

Substantiation: Section 110.26 is intended to provide enough space for personnel to perform work without jeopardizing worker safety. NFPA 70E Article 130 details work involving electrical hazards and it recognizes that work may need to be performed while energized. In order to test a branch circuit for voltage or proper voltage, the equipment will have to be energized. Even with the proper PPE for the task the worker is still at risk of injury. Proper working space is crucial for the safety of the worker and this cannot be compromised.

Panel Meeting Action: Accept in Principle

Panel Statement: See panel action and statement on Comment 12-71.

The submitter's recommendation has been addressed in Comment 12-71, Section 646.18 (renumbered from the original 646.19). The exception has been deleted.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

ARTICLE 647 — SENSITIVE ELECTRONIC EQUIPMENT

12-84 Log #1457 NEC-P12 **Final Action: Reject**
(647)

Submitter: Martin Reid, Golden Era Productions
Comment on Proposal No: N/A
Recommendation: My comment is Article 647 should be deleted completely so as to allow 60/120V system to be universally used for the purpose of drastically increasing the level of electrical safety -- particularly in locations where there are children who would otherwise come into contact with 120VAC. 60/120VAC system should be widely used, so that children and adults making accidental contact with household and office branch circuits receive only 60V

shocks instead of 120V. Furthermore, as currently required in Article 647, 60/120V systems could be mandated to have GFCI protection. The combination of 60/120V distribution and two-pole GFCI branch circuit breaker protection feeding such branch circuits would mostly close the door on accidental electrocutions in residential and office occupancies wherever employed.

It is my understanding that 60/120V system is relegated only for sensitive electronic equipment instead of generally allowed solely because of lamp screw-shell s being energized at 60V with the 60/120V "balanced power" system. This is wrong-headed because the combination of 60/120V systems with two-pole standard 7 milliamp trip GFCI circuit breakers would basically close-the-door on residential and workplace electrocutions in the United States regardless of the "screw shell problem". It is well known that most electrocutions take place on 120V 60 Hertz standard branch circuits due to the sheer number of accidental contacts which take place.

Substantiation: Article 647 restricts use of 60/120V system with GFCIed branch circuits only for sensitive electronic equipment, yet the mandate and purpose is stated to be: "Committee Scope This Committee shall have primary responsibility for documents on minimizing the risk of electricity as a source of electric shock and as a potential ignition source of fires and explosions." Article 647 has blocked drastic and revolutionary increase in electrical safety for the entire US and parts of the world by prohibiting this much-safer electrical distribution method from being used generally. It is my contention this Article was formed due to interference with the purpose of the NEC and your committee, by entrepreneurial vested interests whose aim was to market products aimed for sound-studio use having nothing whatsoever to do with "minimizing the risk of electricity as a source of electric shock." The purpose was to develop a market for selling special "sensitive electronic equipment" power distribution equipment. I contend the entire reason Article 647 was developed was 100% entrepreneurial and 0% for the above altruistic Committee Scope and purpose. Thus, the actual exerted PURPOSE did not align with the purpose of your committee or your organization.

The PROBLEM: It is well known by most educated members of the Electrical Industry that 60 Hertz 120 volts and above were a very poor choice for electrical safety due to peaked ventricular fibrillation risk at this voltage and above and at this particular frequency. Serious students of electrical shock phenomena all must ask themselves the question: HOW DID WE END UP WITH PERHAPS THE WORST POSSIBLE FREQUENCY FOR HEART FIBRILLATION as the current United States standard? The answer is, it was entirely inadvertent and intended to reduce lamp flicker. It is generally well known that as AC voltage magnitude goes down from 120V 60 Hertz, and the closer it gets to 50V 60 Hertz, the more precipitous the drop in danger of heart fibrillation. At 60VAC, the heart fibrillation risk is almost nil, and becomes for all intents and purposes zero at 50VAC. The problem is the fact that this hazard need not be there generally. At all.

GFCIs are decades-old technology well proven to save lives. Had GFCIs been required for all general-use branch circuits, many lives, including the lives of innocent children would have been saved in the last 50 years. The lives of specific children would have been saved I know for an absolute fact – including one specific case I heard about from former Riverside County Chief Electrical Inspector. The combination of 60V-to-ground systems and double-pole 7 milliamp trip standard GFCI circuit breakers forms an unbeatable combination for preventing fatal electric shock in residences and offices. Those enjoying a drastically increased electrical safety-level in the United States are only the sound studio engineers in certain sound studios, and only they have benefited from this simple distribution type. This drastically increased safety must be broadened to include the next generations, so that innocents don't end up with their lives unnecessarily cut short. SPECIFIC REASON: My reasoning is connected with a valuation of human life. The question NFPA members must ask is, what is the value of a single human life? The answer to that question is impossible to answer, but approaches the infinite for a variety of reasons. Every single child deserves the chance to achieve greatness and a long, prosperous life filled with happiness, and their lives must not be allowed to be ever cut short due to a silly inadvertent bad decision --- the 60 Hertz operating frequency decision combined with 120V or greater. We in the electrical industry are charged with the responsibility to DO SOMETHING ABOUT IT. The contention has been that "general use equipment can't handle balanced power" and that "screw shells would be energized by 60VAC". Are these considerations sufficient to warrant unnecessary exposure of risk to individuals? A child contacting 60VAC with 6 milliamp GFCI protection from the circuit breaker is protected. An adult inadvertently contacting the branch circuit is protected. 99.9% of all utilization equipment intended for 120V 60 Hertz operation will plug in to "balanced power" system without the slightest hazard. The cost of upgrading or building a facility with 60/120V power is very low, as it involves a dry type transformer installed to feed the general-use branch circuits of the structure. For those choosing to essentially close-the-door in electric shock fatalities for the most part in their residences or workplaces, the cost is not major particularly if undertaken as part of the original construction and design of a building. Many would be happy to bear the small additional percentage cost if they knew they were securing a safety advantage enjoyed only by a few sound engineers currently. Eventually, the consideration of the valuation of human life could evolve into universal application of 60/120V system, even in Japan where it would be an even-safer 50/100V. Consideration about contacts with screw-shells should not stop a quantum-leap in electrical safety from taking place. That consideration can be dealt with easily – not so the inherent situation with 60 Hertz operating frequency which we are STUCK WITH. Equipment can be tested for being usable on balanced power, and it will be found 99.9% is suitable. For the sake of future generations the other.01 per cent can be dealt with.

I am asking you to honestly and carefully consider this comment. I am aware it has ramifications, but it would also promote business in that those wishing to upgrade the safety of their residences for the sake of their children's welfare would definitely pay for the necessary dry type transformers and double-pole GFCI breakers and additional panelboard to facilitate having highly upgraded safety. Sound Engineers could continue to be protected and safe, but we should revise the Code so that the same level of superlative safety can be expanded for all other uses, particularly for general use branch circuits which offer the highest percentage of accidental contacts that citizens make with our archaic electrical distribution system.

Panel Meeting Action: Reject

Panel Statement: The comment does not comply with the Regulations Governing Committee Projects, Section 4.4.5(b).

The submitter is requesting that Article 647 be deleted. CMP-12 does not agree with the submitter's recommendation or with the submitter's substantiation that 60/120 volt AC systems should be widely used. Article 647 is a very specific article for a very specific application where audio, video or similar electronic equipment is used in commercial and industrial facilities to reduce 60 Hz noise on this type of equipment. It is not used for normal power distribution nor is it permitted in residential applications due to the difference with standard residential wiring from a 120/240 volt, single-phase system.

Number Eligible to Vote: 11

Ballot Results: Affirmative: 11

ARTICLE 660 — X-RAY EQUIPMENT

12-85 Log #751 NEC-P12 **Final Action: Accept**

(660.4(C))

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 12-152

Recommendation: Continue to Accept.

Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 11
Ballot Results: Affirmative: 11

ARTICLE 665 — INDUCTION AND DIELECTRIC HEATING EQUIPMENT

12-86 Log #486 NEC-P12 **Final Action: Reject**
(665.2.Converting Device and 665.3 (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 12-153
Recommendation: Revise text to read as follows:
Converting Device. That part of the heating equipment that converts input mechanical or electrical energy to the voltage, current, and frequency used for the heating applicator. ~~A converting device consists of equipment using mains frequency, all static multipliers, oscillator-type units using vacuum tubes, inverters using solid-state devices, or motor generator equipment.~~
<u>**665.3 General**</u>
<u>**6653.1** A converting device shall consist of equipment using mains frequency, all static multipliers, oscillator-type units using vacuum tubes, inverters using solid-state devices, or motor generator equipment.</u>
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains a list of examples and such examples are not usually contained in definitions but as information. If, on the other hand, the CMP believes that this list is a requirement it should place it somewhere else in Article 665, for example as a section 665.3 or a similar new location, since NEC definitions shall not contain requirements. Moreover, the NEC manual of style does not permit the definition to contain the defined term and the second sentence contains the defined term “converting device”.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Suggested informational note as alternative:
<u>**Informational Note**: A converting device consists of equipment using mains frequency, all static multipliers, oscillator-type units using vacuum tubes, inverters using solid-state devices, or motor generator equipment.</u>
Panel Meeting Action: Reject
Panel Statement: CMP-12 disagrees with the submitter that the definition of converting device contains a requirement. Rather, the definition is stating a fact that the converting device consists of equipment with various attributes. These attributes add clarity to the definition.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

12-87 Log #616 NEC-P12 **Final Action: Accept**
(665.2.Converting Device)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 12-153
Recommendation: Revise text to read as follows:
665.2 Definitions.
Converting Device. That part of the heating equipment that converts input mechanical or electrical energy to the voltage, current, and frequency used for the heating applicator. A converting device consists of equipment using ~~mains~~ <u>line</u> frequency, all static multipliers, oscillator-type units using vacuum tubes, inverters using solid-state devices, or motor generator equipment. **[ROP 12–153]**
Substantiation: *Mains frequency* is British English. *Line frequency* is American English. *Line frequency* is used in several places in the Code. For instance:
665.1 Scope. This article covers the construction and installation of dielectric heating, induction heating, induction melting, and induction welding equipment and accessories for industrial and scientific applications. Medical or dental applications, appliances, or *line frequency* pipeline and vessel heating are not covered in this article.
Use the same name for the same thing to reduce confusion.
Panel Meeting Action: Accept
Panel Statement: CMP-12 accepts the submitter’s text.
CMP-12 disagrees with the submitter’s substantiation that the term “mains frequency” is British English. However, CMP-12 agrees with the recommendation to substitute the word “line” for the term “mains” in the definition.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

12-88 Log #175 NEC-P12 **Final Action: Accept**
(665.2.Heating Equipment Applicator)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 12-154
Recommendation: The Correlating Committee directs that the panel clarify the panel action on this proposal.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-12 accepts the direction of the Correlating Committee to clarify the panel action on Proposal 12-154.
Since the term “heating equipment applicator” is not used in this article CMP-12 decided to “accept in principle” and changed the term to be defined to “applicator” which is used in several places and is not clearly defined elsewhere. Therefore the term to be defined was changed from “heating equipment applicator” to “applicator” and the definition, (The device used to transfer energy between the output circuit and the object or mass to be heated), remained unchanged.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

12-89 Log #176 NEC-P12 **Final Action: Accept**
(665.23)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 12-158
Recommendation: The Correlating Committee directs that the panel correlate this proposal with the action taken on Proposal 1-114.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Add a new last sentence as follows:
The warning sign(s) or label(s) shall comply with 110.21.
Panel Statement: CMP12 accepts the direction of the Correlating Committee to correlate Proposal 12-158 with the action taken on Proposal 1-114.
CMP-12 revises the new last sentence to read as follows: The warning sign(s) or label(s) shall comply with 110.21.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ARTICLE 668 — ELECTROLYTIC CELLS

12-90 Log #487 NEC-P12 **Final Action: Reject**
(668.2.Cell Line Attachments and Auxiliary Equipment)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 12-159
Recommendation: Revise text to read as follows:
Cell Line Attachments and Auxiliary Equipment. As applied to this article, a term that includes, but is not limited to, auxiliary tanks; process piping; ductwork; structural supports; exposed cell line conductors; conduits and other raceways; pumps, positioning equipment, and cell cutout or bypass electrical devices. ~~Auxiliary equipment includes tools, welding machines, crucibles, and other portable equipment used for operation and maintenance within the electrolytic cell line working zone. In the cell line working zone, auxiliary equipment includes the exposed conductive surfaces of ungrounded cranes and crane-mounted cell-servicing equipment.~~
669.3 General
<u>**669.3.1**</u> Equipment for use in electroplating processes shall be identified for such use.
<u>**669.3.2** Auxiliary equipment includes tools, welding machines, crucibles, and other portable equipment used for operation and maintenance within the electrolytic cell line working zone.</u>
<u>**669.3.3** In the cell line working zone, auxiliary equipment includes the exposed conductive surfaces of ungrounded cranes and crane-mounted cell-servicing equipment.</u>
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains a list of examples and such examples are not usually contained in definitions but as information. If, on the other hand, the CMP believes that this list is a requirement it should place it somewhere else in Article 665, for example as a section 669.3 or a similar new location, since NEC definitions shall not contain requirements. Moreover, the NEC manual of style does not permit the definition to contain the defined term.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Suggested informational notes as an alternative:
<u>**Informational Note 1**: Auxiliary equipment includes tools, welding machines,</u>

crucibles, and other portable equipment used for operation and maintenance within the electrolytic cell line working zone.**Informational Note 2:** In the cell line working zone, auxiliary equipment includes the exposed conductive surfaces of ungrounded cranes and crane-mounted cell-servicing equipment.
Panel Meeting Action: Reject
Panel Statement: CMP-12 rejects changing the definition. The current definition does comply with the NEC Style Manual because it just states what cell line attachments and auxiliary equipment are and what they are not. In addition, the submitter's text does not add clarity to the article.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

12-91 Log #752 NEC-P12 **Final Action: Accept**
(668.21(A))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 12-160
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ARTICLE 670 — INDUSTRIAL MACHINERY

12-92 Log #753 NEC-P12 **Final Action: Accept**
(670.4)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 12-167
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

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Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

12-93 Log #1584 NEC-P12 **Final Action: Accept in Principle**
(670.4(A), Informational Note)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 12-167
Recommendation: Revise text to read as follows:
670.4 Supply Conductors and Overcurrent Protection.
(A) Size. The size of the supply conductor shall be such as to have an ampacity not less than 125 percent of the full-load current rating of all resistance heating loads plus 125 percent of the full-load current rating of the highest rated motor plus the sum of the full-load current ratings of all other connected motors and apparatus, based on their duty cycle, that may be in operation at the same time.
Informational Note No. 1: See ~~the 0–2000-volt ampacity tables of Article 310~~ 310.15(B)(16) through (20) for ampacity of conductors rated 1000 volts and below. **[ROP 12–167]**
Substantiation: Add a little more information to the informational note.
Panel Meeting Action: Accept in Principle

Revise Informational Note No. 1 to read as follows:
Informational Note No. 1: See Tables 310.15(B)(16) through 310.15(B)(20) for ampacity of conductors rated 1000 volts and below.
Panel Statement: CMP-12 accepts the submitter's text and edits for clarity.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

ARTICLE 675 — ELECTRICALLY DRIVEN OR CONTROLLED IRRIGATION MACHINES

19-42 Log #251 NEC-P19 **Final Action: Accept**
(675.8(B)19-118, 19-119)

Submitter: Edward G. Kroth, Verona, WI
Comment on Proposal No: 19-117
Recommendation: Proposals 19-117, 118 and 119 as published in the draft for the 2014 NEC meet the intent that I had in proposal 19-116 and they should continue to be accepted.
Substantiation: None given.
Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

19-43 Log #762 NEC-P19 **Final Action: Accept**
(675.10)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 19-120
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity.
The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

ARTICLE 680 — SWIMMING POOLS, FOUNTAINS, AND SIMILAR INSTALLATIONS

17-26 Log #1032 NEC-P17 **Final Action: Accept in Principle**
(680, Part III)

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 17-137
Recommendation: Revise the proposal by adding the word "storable" in several locations, as follows:
III. Storable Pools, Storable Spas, and Storable Hot Tubs
680.30 General. Electrical installations at storable pools, storable spas, or storable hot tubs shall comply with the provisions of Part I and Part III of this article.
Substantiation: The comment by Panel Member Blewitt is correct, although it reads likes a negative statement. By adding the word "storable" as indicated, the issue is resolved.
Panel Meeting Action: Accept in Principle

Revise 680, Part III to read:

III. Storable Pools, Storable Spas, and Storable Hot Tubs

680.30 General. Electrical installations at storable pools, storable spas or storable hot tubs shall comply with the...".

680.32 Ground–Fault Circuit Interrupters Required. (2nd paragraph) All 125-volt, 15 and 20 ampere receptacles located within 6.0 m (20 ft) of the inside walls of a storable pool, storable spa, or storable hot tub shall be...".

680.33 Luminaires. An underwater luminaire, if installed, shall be installed in or on the wall of the storable pool, storable spa, or storable hot tub. It shall comply with either 680.33(A) or (B).

680.34 Receptacle Location. Receptacles shall not be located less than 1.83 m (6 ft) from the inside walls of a storable pool, storable spa, or storable hot tub. In determining these dimensions, the distance to be...".

Panel Statement: CMP-17 agrees with the intent of this comment, but has added to Part III the word "storable", where appropriate, for consistency.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

17-27 Log #963 NEC-P17 **Final Action: Reject**
(680.22(A)(1))

Submitter: David H. Platt, Middle Atlantic Inspections Inc.
Comment on Proposal No: 17-101
Recommendation: Revise text to read as follows:
680.22 Area Lighting, Receptacles, and Equipment.
(A) Receptacles.
(1) Circulation and Sanitation System, Location. Receptacles that provide power for water-pump motors or for other loads directly related to the circulation and sanitation system shall be permitted to be located ~~at least 3.0 m (10 ft) from the inside walls of the pool, or not less than 1.83 m (6 ft)~~ between 1.5m (5 ft) and 1.83(6ft) from the inside walls of the pool ~~if they~~ and shall meet all of the following conditions:
(1) Consist of single receptacles
(2) Employ a locking configuration
(3) Are of the grounding type
(4) Have GFCI protection
Substantiation: Panel 17 has considered a reduction to 1.2m(4 ft) to be a reduction in the level of safety afforded by the Code, Not less than 1.5m(5 ft) was considered a safe distance prior to the change to 1.83m(6 ft) was accepted into the 2008 Code.
There need to be specific requirements for receptacles provided for circulation and sanitation equipment. 680.22(A)(2) states "Other receptacles shall be not less than 1.83 m (6 ft) from the inside walls of a pool." Regardless as to how many are installed or if they are single, duplex or quads, yes they too are required to be of the grounding type and have GFCI protection but other wiring methods may be used for other receptacles. If we do not keep specific provisions more than just being single, grounding type, and GFCI protected for the circulation and sanitation equipment, we will be providing the end user other improperly wired receptacle locations possibly installed using UF cable that may be inadvertently used to connect circulation and associated equipment.
Panel Meeting Action: Reject
Panel Statement: The proposed amendment does not provide the level of safety that is currently mandated by the Code. The proposed language eliminates the requirement for locating the circulation and sanitation system receptacle at least 10 feet from the inside wall of the pool and allows the receptacle to be placed at any location, thus decreasing the level of safety currently provided. Further, CMP-17 does not agree that employing a locking configuration receptacle will prevent the end user from having an improperly wired receptacle location.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

17-28 Log #964 NEC-P17 **Final Action: Reject**
(680.22(A)(1))

Submitter: David H. Platt, Middle Atlantic Inspections Inc.
Comment on Proposal No: 17-103
Recommendation: Revise text to read as follows:
680.22 Area Lighting, Receptacles, and Equipment.
(A) Receptacles.
(1) Circulation and Sanitation System, Location. Receptacles that provide power for water-pump motors or for other loads directly related to the circulation and sanitation system shall be permitted to be located ~~at least 3.0 m (10 ft) from the inside walls of the pool, or not less than 1.83 m (6 ft)~~ between 1.5m (5 ft) and 1.83(6ft) from the inside walls of the pool ~~if they~~ and shall meet all of the following conditions:
(1) Consist of single receptacles
(2) Employ a locking configuration
(3) Are of the grounding type
(4) Have GFCI protection
Substantiation: Panel 17 has considered a reduction to 1.2m(4 ft) to be a reduction in the level of safety afforded by the Code, Not less than 1.5m(5 ft) was considered a safe distance prior to the change to 1.83m(6 ft) was accepted into the 2008 Code.
There need to be specific requirements for receptacles provided for circulation and sanitation equipment. 680.22(A)(2) states "Other receptacles shall be not less than 1.83 m (6 ft) from the inside walls of a pool." Regardless as to how many are installed or if they are single, duplex or quads, yes they too are required to be of the grounding type and have GFCI protection but other wiring methods may be used for other receptacles. If we do not keep specific provisions more than just being single, grounding type, and GFCI protected for the circulation and sanitation equipment, we will be providing the end user other improperly wired receptacle locations possibly installed using UF cable that may be inadvertently used to connect circulation and associated equipment.
1.5m 5(ft) is currently considered a safe distance for Switching devices in 680.22 (D) as well as GFCI protected Luminaires,lighting outlets in 680.22(C) (4)
680.24(B)(2) currently allows a junction box or other electrical enclosure for a GFCI Device obviously not a receptacle to be located.1.2 m (4) ft from the inside wall of a pool.
680.24 Junction Boxes and Electrical Enclosures for Transformers or Ground-Fault Circuit Interrupters.
680.24(B) (2) Installation (b) Horizontal Spacing Junction Boxes and Electrical Enclosures for Transformers or Ground-Fault Circuit Interrupters. The enclosure shall be located not less than 1.2 m (4 ft) from the inside wall of the pool,
There need to be specific requirements for receptacles as there is for the wiring provided for circulation and sanitation equipment. Permitting a closer installation will assist along with the other requirements of 680.22(A)(1) to ensure that the circulation system and sanitation equipment if cord and plug connected get plugged into the the Receptacle(s) with the proper wing method feeding them. If all (4) of the specific requirements are not kept in place we will be providing the end user other improperly wired receptacle locations possibly installed using UF cable or some other non approved wiring method that may be inadvertently used to connect circulation and associated equipment.
Panel Meeting Action: Reject
Panel Statement: See panel action and panel statement in Comment 17-27.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

17-29 Log #965 NEC-P17 **Final Action: Reject**
(680.22(A)(1))

Submitter: David H. Platt, Middle Atlantic Inspections Inc.
Comment on Proposal No: 17-104
Recommendation: Revise text to read as follows:
680.22 Area Lighting, Receptacles, and Equipment.
(A) Receptacles.
(1) Circulation and Sanitation System, Location. Receptacles that provide power for water-pump motors or for other loads directly related to the circulation and sanitation system shall be permitted to be located ~~at least 3.0 m (10 ft) from the inside walls of the pool, or not less than 1.83 m (6 ft)~~ between 1.5m (5 ft) and 1.83(6ft) from the inside walls of the pool ~~if they~~ and shall meet all of the following conditions:
(1) Consist of single receptacles
(2) Employ a locking configuration
(3) Are of the grounding type
(4) Have GFCI protection
Substantiation: 680.22(A)(2) Makes no mention of lighting or other equipment locations in regard their distance to the inside wall of the pool.
680 VII. Hydromassage bathtubs and 680.62 Therapeutic tubs do not require the same type of wiring methods as swimming pool circulation and sanitation systems. They should not be used as a comparison.
680.62(A) & 680.71 have no relationship with a the cord and plug connected type of assembly noted in 680.22(A)(1).
Panel 17 has considered a reduction to 1.2m(4 ft) to be a reduction in the level of safety afforded by the Code, Not less than 1.5m(5 ft) was consider a safe distance prior to the change to 1.83m(6 ft) was accepted into the 2008 Code.
1.5m 5(ft) is already considered a safe distance for Switching devices in 680.22 (D)and Luminaires,lighting outlets in 680.22(C) (4)
There need to be specific requirements for receptacles provided for circulation and sanitation equipment. 680.22(A)(2) states "Other receptacles shall be not less than 1.83 m (6 ft) from the inside walls of a pool." Regardless as to how many are installed or if they are single, duplex or quads, yes they too are required to be of the grounding type and have GFCI protection but other wiring methods may be used for other receptacles. If we do not keep specific provisions more than just being single, grounding type, and GFCI protected for the circulation and sanitation equipment, we will be providing the end user other improperly wired receptacle locations possibly installed using UF cable that may be inadvertently used to connect circulation and associated equipment.
Panel Meeting Action: Reject
Panel Statement: See panel action and panel statement in Comment 17-27.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

17-30 Log #966 NEC-P17 **Final Action: Reject**
(680.22(A)(1))

Submitter: David H. Platt, Middle Atlantic Inspections Inc.
Comment on Proposal No: 17-105
Recommendation: Revise text to read as follows:
680.22 Area Lighting, Receptacles, and Equipment.
(A) Receptacles.
(1) Circulation and Sanitation System, Location. Receptacles that provide power for water-pump motors or for other loads directly related to the circulation and sanitation system shall be permitted to be located ~~at least 3.0 m (10 ft) from the inside walls of the pool, or not less than 1.83 m (6 ft)~~ between 1.5m (5 ft) and 1.83(6ft) from the inside walls of the pool ~~if they~~ and shall meet all of the following conditions:
(1) Consist of single receptacles
(2) Employ a locking configuration
(3) Are of the grounding type
(4) Have GFCI protection
Substantiation: 680.22(A)(2) Makes no mention of lighting or other equipment locations in regard their distance to the inside wall of the pool.
680 VII. Hydromassage bathtubs and 680.62 Therapeutic tubs do not require the same type of wiring methods as swimming pool circulation and sanitation systems. They should not be used as a comparison.
680.62(A) & 680.71 have no relationship with a the cord and plug connected type of assembly noted in 680.22(A)(1).
Panel Meeting Action: Reject
Panel Statement: See panel action and panel statement in Comment 17-27.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

17-31 Log #231 NEC-P17 **Final Action: Accept**
(680.22(A)(3))

TCC Action: The Correlating Committee understands that the text shown in the affirmative comment clarifies the panel's actions on Comment 17-31 and Proposal 17-106.
Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 17-106
Recommendation: The Correlating Committee directs that the action on this proposal be rewritten to comply with the NEC Style Manual regarding subdivision titles.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Reorder the entries in 680.22(A) as follows:
(1) Required Receptacle, Location. (Follow with text from 680.22(A)(3).)
(2) Circulation and Sanitation System, Location. (Follow with text from 680.22(A)(1).)
(3) Other Receptacles, Location. (Follow with text from 680.22(A)(2).)
Order of remainder does not change.
Panel Statement: CMP-17 has provided the title as directed by the Correlating Committee and reordered the subsections.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10
Comment on Affirmative:
COOK, D.: I agree with the Panel Meeting Action, but the text related to that action is not completely clear. Since revisions were accepted in the ROP, I hope the following description of proposed text is what we are voting on:
680.22(A) Receptacles
(1) Required Receptacle, Location. Where a permanently installed pool is installed, no fewer than one 125-volt, 15-or 20-ampere receptacle on a general-purpose branch circuit shall be located not less than 1.83 m (6 ft) from, and not more than 6 m (20 ft) from, the inside wall of the pool. This receptacle shall be located not more than 2.0 m (6 ft 6 in.) above the floor, platform, or grade level serving the pool.

(2) Circulation and Sanitation System, Location. Insert text from 2011 NEC 680.22 (A) (1) without condition (2) which was deleted by Proposals 17-101, 17-104, and 17-105.
(3) Other Receptacles, Location. Insert text from 2011 NEC 680.22 (A) (2).
(4) GFCI Protection. No change from 2011 NEC.
(5) Measurements. No change from 2011 NEC.

17-32 Log #1003 NEC-P17 **Final Action: Accept in Principle**
(680.22(B)(6))

Submitter: David Clements, International Association of Electrical Inspectors
Comment on Proposal No: 17-108
Recommendation: Add new text to read as follows:
Low voltage Class 2 lighting that conforms with low voltage contact limit levels shall be permitted to be located at the edge of a pool.
Substantiation: Even though a new definition for low voltage contact limits has been inserted into Section 680.2. Current language in Section 680.22 does not allow low voltage lighting to be installed in close proximity to the swimming pool. This will permit installations that are already being installed around most swimming pools and are in conflict with the existing NEC. Section 680.3 and Table 680.3 references 411.4(B) for these low voltage lighting systems but creates a Code loop without actually giving permission in Section 680.22 for site lighting to be installed within close proximity to the pool edge. Limiting the power supply to a Class 2 wet location voltage will ensure that the voltage source will be limited to the same low voltage limitation for low voltage swimming pool lighting.
Panel Meeting Action: Accept in Principle
Add a new 680.22(B)(6) to read as follows:
(6) Low-Voltage Luminaires. Listed low-voltage luminaires not requiring grounding, not exceeding the low-voltage contact limit, and supplied by listed transformers or power supplies that comply with 680.23(A)(2) are permitted to be located less than 1.5m (5 ft) from the inside walls of the pool.
Panel Statement: CMP-17 agrees that certain types of low-voltage luminaires should be permitted to be installed less than 5 ft. from the inside walls of the pool. To be acceptable for this location, the luminaires must have a rating that corresponds to the defined low-voltage contact limit and be supplied from a power source meeting the isolation requirements for swimming pool lighting. For example, listed low-voltage landscape lighting power units complying with UL 1838 and marked “For Use with Submersible Fixtures” comply with the low voltage contact limit (680.2) and are isolated as specified in 680.23(A)(2).
The panel does not agree that “Class 2” should be specified as this term would additionally limit the available power to the lighting.
There are a number of different locations in the article that these provisions could be placed but the panel believes a separate heading would provide the most clarity.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

17-33 Log #424 NEC-P17 **Final Action: Accept in Principle**
(680.22(D))

Submitter: Mark C. Ode, UL LLC
Comment on Proposal No: 17-108
Recommendation: Modify the exception proposed in this proposal to the following text:
Exception: Low voltage Class 2 lighting that conforms with low voltage contact limit levels shall be permitted to be located at the edge of a pool.
Substantiation: Even though a new definition for low voltage contact limits has been inserted into 680.2, 680.22 does not permit low voltage lighting to be installed in close proximity to the swimming pool. This new exception to (D) will permit installations that are already being installed around most swimming pools and are in conflict with the existing NEC. Section 680.3 and Table 680.3 references 411.4(B) for these low voltage lighting systems but creates a Code loop without actually giving permission in 680.22 for site lighting to be installed within close proximity to the pool edge. Limiting the power supply to a Class 2 wet location voltage will ensure that the voltage source will be limited to the same low voltage limitation for low voltage swimming pool lighting.
Panel Meeting Action: Accept in Principle
See panel action on Comment 17-32.
Panel Statement: The action on Comment 17-32 accomplishes the submitter’s intent.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

17-34 Log #1333 NEC-P17 **Final Action: Reject**
(680.23(A)(3))

Submitter: David Williams, Delta Township
Comment on Proposal No: 17-112
Recommendation: Revise text to read as follows:
680.23(A)(3) GFCI Protection, Relamping. A ~~g~~Ground-fault circuit interrupter protection shall be ~~installed in the~~ provided for ~~branch circuit supplying~~ luminaires operating at more than the low voltage contact limit such that there is no shock hazard during relamping. The installation of the ground-fault circuit interrupter shall be such that there is no shock hazard with any likely fault-condition combination that involves a person in a conductive path from any ungrounded part of the branch circuit or the luminaire to ground.
Substantiation: The code is not a design manual and the requirements in this section should require GFCI protection. It should be up to the installer on how to apply the rule. This wording has been in the code a number of decades and needs to be revised. GFCI protection in the feeder does not reduce the level of ground fault protection as referenced in the panel statement. The selective coordination issue also addressed in the panel statement is not correct.
Panel Meeting Action: Reject
Panel Statement: This comment reduces safety by potentially allowing disruption of power to unintended circuits.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 8 Negative: 2
Explanation of Negative:
COOK, D.: Discussion associated with committee action to reject and the Panel Statement indicates use of a GFCI in feeders rather than branch circuits reduces safety by potentially allowing disruption to unintended circuits. The proposed revision allowing GFCI protection to be provided in feeders or branch circuits is permissive, not required. Any installation where designers or owners desire to limit an outage, that option would be permitted. The same concern expressed by the Committee Statement could be extended to the feeder overcurrent device. Any equipment, lighting or other type that warrants that type of concern, would seem to be covered by the “Emergency” requirements in Article 700 and be provided with an emergency power source. NEC 210.70 includes required lighting outlets and lighting is not required in many of the areas of concern expressed in the Panel discussion. Committee concerns related to loss of area lighting that is not required by the NEC, IRC, or IBC, doesn’t seem to be a technical reason to exclude GFCI protection in a feeder if that is the desire of the designer and owner. Comment should be accepted.
SCHAPP, R.: I agree with the comments of D. Cook.

17-35 Log #1442 NEC-P17 **Final Action: Reject**
(680.23(A)(3))

Submitter: Brian Myers, IBEW Local Union 98
Comment on Proposal No: 17-112
Recommendation: This proposal should have been an Accept in Principal. To read as follows:
A GFCI shall be installed in accordance with one of the following
a) A ground fault circuit interrupter shall be installed in the branch circuit supplying luminaries operating at more than the low voltage contact limit such that there is no shock hazard during relamping. The installation of the ground fault interrupter shall be such that there is no shock hazard with any likely fault condition combination that involves a person in a conductive path from any ungrounded part of the branch circuit or luminarie to ground.
b) A ground fault circuit interrupter shall be installed in the feeder circuit supplying luminaries operating at more than the low voltage contact limit such that there is no shock hazard during relamping. The installation of the ground fault interrupter shall be such that there is no shock hazard with any likely fault condition combination that involves a person in a conductive path from any ungrounded part of the branch circuit or luminarie to ground. The feeder shall not supply interior lighting or lighting for egress.
Substantiation: The rule was separated into two list items for clarity. The last sentence in list item (b) will prevent imminent nuisance tripping of interior lighting as well as lighting for egress. These changes meet the submitter’s intent.
Panel Meeting Action: Reject
Panel Statement: This comment reduces safety by potentially allowing disruption of power to unintended circuits.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 8 Negative: 2
Explanation of Negative:
COOK, D.: See Cook statement on 17-34.
SCHAPP, R.: I agree with the comments of D. Cook.

17-36 Log #1517 NEC-P17 **Final Action: Reject**
(680.23(A)(3))

Submitter: Donald R. Cook, Shelby County Department of Development Services
Comment on Proposal No: 17-112
Recommendation: Reconsider proposed text and accept.
Substantiation: Panel statement indicated adding the words “feeder” reduces protection. Class A GFCI protective devices provide 4-6 mA ground-fault protection for personnel regardless of their location in the electrical system and the location of GFCI devices has no impact on selective coordination as used in the NEC. Providing GFCI protection at larger feeder devices could certainly be questioned from a design standpoint as the operation of that feeder device could cause an undesirable power outage if a ground-fault occurred. However, many smaller pool installations include a feeder supplying a limited number of branch circuits that only supply pool equipment. Allowing consumers to utilize a less costly option of feeder GFCI protection does not compromise the safety

of the installation. Feeder capacity and length varies tremendously and consumers, designers, and installers should be allowed to make that choice. NEC 90.1(B) indicates this Code contains provisions considered necessary for safety and 90.1(C) indicates the Code is not a design manual. This proposed text would not require the GFCI protection to be provided at the feeder, but simply permit that option. See Panel statements on Proposals 17-136 and 17-147.

Panel Meeting Action: Reject

Panel Statement: This comment reduces safety by potentially allowing disruption of power to unintended circuits.

Number Eligible to Vote: 10

Ballot Results: Affirmative: 8 Negative: 2

Explanation of Negative:

COOK, D.: See Cook statement on 17-34.

SCHAPP, R.: I agree with the comments of D. Cook.

17-37 Log #1513 NEC-P17 **Final Action: Accept**

(680.25)

Submitter: Donald R. Cook, Shelby County Department of Development Services

Comment on Proposal No: 17-119

Recommendation: Revise text to read as follows:

~~*Exception: An existing feeder between an existing remote panelboard and service equipment shall be permitted to run in flexible metal conduit or an approved cable assembly that includes an equipment grounding conductor within its outer sheath. The equipment grounding conductor shall comply with 250.24(A)(5).*~~

(2) Aluminum Conduit. Aluminum conduit shall not be permitted in the pool area where subject to corrosion.

(B) Grounding. An equipment grounding conductor shall be installed with the feeder conductors between the grounding terminal of the pool equipment panelboard and the grounding terminal of the applicable service equipment or source of a separately derived system. For other than ~~(I) existing feeders covered in 680.25(A), exception, or (2)~~ feeders to separate buildings that do not utilize an insulated equipment grounding conductor in accordance with 680.25(8)(2), this equipment grounding conductor shall be insulated.

(1) Size. This conductor shall be sized in accordance with 250.122 but not smaller than 12 AWG. On separately derived systems, this conductor shall be sized in accordance with 250.30(A)(3) but not smaller than 8 AWG.

(2) Separate Buildings. A feeder to a separate building or structure shall be permitted to supply swimming pool equipment branch circuits, or feeders supplying swimming pool equipment branch circuits, if the grounding arrangements in the separate building meet the requirements in 250.32(8). ~~Where installed in other than existing feeders covered in 680.25(A), Exception, a separate equipment grounding conductor shall he an insulated conductor.~~

Substantiation: Panel action on Proposals 17- 119 and 17-120 deleted the exception in 680.25(A). 2011 NEC references to that exception in 680.25(B) and 680.25(B){2) must be eliminated to correlate with the panel action on those proposals.

Panel Meeting Action: Accept

Revise 680.25 to read:

Exception: A~~n existing~~ feeder within a one-family dwelling unit or two-family dwelling unit between ~~an existing~~ remote panelboard and service equipment shall be permitted to run in flexible metal conduit or an approved cable assembly that includes an insulated equipment grounding conductor within its outer sheath. The equipment grounding conductor shall comply with 250.24(A)(5).

(2) Aluminum Conduit. Aluminum conduit shall not be permitted in the pool area where subject to corrosion.

(B) Grounding. An equipment grounding conductor shall be installed with the feeder conductors between the grounding terminal of the pool equipment panelboard and the grounding terminal of the applicable service equipment or source of a separately derived system. For other than (I) existing feeders covered in 680.25(A), exception, or (2) feeders to separate buildings that do not utilize an insulated equipment grounding conductor in accordance with 680.25(8)(2), this equipment grounding conductor shall be insulated.

(1) Size. This conductor shall be sized in accordance with 250.122 but not smaller than 12 AWG. On separately derived systems, this conductor shall be sized in accordance with 250.30(A)(3) but not smaller than 8 AWG.

(2) Separate Buildings. A feeder to a separate building or structure shall be permitted to supply swimming pool equipment branch circuits, or feeders supplying swimming pool equipment branch circuits, if the grounding arrangements in the separate building meet the requirements in 250.32(8). Where installed in other than existing feeders covered in 680.25(A), Exception, a separate equipment grounding conductor shall he an insulated conductor.

Panel Statement:

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

Comment on Affirmative:

17-38 Log #1514 NEC-P17 **Final Action: Accept**

(680.25)

Submitter: Donald R. Cook, Shelby County Department of Development Services

Comment on Proposal No: 17-120

Recommendation: Revise text to read as follows:

~~*Exception: An existing feeder between an existing remote panelboard and service equipment shall be permitted to run in flexible metal conduit or an approved cable assembly that includes an equipment grounding conductor within its outer sheath. The equipment grounding conductor shall comply with 250.24(A)(5).*~~

(2) Aluminum Conduit. Aluminum conduit shall not be permitted in the pool area where subject to corrosion.

(B) Grounding. An equipment grounding conductor shall be installed with the feeder conductors between the grounding terminal of the pool equipment panelboard and the grounding terminal of the applicable service equipment or source of a separately derived system. For other than ~~(I) existing feeders covered in 680.25(A), exception, or (2)~~ feeders to separate buildings that do not utilize an insulated equipment grounding conductor in accordance with 680.25(8)(2), this equipment grounding conductor shall be insulated.

(1) Size. This conductor shall be sized in accordance with 250.122 but not smaller than 12 AWG. On separately derived systems, this conductor shall be sized in accordance with 250.30(A)(3) but not smaller than 8 AWG.

(2) Separate Buildings. A feeder to a separate building or structure shall be permitted to supply swimming pool equipment branch circuits, or feeders supplying swimming pool equipment branch circuits, if the grounding arrangements in the separate building meet the requirements in 250.32(8). ~~Where installed in other than existing feeders covered in 680.25(A), Exception, a separate equipment grounding conductor shall he an insulated conductor.~~

Substantiation: Panel action (HI Proposals 17- 119 and 17-120 deleted the exception in 680.25(A). 2011 NEC references to that exception in 680.25(B) and 680.25(B){2) must be eliminated to correlate with the panel action on those proposals.

Panel Meeting Action: Accept

Number Eligible to Vote: 10

Ballot Results: Affirmative: 10

Comment on Affirmative:

HUNTER, R.: In 680.25(A)(1) the elimination of the Exception allowing existing flexible metal conduit or cable assemblies, has removed the acceptance of these methods without any technical substantiation. The issue for removal was the enforcement of "Existing". There have been no reported issues with these methods feeding pool equipment panelboards. This will now require residential dwellings to use wiring methods completely foreign to the constructions of a dwelling if they choose to pass through the interior of a dwelling.

17-39 Log #877 NEC-P17 **Final Action: Reject**

(680.26(B)(2)(b))

Submitter: C. Douglas White, Center Point Energy / Rep. Edison Electric Institute/Electric Light & Power Group

Comment on Proposal No: 17-126

Recommendation: The proposal should have been accepted.

Substantiation: Testing done by the Electric Power Research Institute (and cited by EnerNex in their NFPA research report as the best available data on the topic) clearly shows that under certain situations involving intermediate voltage short circuits, the alternate single loop method of constructing an equipotential plane as allowed by the current NEC will NOT protect the public from the possibility of serious shock or electrocution. For Panel 17 to require a documentation of hazards to persons before considering change when testing clearly predicts the potential of harm is a completely unacceptable position. In addition, the Panel statement alludes to a willingness to consider alternate technologies or methods to provide better protection. When an attempt at the Panel meeting was made to compromise by looking at other than copper grid solutions, the compromise was voted down with no discussion. The Panel's rejection of this proposal fails to recognize that the current Code does not meet the requirements set forth in 90.1(B) that requires an "installation that is essentially free from hazard". This proposal is an attempt to effect change that would meet this minimum requirement. The panel should be proactive considering the testing evidence of record and not wait on a death or injury statistic.

Panel Meeting Action: Reject

Panel Statement: No new substantiation has been submitted since the Report on Proposals to support this amendment. CMP-17 reiterates its position: CMP-17 disagrees that a copper bonding grid is justified for perimeter bonding to the exclusion of all other technologies. The panel has performed an extensive review, including commissioning a study, and has seen no definitive information demonstrating that the current alternate means is unsafe or results in a demonstrated hazard of death or injury. The panel has seen no evidence of incidents resulting in death or injury attributable to use of the alternate bonding means.

Number Eligible to Vote: 10
Ballot Results: Affirmative: 9 Negative: 1
Explanation of Negative:
RICHBOURG, S.: Testing done by the Electric Power Research Institute on pools with nonconductive shells clearly shows that under certain situations involving intermediate voltage short circuits, the alternate single loop method of constructing an equipotential plane as allowed by the current NEC will not protect the public from the possibility of serious shock or electrocution. The alternate single loop method of constructing an equipotential plane should only be allowed for the pools with conductive shells as specified in 680.26(B)(1).
Comment on Affirmative:
COOK, D.: I agree with the Panel Action to reject the comment. However, I do not agree with all the Panel Statement. Evidence has clearly been provided that stray voltage exists in many areas and in some areas the current permission to use a single # 8 will not eliminate the stray voltage conditions and may not reduce the condition to an acceptable level. I also don't believe enough substantiation has been submitted to determine an acceptable level of voltage and current and don't believe enough substantiation has been submitted to require the proposed bonding requirement at ALL pools.
WEST, L.: The Panel action to reject is correct. The present alternate means of perimeter bonding, which is a minimum requirement, was not demonstrated to be unsafe. Perimeter bonding utilizing a single buried conductor has been employed successfully and without known injury or fatality in a widespread fashion across the United States for over 30 years. Further, materials presented to the Panel do not document stray current issues except in certain geographically localized areas. The studies cited in the comments address pool types that are not in nationally widespread use and do not represent the construction of the vast majority of in-ground pools in the United States. The copper grid proposed by the Commenter is already allowed under this Article.

17-40 Log #1358 NEC-P17 **Final Action: Reject**
(680.26(B)(2)(b))

Submitter: Reuben E. Clark, Consolidated Manufacturing International
Comment on Proposal No: 17-127
Recommendation: Revise text to read as follows: 680.26(B)(2)(b) *Alternate Means*. Where structural reinforcing steel is not available or is encapsulated in a nonconductive compound, a copper conductor(s) grid shall be utilized where the following requirements are met: ~~(1) At least one minimum 8 AWG bare solid copper shall be provided.~~ (1) The copper grid shall be constructed of 8 AWG solid bare copper and be arranged meeting the requirements of 680.26(B)(1)(b)(3).(2) ~~The conductors shall follow the contour of the perimeter surface.~~ (2) The copper grid shall follow the contour of the perimeter surface extending 1 m (3 ft) horizontally beyond the inside walls of the pool. (3) Only listed splices shall be permitted. ~~(4) The required conductor shall be 450 to 600 mm (18 to 24 in.) from the inside walls of the pool. (5) The required conductor shall be secured with in or under the perimeter surface 100 mm to 150 mm (4 in. to 6 in.) from the inside walls of the pool. (5) The required conductor shall be secured with in or under the perimeter surface 100 mm to 150 mm (4 in. to 6 in.) below subgrade.~~ (4) Be secured within or under the deck or unpaved surfaces no more than 150 mm to 600 mm (4 in. to 6 in.) from the underside of the deck
Substantiation: I ask CMP17 to reconsider Proposal 17-127 Log #2716. In the Panel Statement it is written "The panel has performed an extensive review, including commissioning a study, and has seen no definitive information demonstrating that the current alternate means is unsafe or results in a demonstrated hazard of death or injury." However, in the proposal it is pointed out that the NEETRAC test of an actual field condition proves this. The testing conducted by ERPI proves this. Also, the NFPA's own report by EnerNEx states this. The proposal actually states the section of the EnerNex that declares "the only option that appears to keep the voltages under "arbitrarily safe levels" of a few volts was the "Copper Grid" option. "Therefore, the Panel cannot use the statement that the current alternative means is unsafe as justification to reject this proposal.
Simple internet searches will show a steadily growing number of problems with stray voltage presenting on the unprotected pool deck. This submitter has been contacted by many new pool owners who are angry that a pool could be built per code and they can't use the expensive pool they just purchased because they and their family members are getting shocked. Many are worried about the negative and potentially fatal effects of this stray voltage on their very young children and aging members, some who have pace makers and use the benefits of exercise in the water to maintain their health!
Furthermore, this lack of adequate protection is now creating an UNFAIR level of competition in the industry. The most recent example is that a homeowner contacted this submitter on October 16th with stray voltage on his deck and was furious because everyone was placing blame on someone else, after he had saved money "for years" and was finally able to install a pool and now he and his family are getting shocked on the deck and can't use it! He had researched the information on the internet, including the problems with dairy cows in WI. He printed off product information on Copper Bonding Grids that will eliminate the stray voltage or mitigate it successfully, because the single wire used per code did not! He gave it to the pool builder and declared the builder should not install another pool without rebar or copper bonding grid in the deck. Now it is on record that this particular pool builder is aware of a KNOWN PROBLEM, and he needs to execute an installation in EXCESS of the minimum level of safety the NEC currently provides. If he installs a deck without rebar or copper grid, he is subjecting himself to lawsuits as a Licensed Contractor. This puts the builder at an unfair DISADVANTAGE versus the other builders in the area who may not be aware of the new stray voltage in their area. He now has to factor in the cost of the rebar or copper grid just as he did years ago, while the other builders can quote jobs without this product and simply declare they are building "per code." Additionally, what does this builder do with the pools that he has sold but not yet started? He can't install with the single wire in the deck because he and the Electric Utility Company have determined there is a stray voltage in the area. He will have to absorb this cost, and again, while cost should not be an issue with respect to safety, the lack of effect codes has begun creating an unfair level of competition in the industry.
Also, in the Panel Statement is "The panel disagrees that a copper bonding grid is justified for perimeter bonding to the exclusion of all other technologies." This proposal addresses an ALTERNATE MEANS, not excluding anything, by definition, "alternate means" declares there is another means to accomplish the objective. Putting the copper bonding grid back into the code does NOT exclude all others, ONLY the single wire, which has been proven over and over to not provide adequate protection. The proposal reads that including the copper grid is only an OPTION, the installer always can use the preferred means stated in the earlier section of this code (rebar). Accepting this proposal simply eliminates the ineffective single wire, and elevates the minimum level of safety!
Finally, the conflict the proposal pointed out between allowing a single wire in the deck but not the shell, still has not been addressed. Leaving a single wire for the deck, but not the shell is a conflict in the code and cannot exist. If this proposal is not accepted, then this submitter requests an explanation as to how this conflict can exist.
I ask CMP-17 to ACCEPT this proposal and increase the level of safety back to the 2005 level, eliminate the unfair advantage the current alternate means is creating, and adhere to its own commissioned study by the EnerNex. Finally, all experts in this field have supported this proposal; NEETRAC, EPRI, IEEE, EEI and many Electric Utilities, the Electrical Section of the NFPA (2010 Annual Meeting voting to support NITMAM) and almost the entire body of the NFPA. The overwhelming support and evidence from testing, as well as increasing field problems should make this an easy decision.
Panel Meeting Action: Reject
Panel Statement: See panel statement on Comment 17-39.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9 Negative: 1
Explanation of Negative:
RICHBOURG, S.: See my Explanation of Negative vote on 17-39.
Comment on Affirmative:
COOK, D.: See Cook statement on 17-39.
WEST, L.: The Panel action to reject is correct. The present alternate means of perimeter bonding, which is a minimum requirement, was not demonstrated to be unsafe. Perimeter bonding utilizing a single buried conductor has been employed successfully and without known injury or fatality in a widespread fashion across the United States for over 30 years. Further, materials presented to the Panel do not document stray current issues except in certain geographically localized areas. The studies cited in the comments address pool types that are not in nationally widespread use and do not represent the construction of the vast majority of in-ground pools in the United States. The copper grid proposed by the Commenter is already allowed under this Article.
YASENCHAK, R.: Funding should be added to research this issue.

17-41 Log #1004 NEC-P17 **Final Action: Accept in Part**
(680.27(B)(2))

Submitter: David Clements, International Association of Electrical Inspectors
Comment on Proposal No: 17-136
Recommendation: Accept the proposal as submitted:
(2) Protection. The electric motor and controller shall be connected to a branch circuit or feeder protected by a ground-fault circuit interrupter.
Substantiation: The Panel stated that GFCI protection is currently allowed for either a branch circuit or feeder for electrically operated pool covers. That may be the interpretation of the Panel, but the current requirement states that the electrically operated pool cover shall be connected to a circuit protected by a GFCI. The wording implies that the only acceptable protection is protection of the branch circuit. Providing GFCI protection in either the branch circuit or the feeder will provide equivalent protection and will offer more flexibility in design and installation. The proposal will also add clarity as to the intent of this requirement.
Panel Meeting Action: Accept in Part
Accept only the addition of the word "branch" and not addition of the phrase "or feeder".
Panel Statement: To adopt the second of the two suggested amendments would reduce safety by allowing unintended disruption of power to lighting circuits.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 8 Negative: 2
Explanation of Negative:

COOK, D.: See Cook statement on Comment 17-34.
SCHAPP, R.: I agree with the comments of D. Cook.

17-42 Log #1334 NEC-P17 **Final Action: Reject**
(680.27(B)(2))

Submitter: David Williams, Delta Township
Comment on Proposal No: 17-136
Recommendation: Revise text to read as follows:
680.27(B)(2) Protection. The electric motor and controller shall be ~~connected to a circuit~~ protected by a ground-fault circuit interrupter.
Substantiation: The present wording is not clear that the GFCI protection is permitted to be installed in the feeder. The proposed chage will allow the installer to provide the GFCI protection in the branch circuit or in the feeder. The code is not a design manual and the requirements in this section should require GFCI protection. It should be up to the installer on how to apply the rule. This wording has beeen in the code a number of decades and needs to be revised.
Panel Meeting Action: Reject
Panel Statement: See Panel Action and Statement on Comment 17-41.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 8 Negative: 2
Explanation of Negative:
COOK, D.: See Cook statement on Comment 17-34.
SCHAPP, R.: I agree with the comments of D. Cook.

17-43 Log #232 NEC-P17 **Final Action: Accept**
(680, Part III)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 17-137
Recommendation: It was the action of the Correlating Committee that further consideration be given to the comments expressed in the voting.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: See Panel Action and Statement on Comment 17-26.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

17-44 Log #1515 NEC-P17 **Final Action: Reject**
(680.34)

Submitter: Donald R. Cook, Shelby County Department of Development Services
Comment on Proposal No: 17-138
Recommendation: Reconsider panel action and accept proposal as submitted.
Substantiation: Panel statement indicates the NEC cannot require or enforce product installation requirements or standards. That statement seems to contradict NEC 110.3(B). Proposal enhances safety and substantiation is accurate.
Panel Meeting Action: Reject
Panel Statement: See panel statement on Comment 17-45.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

17-45 Log #1571 NEC-P17 **Final Action: Reject**
(680.34)

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 17-138
Recommendation: Accept the proposal.
Substantiation: The panel statement is preposterous. Every single construction part of NEC wiring articles is filled with constraints that inform product standards, and such precedents extend back to the very earliest days of the NEC. The provision cited in the substantiation, 410.74(A) is exactly on point. The wording should go forward as noted in the comment in the voting and in the Correlating Committee action.
Panel Meeting Action: Reject
Panel Statement: UL 1081 includes instructions for installation and these become effective in early 2013. This requirement is also in the process of being added to ANSI/APSP/ICC-4, which contains the requirements for instructions to be provided with the pool. The submitter's intent is met by the product standards.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

17-46 Log #855 NEC-P17 **Final Action: Accept**
(680.42(B))

Submitter: Mike McCague, Watkins Manufacturing
Comment on Proposal No: 17-142
Recommendation: This comment is offering support for Accepted Proposal No. 17-142 Log #344 NEC-P17 to supersede Tentative Interim Amendment 70-11-1 (TIA 1005) issued by the Standards Council on March 1, 2011.
Substantiation: The new proposed language captures the intent of TIA 1005 to exempt listed portable electric spas from perimeter bonding requirements while better defining the class of spas as self-contained outdoor/indoor rated UL1563 listed. It is important to reference the separate external non-conductive step as not impacting the minimum height requirement.
Panel Meeting Action: Accept
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10
Comment on Affirmative:
COOK, D.: While text submitted in Comment 17-47 is more concise and better reflects NEC Style Manual requirements, this concept is met by this action.

17-47 Log #1572 NEC-P17 **Final Action: Reject**
(680.42(B))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 17-144
Recommendation: Accept the proposal in principle, using it to replace the action taken on Proposal 17-142, however, revise item (1) in the recommendation to read as follows:
(1) The spa or hot tub is not identified as suitable only for indoor use, and is installed on or above grade in accordance with all manufacturer's instructions.
Substantiation: This wording incorporates the wording identified in the panel statement on Proposal 17-142, but otherwise uses the syntax of the original proposal. It is more economical of wording and accords with metrication principles in 90.9 which Proposal 17-142 does not. The comment in the voting is correct.
Panel Meeting Action: Reject
Panel Statement: The submitter makes no substantive change to the text.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9 Negative: 1
Explanation of Negative:
COOK, D.: See Cook statement on Comment 17-46.

17-48 Log #407 NEC-P17 **Final Action: Accept in Principle in Part**
(680.57(B))

Submitter: Russel LeBlanc, The Peterson School of Engineering
Comment on Proposal No: 17-147
Recommendation: This proposal should be accepted. The present wording in the NEC should not be applicable to ALL circuits.
Substantiation: Some signs are connected to communication or signaling circuits. How can GFCI protection be provided for a communication circuit (Article 800) or a Class 2 remote control and signaling circuit (Article 725) that sends data or signals to an electronic sign? I don't believe a GFCI device exists for these types of circuits! Nor would it be necessary. Also, GFCI protection is not simultaneously required for the service, feeder AND the branch circuit. This needs to be made clear. Only of of those power circuits needs to be GFCI protected either the branch circuit or the feeder, but not both. That is presently not permitted since ALL CIRCUITS, no matter the type, feeding the sign need to be GFCI protected. The present wording literally means it would be a violation if ONLY the branch circuit, and not the feeder, feeding the sign was GFCI protected, since the feeder is another circuit feeding the sign too. I don't believe it is the intent of this section to require GFCI protection for the feeder AND the branch circuit simultaneously. Not do I believe that communication circuits, fire alarm circuits or remote control and signaling circuits are intended to be included in this requirement. My proposed wording will help make this clear.
Panel Meeting Action: Accept in Principle in Part
Revise 680.57(B) to read:
Ground-Fault Circuit-interrupter Protection for Personnel. ~~All circuits~~ Branch circuits or feeders supplying the sign shall have ground-fault circuit-interrupter protection for personnel.
Panel Statement: The exception is not adopted because it is redundant. The revised wording is simpler and satisfies the intent of the submitter.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

ARTICLE 682 — NATURAL AND ARTIFICALLY MADE BODIES OF WATER

17-49 Log #1225 NEC-P17 **Final Action: Reject**
(682.16)

Submitter: Carson Day, Gerogia Institute of Technology - NEETRAC
Comment on Proposal No: 17-154
Recommendation: The following text would be a new paragraph under section 682. Below are the changes recommended to the original change proposal submitted in November 20 I I.
682.16 Mitigation of Neutral Related Stray Voltages and Currents
To provide protection for neutral related stray voltages and currents, a suitably rated isolated transformer (a separately derived system) at the branch circuit service panel supplying the shore power shall be permitted.
The following ~~shall be required~~ configuration is recommended for the isolated system:
~~(1) The isolation transformer should be double insulated or its equivalent and shall have an internal shield between the windings that is rated to carry full fault current.~~
(1) The isolation transformer shall have overcurrent protection on the supply side as required in 450.3.
(2) The isolation transformer shall be provided with a ground fault protection device on the load side ~~30MA (UL943C Class B Ground Fault Circuit Interrupter).~~
(3) Metal enclosure ~~and internal shield conductor~~ of the transformer shall be connected to the supply side neutral and grounding system as required by 250.4 (A).
(4) The load side neutral and equipment grounding conductors shall be connected together and grounded on the secondary side of the transformer as required by 250.20(8). To provide adequate isolation, the installed grounding electrode shall ~~should~~ be located at least 6' from the nearest grounding electrode of the supply side and shall ~~should~~ be connected to the transformer by an insulated grounding conductor.
(5) The location of the isolation transformer shall be on the load side of the service disconnecting means ~~panel containing breaker and/or disconnecting means~~ and shall not be below the electrical datum plane.
Substantiation: Last summer, four children and one adult died in a two week period around July 4 due to electrocution while swimming around boat docks. These occurred in Missouri and Tennessee. The source of the electricity, whether contact voltage or stray voltage, was not detailed in the reports. During testing at similar boat docks, in North Carolina and Georgia, the stray voltage was great enough to pose a similar risk. Application of the isolation transformer, as described in the change proposal, effectively mitigates the risk to
people swimming near docks. In the case of single branch circuit, the isolation transformer can also serve as a back up to GFCI outlets and provide effective protection against contact voltages.
The changes presented here address some of the committee member comments to the original change proposal. This includes, changing the verbiage which makes this application mandatory and removing references to obsolete GFCI circuits.
A more detailed description of the isolation transformer application and the test results for contact voltage and stray voltage scenarios
is presented in the report, "Summary of NEC Change Proposal for Mitigation of Neutral Related Exposure Voltages at Marinas and Boat Docks."
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: This comment is a recommendation to allow what is already permitted in the NEC.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9
Ballot Not Returned: 1 Sweigart, R.

17-50 Log #1355 NEC-P17 **Final Action: Reject**
(682.16)

Submitter: Robert Metz, Duke Energy
Comment on Proposal No: 17-154
Recommendation: The following text would be a new paragraph under section 682. Below are the changes recommended to the original change proposal submitted in November 2011.
682.16 Mitigation of Neutral Related Stray Voltages
To provide protection for neutral related stray voltages, a suitably rated isolation transformer at the branch circuit service panel supplying the shore power may be permitted.
The following configuration is recommended for the isolated system:
(1) The isolation transformer should be double insulated or its equivalent and shall should have an internal shield between the windings that is rated to carry full fault current.
(2) The isolation transformer should have overcurrent protection on the supply side as required in 450.3.
(3) The isolation transformer should be provided with a ground fault protection device on the load side.
(4) Metal enclosure an internal shield conductors of the transformer should be connected to the supply side neutral and grounding system as required by 250.4(A).
(5) The load side neutral and equipment grounding conductors should be connected together and grounded at the transformer as required by 250.20(B). To provide adequate isolation, the installed grounding electrode should be located at least 6 ft. from the nearest grounding electrode and should be connected to the transformer by an insulated grounding conductor.
(6) The location of the isolation transformer should be on the load side of the service panel containing breaker and/or disconnecting means and should not be below the electrical datum plane.
Substantiation: This change proposal was submitted by Carson Day from Georgia Tech NEETRAC. Duke Energy supports this change to provide a method for boat dock owners to mitigate both stray voltage and contact voltage problems. As a registered professional engineer in North and South Carolina and as a Power Quality Specialist with Duke Energy. I have worked to address numerous contact and stray voltage issues at docks on Lakes Jocassee, Keowee and Hartwell in south Carolina. Years of monitoring shows that dock safety is a serious issue that is not adequately addressed in the NEC.
The five deaths due to electrocution around boat docks show the importance of this change proposal. contact voltage problems are possible at any boat dock that has electric service. Stray voltage is a problem that can occur even when the dock is wired correctly due to current NEC requirements.
During their testing, NEETRAC has shown that both contact voltage and stray voltage can be fatal. The testing also showed that the use of an isolation transformer can successfully mitigate these dangers.
Panel Meeting Action: Reject
Panel Statement: This comment is a recommendation to allow what is already permitted in the NEC.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9
Ballot Not Returned: 1 Sweigart, R.

17-51 Log #1438 NEC-P17 **Final Action: Reject**
(682.16)

Submitter: Marty L. Page, Georgia Power Company
Comment on Proposal No: 17-154
Recommendation: The following text would be a new paragraph under section 682. Below are the changes recommended to the original change proposal submitted in November 2011.
682.16 Mitigation of Neutral Related Stray Voltages
To provide protection for neutral related stray voltages, a suitably rated isolation transformer at the branch circuit service panel supplying the shore power may be permitted.
The following configuration is recommended for the isolated system:
(I) The isolation transformer should be double insulated or its equivalent and shall should have an internal shield between the windings that is rated to carry full fault current.
(2) The isolation transformer should have overcurrent protection on the supply side as required in 450.3.
(3) The isolation transformer should be provided with a ground fault protection device on the load side.
(4) Metal enclosure and internal shield conductor of the transformer should be connected to the supply side neutral and grounding system as required be 250.4 (A).
(5) The load side neutral and equipment grounding conductors should be connected together and grounded at the transformer as required be 250.20(8). To provide adequate isolation, the installed grounding electrode should be located at least 6' from the nearest grounding electrode and should be connected to the transformer be an insulated grounding conductor.
(6) The location of the isolation transformer should be on the load side of the service panel containing breaker and/or disconnecting means and should not be below the electrical datum plane.
Substantiation: This change proposal was submitted by Carson Day from Georgia Tech - NEETRAC. My company supports this change to provide a method for boat dock owners to mitigate both stray voltage and contact voltage problems.
The five deaths due to electrocution around boat docks show the importance of this change proposal. Contact voltage problems are possible at any boat dock that has electric service. Stray voltage is a problem that can occur even when the dock is wired correctly due to current NEC requirements.
During their testing, NEETRAC has shown that both contact voltage and stray voltage can be fatal. The testing also showed that the. use of an isolation transformer can successfully mitigate these dangers.
Panel Meeting Action: Reject
Panel Statement: This comment is a recommendation to allow what is already permitted in the NEC.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9
Ballot Not Returned: 1 Sweigart, R.

ARTICLE 690 — SOLAR PHOTOVOLTAIC (PV) SYSTEMS

4-79 Log #912 NEC-P04 **Final Action: Reject**
(690.1)

Submitter: Dale Rooney, Municipality of Anchorage
Comment on Proposal No: 4-168
Recommendation: Accept the proposal with the additional text for Class 2 systems not exceeding 30 volts after the words Tables 11(A) or (B).
Substantiation: The added text is needed to correlate with stated intend to establish limits below which the shock and fire hazards are reduced. The reference to Class 2 is in keeping with standards that are already recognized within the electrical industry as having reduced hazards. If the panel is not satisfied with a reference outside of Article 690 they should restate those limits or establish and state their own limits. Is a system operating at 12 volts and 5 amps safe enough to not require additional regulation or perhaps 5 volts and 1 amp? Logically there must be some limit below which the panel is just making rules for the sake of regulation, which I believe is wrong.
Panel Meeting Action: Reject
Panel Statement: PV modules below Class 2 limits can become a fire hazard when backfed by other energy sources.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14
Comment on Affirmative:
ROGERS, J.: As the submitter has referenced even class 2 systems are covered by the NEC when they are installed so why should PV systems at restricted power levels not be covered? The small stand alone systems that are integrated into products, and that are not used to connect into the premises wiring, are already exempt from complying with the NEC. If any size PV system is used within buildings, especially in an emergency situation, there should be a set of requirements to be certain the systems and their interconnection is safe.

4-80 Log #529 NEC-P04 **Final Action: Reject**
(690.2)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 4-184
Recommendation: Revise text to read as follows:
690.2 Definitions.
Photovoltaic System. The total components and subsystems that, in combination, convert solar energy into electric energy suitable for connection to a utilization load and/or the electrical production and distribution network.
Substantiation: To cover net metering (or production metering) should the text in *italics* below be included?
Inverter Input Circuit. Conductors between the inverter and the battery in stand-alone systems or the conductors between the inverter and the photovoltaic output circuits for *electrical production and distribution network*.
Panel Meeting Action: Reject
Panel Statement: Connection to a utilization load includes the electrical production and distribution network.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-81 Log #1070 NEC-P04 **Final Action: Reject**
(690.2)

TCC Action: The Correlating Committee directs that this Comment be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative. The Correlating Committee understands, based on the comments on voting, that consensus still exists on Proposal 4-173.
Submitter: John C. Wiles, Southwest Technology Development Institute, New Mexico State University
Comment on Proposal No: 4-173
Recommendation: Revise text to read as follows:
Direct Current (dc) Combiner. A ~~device~~ junction box or an enclosed and listed assembly of components used in the PV Source and PV Output circuits to combine two or more dc circuit inputs and provide one or more dc circuit outputs.
Substantiation: There was no intent to include listed cable assemblies in this definition. The use of listed (UL 6703) cable assemblies (aka harnesses) which include in-line fusing and electrical taps have become a popular method of combining strings before terminating into a combiner box. The language as written could be interpreted to include cable harnesses in the definition of Direct Current (dc) Combiner. Further, there are designs for ungrounded PV arrays that employ a split bus combiner box that technically have two outputs. The above changes make it clear that the above definition is meant to define an enclosed assembly of fuse holders, terminals, bus bar, power distribution blocks etc and not listed cable harnesses.
Panel Meeting Action: Accept in Principle
Revise proposed text as follows:
Direct Current (dc) Combiner. A ~~device~~ junction or pull box, or an enclosed and listed assembly of components used in the PV Source and PV Output circuits to combine two or more dc circuit inputs and provide one or more dc circuit outputs.
Panel Statement: The panel added the words "pull box".
Number Eligible to Vote: 14
Ballot Results: Affirmative: 9 Negative: 5
Explanation of Negative:
ALLISON, M.: Pull boxes and junction boxes have not been investigated for use as combiner boxes.
BOWER, W.: The addition of the word "pull box" by the panel may have unintended consequences. A PV module junction box is typically a part of a PV module. Adding the term "pull box" could allow for an assembly of components in the field that escapes the listing and safety process and may include components that are not rated or listed for the application. I strongly recommend the panel addition of "pull box" be deleted until clarifications on what can be installed within the "pull box" are added. Article 314.24(B)(2) Exception allows for devices or utilization equipment be located within a pull box under some conditions.
Rejecting this comment will allow the original proposal 4-199 that requires in 690.4(B) that combiner boxes be listed for the PV application. Furthermore, the panel accepted modifications to 690.31(A) which states "(A) Wiring Systems. All raceway and cable wiring methods included in this Code, other wiring systems and fittings specifically listed for use on PV arrays, and wiring as part of a listed system shall be permitted."
ROGERS, J.: This comment should have been rejected. The original proposal was fine as it was originally submitted in limiting the DC combiner to a specified product. This is a definition and should be based on an identified product that can be listed. Many of the field related problems and fires have actually resulted from improper connections using parts that do not meet the product standards for combiners but are being used as such. Even if this definition were to be accepted other means could be approved by the AHJ on smaller systems. In addition manufacturers have already responded and they are making listed DC combiners for use on small systems.
STAFFORD, T.: By allowing a junction or pull box into the definition, it has provided confusion not clarity of the definition for the installer. By allowing those terms, a 4 square box can be considered a combiner because it can be a junction box and/or a pull box. Overcurrent devices used in some combiners, could now be placed into junction boxes, and pull boxes without regard to spacing requirements or heating concerns that the current listing requirement includes.
NEC 314.16 applies to box fill, but not for overcurrent devices. By allowing this addition of these two terms, we will see more problems with this in the future as companies trying to compete for PV installations will replace a listed combiner with anything that could be considered a junction or pull box such as a 4 square box.
ZGONENA, T.: The panel should have rejected the comment thereby reverting back to the text accepted in the ROP. 690.4 requires combiner boxes to be listed for the PV application which would prevent cable assemblies that are not listed for the application.
The commenter's concern about PV harnesses and cable assemblies were addressed in the ROP stage. Under proposal 4-287 we accepted the following:
690.31 Methods Permitted.
(A) Wiring Systems. All raceway and cable wiring methods included in this Code, other wiring systems and fittings specifically listed for use on photovoltaic arrays, and wiring as part of a listed system shall be permitted.
Allowing the addition of junction or pull boxes will create additional confusion and permit the building of combiner boxes in the field from components without testing. When combiner boxes are assembled from various components, it is very common that the assembly will not meet the temperature test requirements, therefore the use of field assembled combiner boxes may result in assemblies that could overheat in use.

4-82 Log #60 NEC-P04 **Final Action: Accept**
(690.2.Solar Photovoltaic System)

TCC Action: The Correlating Committee understands that the definition for Photovoltaic System will be placed in Article 100 per the panel action on Proposal 4-8a. The text of the definition is not identical in Proposals 4-8a and 4-184. Hence, the Correlating Committee clarifies the text of the definition as follows: "Photovoltaic (PV) System. The total components and subsystems that, in combination, convert solar energy into electric energy suitable for connection to a utilization load."
Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-184
Recommendation: The Correlating Committee directs that the panel clarify the panel action on this proposal to correlate with the panel action on Proposal 4-8a and determine the placement of the definition, Article 100 or 690.2.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Move definition of solar photovoltaic system to Article 100.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

Comment on Affirmative:

BOWER, W.: Although it is proper that this definition be in the definition section of the Code, I recommend that since this is one of the first times "photovoltaic" is used, the term "PV" be added to set the stage for the use of PV as appropriate in the rest of the code. (e.g. "Solar Photovoltaic (PV) System") (This is an editorial change only)

4-83 Log #1198 NEC-P04 **Final Action: Accept in Principle**
(690.4. DC to DC Converter)

TCC Action: The Correlating Committee directs that the panel action on Comment 4-83 be reported as "Accept in Principle" and the text revised editorially for proper grammar and for conformance with the NEC Style Manual regarding the use of the abbreviation "dc". The text is revised as follows: "DC to DC Converter. A device installed in the PV source circuit or PV output circuit that can provide an output dc voltage and current at a higher or lower value than the input dc voltage and current."
Submitter: Marvin Hamon, Hamon Engineering
Comment on Proposal No: 4-172
Recommendation: Revise text to read as follows:

DC to DC Converter. ~~DC utilization equipment in the PV Source Circuit or PV Output Circuit, or integrated into the PV module, used to modify and control DC power.~~ Device installed in the PV Source or PV Output Circuit that can output a DC voltage and current at a higher or lower value than the input DC voltage and current.

Substantiation: DC to DC Converters are in Article 690, and are used more and more in PV systems, but not defined in the NEC. Since the output parameters of these devices can be different than the input parameters users of the code need to be made aware of this so they will be aware that the rating of equipment on the output side may need to be different than that on the input.
Panel Meeting Action: Accept
Panel Statement: The comment corrects the definition to address the panel statement in the proposal stage.

The panel recognizes the correct print line should be 690.2.

Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:

STAFFORD, T.: This panel member feels that a combiner box or a y-connector falls under this definition. A y-connector outputs a current at twice the level of the two inputs

Comment on Affirmative:

BOWER, W.: The term DC should be "dc" in two places for consistency in the Code. Also "output is not normally a verb so I recommend a change to the wording of the definition to "...that can provide at the output a dc voltage and/or current...." (This is an editorial change only)

4-84 Log #61 NEC-P04 **Final Action: Accept**
(690.4(B))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-194
Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the panel actions taken on Proposals 4-188a, 4-190, and 4-284a since the accepted text in this proposal is not the same as the revised text in the other proposals.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the direction of the Correlating Committee. The panel reviewed this and the language was inserted into 690.31(B) with Proposal 4-284a.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-85 Log #1285 NEC-P04 **Final Action: Accept in Principle in Part**
(690.5)

TCC Action: See panel action on Comment 4-87.
Submitter: Jim Eichner, Schneider Electric - Solar Business
Comment on Proposal No: 4-214
Recommendation: Original Proposal 4-214 was as follows:

The ground-fault protection device or system shall:

1) determine the pv input circuit has a minimum acceptable level of isolation prior to export of current,
2) be capable of detecting a ground-fault current,
3) interrupting the flow of fault current, and
4) provide ~~providing~~ an indication of the fault.

Automatically opening the grounded conductor for measurement purposes or ~~of the faulted circuit~~ to interrupt the ground-fault current path shall be permitted. If a grounded conductor is opened to interrupt the ground-fault current path, all conductors of...".

Schneider Electric supports improved GFP and suggests the following improvements to the above proposal (strike-through and underline in the following are relative to the above original proposal):

"The ground-fault protection device or system shall:

1) determine the ~~pv input circuit~~ Photovoltaic Power Source has a ~~minimum acceptable level of~~ isolation from ground from ground prior to export of current,
2) be capable of detecting a ground-fault,
3) interrupt the flow of fault current, and
4) ~~provide an indication of the fault~~ have an annunciator that provides both a visual or audible indication, and an indication capable of being remotely monitored, that the ground fault protection system has operated, and
5) be approved for the purpose.

Automatically opening or ungrounding the grounded conductor, for measurement purposes or to interrupt the ground-fault current path shall be permitted. If a grounded conductor is opened to interrupt the ground-fault current path, all conductors of...".

Substantiation: The proposal as originally submitted is not as clear as it could be, uses a term that is not defined, could be interpreted as disallowing a commonly accepted method, and does not require approved device or system. We feel these changes make the proposal more accurate and clear.

1. "a minimum acceptable level of" is deleted as per the Panel Statement in the ROP
2. "pv input circuit" is not a defined term - the intent of the requirement is to check the whole array - i.e. the "Photovoltaic Power Source" which is the defined NEC term.
3. "from ground" is added to make it clear what the isolation is with respect to (as opposed to isolation from the AC part of the system, or from other circuits, etc.)
4. "or ungrounding" (the grounded conductor) is added because that is what many approved GFP systems actually do today, rather than opening the ungrounded conductor - the existing and originally proposed wording could be interpreted as disallowing a commonly accepted method
5. in sub-section (4) we propose requiring additional annunciation that is able to be monitored remotely, since a local visual or audible annunciator is useless if the PV plant is 100 miles from the nearest person or on a rooftop that rarely gets accessed
6. sub-section 5) "be approved for the purpose" is added because the proposal contains no values for the required isolation or ground fault current detection levels and therefore the equipment standards (UL1741) must be used to determine if the system addresses the requirement properly.

Panel Meeting Action: Accept in Principle in Part

The panel rejects the changes in item 4.

Panel Statement: Specific product requirements and the remote monitoring and annunciator belong in the product standard.

The correct section reference is 690.5(A).

See panel action on Comment 4-87, which addresses the concerns of the submitter.

Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:

BOWER, W.: It appears the panel has accepted this modification to (a)(1) through this comment, but has then eliminated the (a)(1) in 4-85, 4-86, and 4-87. This panel statement should have also rejected the changes in (a)(1) with the acceptance of 4-87 being the Final Action.

4-86 Log #1071 NEC-P04 **Final Action: Accept in Principle**
(690.5(A))

Submitter: John C. Wiles, Southwest Technology Development Institute, New Mexico State University
Comment on Proposal No: 4-214
Recommendation: Revise 4-214 as shown:

(A) Ground-Fault Detection and Interruption. The ground-fault protection device or system shall:

~~(1) Determine the pv input circuit has isolation prior to export of current,~~
(1) ~~(2)~~ Be capable of detecting a ground-fault in the PV array dc current carrying conductors and components including any intentionally grounded conductors,
(2) ~~(3)~~ Interrupt the flow of fault current, ~~and~~
(3) ~~(4)~~ Provide an indication of the fault, and
(4) Be listed for providing PV ground fault protection.

Substantiation: Undetected ground faults on grounded conductors have caused several fires in PV systems over the last half decade. Clearly ground fault protection (GFP) capabilities need to be improved in new PV systems. As result, we applaud and support the Code Making Panel in addressing this important issue. In the end, however, the ground fault protection sensitivity requirements in the standards, which are too lenient for modern PV systems, need to be updated to resolve this problem. The modifications proposed in this comment will help drive changes to the standards so as to eliminate this problem and will require that GFP used in PV systems comply with these new standards.

The modifications included in Proposal 4-214 successfully address several issues with the NEC requirements for GFP. First, the 2011 Code is sometimes interpreted to require a current based detection method because it reads GFP "…shall be capable of detecting a ground-fault current". Unfortunately, current based detection methods are not always the most effective GFP solutions for all PV system designs. Second, some inspectors view the 2011 Code as not allowing for insulation resistance measurements on grounded conductors in solidly grounded systems because it would require disconnecting these conductors from ground during the measurement. Insulation resistance measurements can be a very effective GFP method in some system designs and will help improve detection of grounded conductor ground faults. It is tremendous that the Code Making Panel has addressed both of these issues with Proposal 4-214 by removing current from requirement #2 and adding “for measurement purposes or” to the supporting paragraph.

Now then, the new 2014 language does raise a new problem as result of this proposal. It requires the use of insulation resistance measurements in all systems. This method is not universally effective and will not be the best GFP for all PV system designs. Furthermore, as new technologies come to market, GFP methods superior to insulation resistance measurements may emerge. We want the 2014 NEC to address the inadequacies of present GFP once and for all and not legislate the use of a specific solution. For this reason, we would request that you adapt 690.5(A) to read as modified above. This will stimulate UL 1741 to be updated to reflect the needs for improved GFP in PV systems and to ensure that the new functional requirements are met without requiring a specific implementation/solution.

Lastly, the statement of “… prior to the export of current” is not enforceable. It is unclear how frequently this test would have to be performed. It could be interpreted to be: 1) before the system is turned on for the first time; 2) every night; or 3) every time the inverter starts up.

Panel Meeting Action: Accept in Principle

Panel Statement: See panel action on Comment 4-87, which addresses the concerns of the submitter.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-87 Log #1489 NEC-P04 **Final Action: Accept**

(690.5(A))

Submitter: John Smirnow, Solar Energy Industries Association

Comment on Proposal No: 4-214

Recommendation: Revise text to read as follows:

(A) Ground-Fault Detection and Interruption. The ground-fault protection device or system shall:

~~(1) Determine the pv input circuit has isolation prior to export of current,~~

(1) ~~(2)~~ Be capable of detecting a ground-fault in the PV array dc current carrying conductors and components including any intentionally grounded conductors,

(2) ~~(3)~~ Interrupt the flow of fault current~~, and~~

(3) ~~(4)~~ Provide an indication of the fault, and

(4) Be listed for providing PV ground fault protection.

Substantiation: This comment is the result of a consensus process established among two groups of stakeholders: 1) the SEIA Codes and Standards Working Group, and 2) the PV Industry Forum. Participants in these groups included the following individuals:

SEIA Codes and Standards Working Group

1. Mark Albers, SunPower
2. Mark Baldassari, Enphase Energy
3. Ward Bower, SEIA
4. Bill Brooks, Brooks Engineering/SEIA
5. Joe Cain, Chair of SEIA Codes and Standards Working Group
6. Keith Davidson, SunTech
7. Darrel Higgs, Dow Solar
8. Lee Kraemer, First Solar
9. Carl Lenox, SunPower
10. Charles Luebke, Eaton
11. Martin Mesmer, E.ON
12. Steve Pisklak, Dow Solar
13. Robert Rynar, First Solar
14. Michael Schenck, First Solar
15. John Smirnow, SEIA
16. Kris VanDerzee, First Solar
17. Leo Wu, SolarCity
18. Tilak Gopalarathnam, REFUsol Incorporated

PV Industry Forum

1. Greg Ball, BEW Engineering
2. Robert Rynar, First Solar
3. Tilak Gopalarathnam, REFUsol Incorporated
4. Mark Albers, SunPower Corporation
5. Tim Zgonena, UL

Undetected ground faults on grounded conductors have caused several fires in PV systems over the last half decade. Clearly ground fault protection (GFP) capabilities need to be improved in new PV systems. As result, we applaud and support the Code Making Panel in addressing this important issue. In the end, however, the ground fault protection sensitivity requirements in the standards, which are too lenient for modern PV systems, need to be updated to resolve this problem. The modifications proposed in this comment will help drive changes to the standards so as to eliminate this problem and will require that GFP used in PV systems comply with these new standards.

The modifications included in Proposal 4-214 successfully address several issues with the NEC requirements for GFP. First, the 2011 Code is sometimes interpreted to require a current based detection method because it reads GFP “…shall be capable of detecting a ground-fault current”. Unfortunately, current based detection methods are not always the most effective GFP solutions for all PV system designs. Second, some inspectors view the 2011 Code as not allowing for insulation resistance measurements on grounded conductors in solidly grounded systems because it would require disconnecting these conductors from ground during the measurement. Insulation resistance measurements can be a very effective GFP method in some system designs and will help improve detection of grounded conductor ground faults. It is tremendous that the Code Making Panel has addressed both of these issues with Proposal 4-214 by removing current from requirement #2 and adding “for measurement purposes or” to the supporting paragraph.

Now then, the new 2014 language does raise a new problem as result of this proposal. It requires the use of insulation resistance measurements in all systems. This method is not universally effective and will not be the best GFP for all PV system designs. Furthermore, as new technologies come to market, GFP methods superior to insulation resistance measurements may emerge. We want the 2014 NEC to address the inadequacies of present GFP once and for all and not legislate the use of a specific solution. For this reason, we would request that you adapt 690.5(A) to read as modified above. This will stimulate UL 1741 to be updated to reflect the needs for improved GFP in PV systems and to ensure that the new functional requirements are met without requiring a specific implementation/solution.

Lastly, the statement of “… prior to the export of current” is not enforceable. It is unclear how frequently this test would have to be performed. It could be interpreted to be: 1) before the system is turned on for the first time; 2) every night; or 3) every time the inverter starts up.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

Comment on Affirmative:

BOWER, W.: The accepted language for (a)(1) uses the words “Be capable of detecting”. That does not appear enforceable or prescriptive enough to meet the intent. Changing the language to “Detect a ground-fault in the PV array dc current carrying conductors and components including any intentionally grounded conductors,” is much more prescriptive and meets the intent of the action and is enforceable. (This is an editorial change only)

4-88 Log #1199 NEC-P04 **Final Action: Reject**

(690.7)

Submitter: Marvin Hamon, Hamon Engineering

Comment on Proposal No: 4-220

Recommendation: Revise text to read as follows:

(F) DC to DC Converter. The maximum system voltage on the output of one or more DC to DC Converters in series shall be ~~determined in accordance with the manufacturer’s instructions~~ calculated as the sum of the rated maximum output voltages of the series-connected DC to DC Converters.

Substantiation: There is currently no authoritative guideline, based on the NEC or UL Standards, for a PV installer or AHJ to use to determine what the voltage rating of equipment connected to the output of a DC to DC Converter or series string of converters should be. Since a boost type device can output a voltage higher than the input voltage the maximum output voltage cannot be based on the PV module voltage. Manufacturers are allowing the connection of a number of these devices in series that if the listed maximum output voltage of the devices were added up would exceed the voltage rating of the connected equipment.

To insure that equipment and conductors are correctly rated for the maximum system voltage they may be exposed to it is recommended that the wording in this proposal be adopted. This wording is based on the existing wording in 690.72(C)(2) for DC Charge Controllers and 690.7(A) for PV modules operating in series strings.

As CMP 4 often states, “Even if a product is listed, the only enforcement tool that an AHJ has is to utilize a requirement that is found in the NEC. Although 110.3(B) could be used that does not always suffice in the same fashion as a direct NEC requirement.”

Panel Meeting Action: Reject

Panel Statement: The output of dc to dc converters do not necessarily sum at maximum voltage.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-89 Log #642 NEC-P04 **Final Action: Reject**

(690.7(C))

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 4-223

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use to day at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc

Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

Panel Meeting Action: Reject

Panel Statement: The panel action on this proposal was accept in part not accept in principle.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 12 Negative: 2

Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative vote on Comment 4-2.

4-90 Log #679 NEC-P04 **Final Action: Accept**

(690.7(C))

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 4-223

Recommendation: Continue to Accept in Part.

Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 12 Negative: 2

Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative vote on Comment 4-2.

4-91 Log #1382 NEC-P04 **Final Action: Accept**

(690.7(H))

Submitter: Chad Kennedy, Schneider Electric

Comment on Proposal No: 4-325

Recommendation: Revise text to read as follows:

(H) Disconnects and Overcurrent Protection. Where energy storage device ~~input and~~ output ~~terminals~~ <u>conductor length exceeds</u> ~~are more than~~ 1.5 meters (5 feet) ~~from connected equipment,~~ or where the circuits ~~from these terminals~~ pass through a wall or partition the installation shall comply with (1) through (~~4~~ <u>5</u>):

Substantiation: Schneider Electric supports the enhancements to safety provided in this proposal but requests clarification that the 1.5 meter measurement pertains to the unprotected conductor length and not the physical arrangement of the equipment to the storage device. In addition, the input conductors to the storage device will be required to have overcurrent protection based on other code requirements so these requirements apply to the output conductors. Finally, an editorial correction is needed to correlate with the number of list items provided in the requirements.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-92 Log #62 NEC-P04 **Final Action: Accept in Principle**

(690.8x (New))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 4-227

Recommendation: It was the action of the Correlating Committee that further consideration be given to the comments expressed in the voting since the PV cable is a special use cable listed for use in Article 690 and not covered in Article 310.

Section 300.50 and the accompanying Table 300.50 require over 600 volt cable to comply with the requirements in 310.10(F), which may not apply to PV cable.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept in Principle

Insert new section 690.81 to read as follows:

<u>690.81 **Listing.** Products listed for photovoltaic systems shall be permitted to be used and installed in accordance with their listing. Photovoltaic wire that is listed for direct burial at voltages above 600 volts but not exceeding 2000 volts shall be installed in accordance with Table 300.50, Column 1.</u>

Panel Statement: The panel accepts the direction of the Correlating Committee. The proposed section from Proposal 4-227 is inserted as Section 690.81.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

Comment on Affirmative:
BOWER, W.: The word "Listing" should be in bold and be followed by a (.) (This is an editorial change only)

4-93 Log #63 NEC-P04 **Final Action: Accept**
(690.9)

TCC Action: The Correlating Committee understands that 690.9(B)(2) through (4) are being removed and 690.9(B)(1) revised in this comment to become 690.9(B).
Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-232a
Recommendation: The Correlating Committee directs that the panel clarify the panel action on this proposal by providing a complete sentence in (B)(1) in accordance with 3.3.5 of the NEC Style Manual.
The Correlating Committee further directs that the panel reconsider general references to Articles in Chapters 1 through 4 since they apply to the remainder of the code, unless supplemented or modified in Chapters 5, 6 or 7. See 90.3.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise proposed 690.9(B) to read as follows:
(B) Overcurrent Device Ratings. Overcurrent device ratings shall not be less than 125 percent of the maximum currents calculated in 690.8(A).
Exception: Circuits containing an assembly, together with its overcurrent device(s), that is listed for continuous operation at 100 percent of its rating shall be permitted to be used at 100 percent of its rating.
Panel Statement: Accept the direction of the Correlating Committee by modifying the text as shown. Editorial changes were made for clarity.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-94 Log #1380 NEC-P04 **Final Action: Accept in Part**
(690.9)

Submitter: Chad Kennedy, Schneider Electric
Comment on Proposal No: 4-232a
Recommendation: Revise text to read as follows:
690.9(A) Circuits and Equipment. PV source circuit, PV output circuit, inverter output circuit, and storage battery circuit conductors and equipment shall be protected in accordance with the requirements of Article 240. Protection devices for PV source circuits and PV output circuits shall be ~~listed for use in PV systems~~ in accordance with the requirements of 690.9(B) - (E). Battery system conductors shall be installed in accordance with the requirements of Article 480. Circuits, either ac or dc, connected to current limited supplies (e.g. PV modules, ac output of utility-interactive inverters) and also connected to sources having significantly higher current availability (e.g. parallel strings of modules, utility power) shall be protected at the source from overcurrent.
Exception: An overcurrent device shall not be required for PV modules or PV source circuit conductors sized in accordance with 690.8(B) where one of the following applies:
(a) There are no external sources such as parallelconnected source circuits, batteries, or backfeed from inverters.
(b) The short-circuit currents from all sources do not exceed the ampacity of the conductors and the maximum overcurrent protective device size specified on the PV module nameplate.
690.9(B) Overcurrent Devices. Overcurrent devices, where required, shall be rated as required by 690.9(B)(1) through (4).
(1) To carry not less than 125 percent of the maximum currents calculated in 690.8(A).
Exception: Circuits containing an assembly, together with its overcurrent device(s), that is listed for continuous operation at 100 percent of its rating shall be permitted to be used at 100 percent of its rating.
(2) Terminal temperature limits shall be in accordance with 110.3(B) and 110.14(C).
(3) Where operated at temperatures greater than 40°C (104°F), the manufacturer's temperature correction factors shall apply.
(4) The rating or setting of overcurrent devices shall be permitted in accordance with 240.4(B), (C), and (D).
690.9(C) Direct-Current Rating. Overcurrent devices, either fuses or circuit breakers, used in any dc portion of a PV power system shall be listed ~~for use in PV systems~~ and shall have the appropriate voltage, current, and interrupt ratings.
690.9(D) Photovoltaic Source and Output Circuits. ~~Listed PV overcurrent devices shall be required to provide overcurrent protection in photovoltaic source and output circuits. The o~~Overcurrent devices in PV source and output circuits shall be accessible but shall not be required to be readily accessible.
Substantiation: Schneider Electric supports the committee actions in ROP 4-232a to the overcurrent protection requirements for PV circuits and recommends the following revisions to further clarify the provisions of this section. For the circuits and equipment requirements in 690.9(A), it is important to also reference sections 690.9(B) - (E) as these provide specific detail to the overcurrent protection required. The exception to 690.9(A) and section 690.9(B) are unchanged from the ROP 4-232a action. In 690.9(C) it is important that the overcurrent protection provided has the appropriate dc ratings and the proposed changes align with the committee action on ROP 4-278a. Finally, the overcurrent protection requirements in 690.9(D) are redundant with the requirements in 690.9(A) and 690.9(C) and should be removed.
Panel Meeting Action: Accept in Part
Reject the recommended 690.9(A) statement: Battery system conductors shall be installed in accordance with the requirements of Article 480.
Reject changes in 690.9(D).
Accept the remainder of the changes to 690.9(A) and the changes in (C).
Panel Statement: The panel rejects the change in 690.9(A) that states: Battery system conductors shall be installed in accordance with the requirements of Article 480. The sentence adds no beneficial information to this section.
The panel rejects the changes to 690.9(D). The panel retains the first sentence in 690.9(D) in order to require PV overcurrent devices for those circuits.
The remainder of the changes to 690.9(A) and the changes in (C) are accepted.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
STAFFORD, T.: By removing the wording "for use in PV systems" in 690.9(C) it allows Overcurrent devices to be listed, but not specifically for PV systems. We rejected the deletion of the language in 690.9(D), why did we accept the removal of those words in 690.9(C) without any substantiation from the submitter? This panel member feels that installers reading this code will make sure the OCPD is listed and not knowing about the specific requirements to list a device for a PV system will install improper devices that provide a false sense of security.

4-95 Log #64 NEC-P04 **Final Action: Accept**
(690.9(A)(b))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-237
Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on proposal 4-232a.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the direction of the Correlating Committee. The changes recommended for Proposal 4-237 have already been incorporated in accepted Proposal 4-232a.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-96 Log #1072 NEC-P04 **Final Action: Accept in Principle**
(690.9(C))

Submitter: John C. Wiles, Southwest Technology Development Institute, New Mexico State University
Comment on Proposal No: 4-232a
Recommendation: Change the proposed text as follows:
(C) Direct-Current Rating. Overcurrent devices, either fuses or circuit breakers, used in PV dc source and PV dc output circuits ~~any dc portion of a PV power system~~ shall be listed for use in PV systems and shall have the appropriate voltage, current, and interrupt ratings.
Substantiation: PV systems, both stand-alone (off grid) and multimode systems (utility-interactive with battery backup) may employ dc circuits that include batteries. Any overcurrent device that is listed for use with direct currents and that has the proper ratings will work effectively and safely in the dc battery circuits.
Only the unique PV module sourced PV source and PV output circuits (defined in 690.2) have electrical characteristics that require overcurrent devices specifically listed for PV applications.
Panel Meeting Action: Accept in Principle
The following action under that comment addresses the submitter's concern.
690.9(C) Direct-Current Rating. Overcurrent devices, either fuses or circuit breakers, used in any dc portion of a PV power system shall be listed ~~for use in PV systems~~ and shall have the appropriate voltage, current, and interrupt ratings.
690.9(D) Photovoltaic Source and Output Circuits. Listed PV overcurrent devices shall be required to provide overcurrent protection in photovoltaic source and output circuits. Overcurrent devices in PV source and output circuits shall be accessible but shall not be required to be readily accessible.
Panel Statement: See panel action and statement on Comment 4-94.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 12 Negative: 2
Explanation of Negative:
ROGERS, J.: This comment should be accepted. There is solid rationale to utilize overcurrent devices that are listed for PV systems on these particular circuits. These devices are commonly placed in areas that are subject to

extreme ambient temperature variations and other environmental concerns. The standards for listing these items for use in PV systems takes these extremes into consideration.

STAFFORD, T.: See Comment on 4-94.

13-31 Log #65 NEC-P13 **Final Action: Accept**
(690.10 (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-243
Recommendation: The Correlating Committee advises that Article Scope statements are the responsibility of the Correlating Committee and the Correlating Committee "Rejects" the panel action.

The Correlating Committee notes that the proposed new Article is assigned to Code-Making Panel 13, therefore, this proposal is forwarded to Code-Making Panel 13 for action. See the action of Code-Making Panel 13 on Proposal 13-152.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-13 accepts the direction of the Correlating Committee to take action on Proposal 4-243.

CMP-13 rejects Proposal 4-243. CMP-13 rejected this proposed new Article (Proposal 13-152) and continues to reject with the same statement as follows: "While there are similar requirements in multiple NEC Articles for standalone systems, there are other unique requirements for each type of system and the noted redundancy is necessary."

Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

4-97 Log #66 NEC-P04 **Final Action: Accept**
(690.10(E))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-245
Recommendation: The Correlating Committee directs that the panel clarify the panel action on this proposal and correlate with the action taken on Proposal 4-246.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise proposed text to read as follows:

690.10(E) Back-fed Circuit Breakers. Plug-in type back-fed circuit breakers connected to a stand-alone <u>or multimode</u> inverter output in stand-alone systems shall be secured in accordance with 408.36(D). Circuit breakers that are marked "line" and "load" shall not be back-fed.

Panel Statement: The panel accepts the Correlating Committee recommendation by adding "or multimode" after the first "alone". This correlates the two Proposals 4-245 and 4-246 which CMP 4 accepted.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14
Comment on Affirmative:

STAFFORD, T.: This panel member feels this proposal and comment does not go far enough. It does not matter if a circuit breaker connects a stand alone or a utility interactive inverter it must maintain the same requirements. This panel member suggests that the operation of a circuit breaker does not change if a circuit breaker is installed for backfeed in stand alone or interactive mode. The requirements of 408.36 (D) should be maintained for standalone systems. The inclusion of "multimode inverter" does require additional safety measures. The requirements of 408.36 (D) should be maintained for standalone systems, multimode, and utility interactive systems.

4-98 Log #67 NEC-P04 **Final Action: Accept**
(690.10(E))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-246
Recommendation: The Correlating Committee directs that the panel clarify the panel action on this proposal and correlate with the action taken on Proposal 4-245.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: See panel action and statement on Comment 4-97.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14
Comment on Affirmative:

STAFFORD, T.: See Comment on 4-97.

4-99 Log #1073 NEC-P04 **Final Action: Accept in Principle**
(690.11)

Submitter: John C. Wiles, Southwest Technology Development Institute, New Mexico State University
Comment on Proposal No: 4-246a
Recommendation: Modify the text of 4-246a as shown:
(1) The system shall detect and interrupt arcing faults <u>resulting from a failure in the intended continuity of a conductor, connection, module, or other system component</u> in dc PV source and output circuits.
(2) The system shall require that the disabled or disconnected equipment be manually restarted.
(3) The system shall have an annunciator that provides a visual indication that the circuit interrupter has operated. This indication shall not reset automatically.
Substantiation: The comment limits the arc-fault protection requirements in PV-DC systems to <u>series</u> arcs by re-inserting existing language from the 2011 NEC.
The PV Industry Forum Task Group welcomes the 4-246a proposed changes in clauses (1)-(3) to simplify language and to remove prescribed methods, thereby allowing alternate methods. We recommend however that arc-fault protection should be limited to series arcs and not include parallel arcs at this time for the following reasons:

- <u>Parallel arc-fault protection technology has significant implementation implications and needs further development:</u> Parallel arc-fault protection technology has much greater implications for the industry than series arc-fault technology, effectively requiring module level control or string/array short-circuiting. Module level methods have been developed and tested in limited settings, but still have complex control, communication, field-reliability, and therefore safety considerations that are of concern, especially for larger systems. String/array short-circuiting methods are known to have caused thermal overheating in modules, and possibly will be avoided altogether. We acknowledge and encourage the progress being made in parallel arc-fault protection technology, particular with detection, but believe that more research is needed on mitigation/implementation techniques before protection should be mandated by code.
- Industry data being collected in the United States and Germany, among others, indicates that PV failures leading to fire are overwhelmingly initiated by ground faults and series arcs, not parallel arcs. Where parallel (line-line) faults have occurred, they have been precipitated by ground faults or series arcs. This data corroborates the experience of Industry Forum participants, IEC experts, and others throughout the industry.
- <u>The CMP is already (appropriately) tackling the important sources of failure:</u>

Ground-fault protection: The CMP has approved PV Industry Forum proposals addressing known deficiencies in PV ground-fault protection, the most important of which is 690.5.

Series-arc fault protection (expanded): We support proposal 4-251, which extends (series) arc-fault protection to all systems rather than building systems only, for the reasons described in the 4-251 proposal substantiation. Fires have occurred in building and ground mount systems alike as a result of <u>series</u> arcs, and protection is needed.

Although parallel arcing faults are rare, they are even less likely to occur with improved ground fault protection and series AF protection which would detect and mitigate those faults before they progress to a parallel arc fault.

By approving proposals 4-246a and 4-251 together, we believe the CMP is inadvertently extending module level control requirements to all systems, including ground mounted systems. This would have significant implications for the PV industry, and is not justified given the points described above.

Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and statement on Comment 4-105, which addresses the concerns of the submitter.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-100 Log #1158 NEC-P04 **Final Action: Accept in Part**
(690.11)

Submitter: Joerg Grosshennig, SMA Solar Technology AG
Comment on Proposal No: 4-246a
Recommendation: Revise text to read as follows:

690.11 Arc-Fault Circuit Protection (Direct Current).

Photovoltaic systems with dc source circuits, dc output circuits, or both, ~~on or penetrating a building~~ operating at a PV system maximum system voltage of 80 volts or greater, shall be protected by a listed (dc) arc-fault circuit interrupter, PV type, or other system components listed to provide equivalent protection. The PV arc-fault protection means shall comply with the following requirements:

(1) The system shall detect and interrupt arcing faults<u> resulting from a failure in the intended continuity of a conductor, connection, module, or other system component i</u>n <u>the</u> dc PV source and output circuits.<u> Systems on or penetrating a building shall detect and interrupt arcing faults in general.</u>

(2) The system shall disable or disconnect one of the following:

a. Inverters or charge controllers connected to the fault circuit when the fault is detected

b. System components within the arcing circuit

(3) The system shall require that the disabled or disconnected equipment be manually restarted.

(4) The system shall have an annunciator that provides a visual indication that the circuit interrupter has operated. This indication shall not reset automatically.

Substantiation: Proposal 4-246a extends the requirement of detection and interruption of arcing faults to ground mount PV installations.

Proposal 4-251 extends the requirement of detection and interruption of arcing faults to parallel arcs.

This comment is to exempt ground mount installations from the parallel arc fault detection requirement.

The central argument for requiring AFCI is to lower the fire risk to buildings and people inside. For a ground mounted PV installation, the risk to people and property is dramatically lower than for a rooftop system. These areas are generally inaccessible to the public (or present barriers to access), and are only serviced by qualified personnel, in their vicinity for maintenance purposes.

The hazard posed by the systems to the general public is that of a fire started by ignition of nearby organic plant matter with a spark, which may spread to surrounding areas. Parallel arc fault protection, which has never been recorded in a single installation, does not credibly lower this general risk and does not substitute proper installation methods, a thorough inspection, and adherence to fire prevention guidelines such as fire breaks, which are proven methods for minimizing this risk. The extended use of proven and existing technology such as isolation tests (690.35), residual current measurements (690.35), and serial arc fault detection (existing 690.11) can reduce this risk in a quantifiable and reliable manner. Large, non-utility owned, PV plants of which there are thousands in the country, do not pose health risks to the public. These power plants would be adversely impacted from the financial cost of additional equipment, nuisance tripping, with no material safety benefit.

There is no field experience of AFCI in general in PV systems today and implications of parallel (in particular) AFCI are not fully understood. The impact on large PV plants are expected to be even higher. (stronger noise coupling, highly branched DC-circuits, …) Therefore the influence of parallel AFCI on large PV plants (e.g. fuses and interaction between affected and non-affected circuits) needs to be thoroughly investigated before its introduction.

Parallel AFCI and Emergency Shutdown/Deenergization (690.12) cannot be generally performed at the same time. Since deenergization minimizes shock risks to firefighters in action it should be favored to parallel AFCI.

Panel Meeting Action: Accept in Part

Reject the addition in 690.11(1) of "Systems on or penetrating a building shall detect and interrupt arcing faults in general"

Accept the remainder of the recommendation.

Panel Statement: The panel rejects the addition of "systems on or penetrating a building shall detect and interrupt arcing faults in general" in 690.11(1) which would add parallel arc-fault protection to buildings.

See panel action and statement on Comment 4-105.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-101 Log #1159 NEC-P04 **Final Action: Accept in Part**
(690.11)

Submitter: Joerg Grosshennig, SMA Solar Technology AG

Comment on Proposal No: 4-251

Recommendation: Revise text to read as follows:

690.11 Arc-Fault Circuit Protection (Direct Current).

Photovoltaic systems with dc source circuits, dc output circuits, or both, ~~on or penetrating a building~~ operating at a PV system maximum system voltage of 80 volts or greater, shall be protected by a listed (dc) arc-fault circuit interrupter, PV type, or other system components listed to provide equivalent protection. The PV arc-fault protection means shall comply with the following requirements:

(1) The system shall detect and interrupt arcing faults resulting from a failure in the intended continuity of a conductor, connection, module, or other system component in the dc PV source and output circuits. Systems on or penetrating a building shall detect and interrupt arcing faults in general.

(2) The system shall disable or disconnect one of the following:

a. Inverters or charge controllers connected to the fault circuit when the fault is detected

b. System components within the arcing circuit

(3) The system shall require that the disabled or disconnected equipment be manually restarted.

(4) The system shall have an annunciator that provides a visual indication that the circuit interrupter has operated. This indication shall not reset automatically.

Substantiation: Proposal 4-246a extends the requirement of detection and interruption of arcing faults to ground mount PV installations.

Proposal 4-251 extends the requirement of detection and interruption of arcing faults to parallel arcs.

This comment is to exempt ground mount installations from the parallel arc fault detection requirement.

The central argument for requiring AFCI is to lower the fire risk to buildings and people inside. For a ground mounted PV installation, the risk to people and property is dramatically lower than for a rooftop system. These areas are generally inaccessible to the public (or present barriers to access), and are only serviced by qualified personnel, in their vicinity for maintenance purposes.

The hazard posed by the systems to the general public is that of a fire started by ignition of nearby organic plant matter with a spark, which may spread to surrounding areas. Parallel arc fault protection, which has never been recorded in a single installation, does not credibly lower this general risk and does not substitute proper installation methods, a thorough inspection, and adherence to fire prevention guidelines such as fire breaks, which are proven methods for minimizing this risk. The extended use of proven and existing technology such as isolation tests (690.35), residual current measurements (690.35), and serial arc fault detection (existing 690.11) can reduce this risk in a quantifiable and reliable manner. Large, non-utility owned, PV plants of which there are thousands in the country, do not pose health risks to the public. These power plants would be adversely impacted from the financial cost of additional equipment, nuisance tripping, with no material safety benefit.

There is no field experience of AFCI in general in PV systems today and implications of parallel (in particular) AFCI are not fully understood. The impact on large PV plants are expected to be even higher. (stronger noise coupling, highly branched DC-circuits, …) Therefore the influence of parallel AFCI on large PV plants (e.g. fuses and interaction between affected and non-affected circuits) needs to be thoroughly investigated before its introduction.

Parallel AFCI and Emergency Shutdown/Deenergization (690.12) cannot be generally performed at the same time. Since deenergization minimizes shock risks to firefighters in action it should be favored to parallel AFCI.

Panel Meeting Action: Accept in Part

Panel Statement: See panel action and statement on Comment 4-100.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-102 Log #1167 NEC-P04 **Final Action: Reject**
(690.11)

Submitter: Greg Pitz, Logos Solar

Comment on Proposal No: 4-246a

Recommendation: Add new text to read as follows:

(1) The system shall detect and interrupt arcing faults in dc PV source and output circuits.

(2) The system shall require that the disabled or d is connected equipment be manually restarted or manually reset.

(3) The system shall have an annunciator that provides a visual indication that the circuit interrupter has operated. This indication shall not reset automatically.

Substantiation: Language is revised from current text to make arc fault detection a requirement for both series and parallel arc faults. Additionally prescribed methods and equipment are removed from current text to allow alternate implementation. 70Some devices or equipment need to be reset, not restarted.

Panel Meeting Action: Reject

Panel Statement: The addition of the words "or manually reset" is redundant. Adding the words is unnecessary since restarted adequately describes the action.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-103 Log #1289 NEC-P04 **Final Action: Hold**
(690.11)

Submitter: Fred Kracke, Schneider Electric - Solar Business

Comment on Proposal No: 4-246a

Recommendation: Revise text to read as follows:

Schneider Electric feels that addition of parallel arc fault detection and interruption is premature given the current state of the PV AFDI technology and experience, and the different methods required to properly deal with parallel arcs. We recommend reverting to the series-only approach in the 2011 NEC, and making the following revisions:

Original ROP 4-246a was as follows…

(1) The system shall detect and interrupt arcing faults in dc PV source and output circuits.

(2) The system shall require that the disabled or disconnected equipment be manually restarted.

(3) The system shall have an annunciator that provides a visual indication that the circuit interrupter has operated. This indication shall not reset automatically.

Schneider Electric proposal (strike-through and underline in the following are relative to the above original proposal, not the current NEC wording):

"(1) The system shall detect and interrupt arcing faults resulting from a failure in the intended continuity of a conductor, connection, module, or other system component in a Photovoltaic Power source operating at a PV system maximum system voltage of 20 volts or greater ~~dc PV source and output circuits.~~

(2) The system shall require that the disabled or disconnected equipment be manually restarted.

(3) The system shall have an annunciator that provides both a visual or audible indication, and an indication capable of being remotely monitored, that the PV arc fault protection means ~~circuit interrupter~~ has operated. This indication shall not reset automatically."

Substantiation: The proposal as originally submitted was intended to increase the scope to include parallel arcs. While Schneider Electric supports improvements in safety, we feel that there are implementation difficulties associated with parallel arc fault interruption, which requires different action than series arc interruption, and therefore also requires the ability for the system to discriminate between series and parallel arcs. The current state of the PV AFDI industry is very immature, and we feel these developments need to be postponed until the industry has more experience with AFDI and is better prepared to distinguish series arcs from parallel arcs and to extinguish parallel arcs. Therefore we suggest reverting back to the 2011 language that limited the scope to series arcs. We are also proposing other wording changes as substantiated below:

Substantiation:

1. "resulting from a failure in the intended continuity of a conductor, connection, module, or other system component" is added back in to limit the scope to series arcs. The substantiation for this is given in the paragraph above.

2. "dc PV source and output circuits" is replaced by "Photovoltaic power source" so that arcs within the modules themselves are included in the coverage; this is needed to provide full coverage, as arcing faults have occurred within the modules or their junction boxes.

3. the lower limit of 20V is added. We feel the removal of the lower limit of 80V was a good step, but removing it altogether is not necessary. A lower limit of 20V is suggested above so that the requirement does not apply at voltages too low to strike or maintain an arc. Research may be needed to determine if 20V is low enough to achieve that goal.

4. in sub-section (3) we propose allowing either audible or visual location indication, since they are equivalent local annunciation means

5. in sub-section (3) we propose requiring additional annunciation that is able to be monitored remotely, since a local visual or audible annunciator is useless if the PV plant is 100 miles from the nearest person or on a rooftop that rarely gets accessed.

6. in sub-section (3) we propose replacing "circuit interrupter" with "PV arc fault protection means" which is the existing term in the 2011 NEC.

Panel Meeting Action: Hold

Panel Statement: The addition of the words "system voltage of 20V.." and "being remotely monitored" is new language. The comment includes language in (1) as accepted in Comment 4-105. See panel action for Comment 4-105.

The remainder of the comment includes new requirements (20V and remote monitoring) that were not accepted or discussed during the proposal period, are new technical requirements and will not be available for public comment in this code cycle. The annunciator details should be found in the standard and not the code.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13 Negative: 1

Explanation of Negative:

BOWER, W.: This comment should have been rejected instead of placed on hold. It introduced new material including a 20 V voltage constraint that had no solid substantiation. Rather than be put on hold, the panel should have rejected with comments that the submitter should introduce a new proposal for the next code cycle. The new material included in the comment "provides both a visual or audible indication, and an indication capable of being remotely monitored, that the PV arc fault protection means circuit interrupter has operated." I see no reason to automatically introduce this comment as a proposal into the next code cycle when many technical changes will likely be in effect. Also note the comment says "(3) The system shall have an annunciator that provides both a visual or audible indication, and an indication capable of being remotely monitored, that the PV arc fault protection means circuit interrupter has operated." The sentence is convoluted and should not be something the panel must fix during the next code cycle.

4-104 Log #1453 NEC-P04 **Final Action: Reject**
(690.11)

Submitter: Lee Charles Martin, Sensata Technologies

Comment on Proposal No: 4-251

Recommendation: Modify text of 690.11 as shown:

690.11 Arc-Fault Circuit Protection (Direct Current). Photovoltaic systems with dc source circuits, dc output circuits, or both, operating at a PV system maximum system voltage of 80 volts or greater, shall be protected by a UL <u>1699B</u> listed <u>PV</u> (dc) arc-fault circuit protection, <u>PV</u> type <u>2 device</u>, or other system components listed to provide equivalent protection. The ~~PV~~ arc-fault protection means shall...".

Substantiation: The arc-fault detection performance is not specified, the inclusion of the UL1699B document explicitly defines the performance required for this arc-fault protection application. Performance that is equivalent to the type 2 device performance requirements of UL 1699B are important for the following reasons:

• Significant development progress has been realized toward the practical implementation of a parallel arc-fault protection technology: Most significant damage occurs as the direct result of a parallel arc-fault. Parallel arc fault protection developers have made significant progress toward parallel arc detection and these type 2 performance requirements are large part of the market considerations that have allowed Sensata to get such a large jump on this development. This progress puts cost effective parallel arc detection development on a track to intersect the adoption expectations of the 2014 NEC.

• While series arc mitigation is essential it drives a different system response than parallel arc mitigation. As such, any situations that start as parallel arcs and any situations that progress from a series arc or a ground fault to a parallel arc before mitigation will result in an unchecked parallel with no effective improvement over a system with absolutely no arc fault protection.

• Anecdotally speaking, many ground faults are caused by installation practices, and as such multiple faults are present at a given sight, as soon as there is a single high side and a single low side fault even the improved ground fault mitigation practices will again result in an unchecked parallel fault with no effective improvement over a system with no arc fault protection.

• Having the type 2 requirements in the CMP will considerably accelerate parallel arc protection development. Protection developers like Sensata, et al, will be able to justify solution projects and funding levels with this statement of importance by the industry standard. The effects of the 2011 NEC series arc protection requirements are beginning to increase the safety of PV installations, the increases would surely be delayed had series arc protection been left out of the 2011 NEC. In the same way these type 2 equivalent requirements will drive parallel arc benefit PV systems.

Panel Meeting Action: Reject

Panel Statement: Mandatory references (to UL1699B) are not allowed per the NEC Style Manual. The comment to include PV type 2 device would be in error without reference to 1699B. PV type 2 devices are typically for surge protection and not arc fault detection as defined in IEC 61643-11.

See the panel action on Comment 4-105 for additional information.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-105 Log #1490 NEC-P04 **Final Action: Accept in Principle**
(690.11)

Submitter: John Smirnow, Solar Energy Industries Association

Comment on Proposal No: 4-246a

Recommendation: Revise text to read as follows:

(1) The system shall detect and interrupt arcing faults <u>resulting from a failure in the intended continuity of a conductor, connection, module, or other system component</u> in dc PV source and output circuits.

(2) The system shall require that the disabled or disconnected equipment be manually restarted.

(3) The system shall have an annunciator that provides a visual indication that the circuit interrupter has operated. This indication shall not reset automatically.

Substantiation: This comment is the result of a consensus process established among two groups of stakeholders: 1) the SEIA Codes and Standards Working Group, and 2) the PV Industry Forum. Participants in these groups included the following individuals:

SEIA Codes and Standards Working Group

1. Mark Albers, SunPower
2. Mark Baldassari, Enphase Energy
3. Ward Bower, SEIA
4. Bill Brooks, Brooks Engineering/SEIA
5. Joe Cain, Chair of SEIA Codes and Standards Working Group
6. Keith Davidson, SunTech
7. Darrel Higgs, Dow Solar
8. Lee Kraemer, First Solar
9. Carl Lenox, SunPower
10. Charles Luebke, Eaton
11. Martin Mesmer, E.ON
12. Steve Pisklak, Dow Solar
13. Robert Rynar, First Solar
14. Michael Schenck, First Solar
15. John Smirnow, SEIA
16. Kris VanDerzee, First Solar
17. Leo Wu, SolarCity
18. Tilak Gopalarathnam, REFUsol Incorporated

PV Industry Forum

1. Greg Ball, BEW Engineering
2. Bill Brooks, Brooks Engineering
3. Charles Luebke, Eaton
4. Mark Baldassari, Enphase Energy
5. Michael Schenck, First Solar
6. Phil Undercuffler, Outback Power
7. Jay Johnson, Sandia National Labs
8. John Smirnow, SEIA
9. Joerg Grosshennig, SMA
10. Mark Albers, SunPower Corporation
11. Keith Davidson, Suntech Power
12. Tim Zgonena, UL

The comment limits the arc-fault protection requirements in PV-DC systems to <u>series</u> arcs by re-inserting existing language from the 2011 NEC.

The Solar Energy Industries Association welcomes the 4-246a proposed changes in clauses (1)-(3) to simplify language and to remove prescribed methods, thereby allowing alternate methods. We recommend however that arc-fault protection should be limited to series arcs and not include parallel arcs at this time for the following reasons:

● <u>Parallel arc-fault protection technology has significant implementation</u>

implications and needs further development: Parallel arc-fault protection technology has much greater implications for the industry than series arc-fault technology, effectively requiring module level control or string/array short-circuiting. Module level methods have been developed and tested in limited settings, but still have complex control, communication, field-reliability, and therefore safety considerations that are of concern, especially for larger systems. String/array short-circuiting methods are known to have caused thermal overheating in modules, and possibly will be avoided altogether. We acknowledge and encourage the progress being made in parallel arc-fault protection technology, particular with detection, but believe that more research is needed on mitigation/implementation techniques before protection should be mandated by code.

● Industry data being collected in the United States and Germany, among others, indicates that PV failures leading to fire are overwhelmingly initiated by ground faults and series arcs, not parallel arcs. Where parallel (line-line) faults have occurred, they have been precipitated by ground faults or series arcs. This data corroborates the experience of Industry Forum participants, IEC experts, and others throughout the industry.

● The CMP is already (appropriately) tackling the important sources of failure:

● Ground-fault protection: The CMP has approved PV Industry Forum proposals addressing known deficiencies in PV ground-fault protection, the most important of which is 690.5.

● Series-arc fault protection (expanded): We support proposal 4-251, which extends (series) arc-fault protection to all systems rather than building systems only, for the reasons described in the 4-251 proposal substantiation. Fires have occurred in building and ground mount systems alike as a result of series arcs, and protection is needed.

● Although parallel arcing faults are rare, they are even less likely to occur with improved ground fault protection and series AF protection which would detect and mitigate those faults before they progress to a parallel arc fault.

● By approving proposals 4-246a and 4-251 together, we believe the CMP is inadvertently extending module level control requirements to all systems, including ground mounted systems. This would have significant implications for the PV industry, and is not justified given the points described above.

Panel Meeting Action: Accept in Principle

Revise proposed text in 690.11(1) as follows:

(1) The system shall detect and interrupt arcing faults resulting from a failure in the intended continuity of a conductor, connection, module, or other system component in dc PV source and dc PV output circuits.

Panel Statement: The panel added "dc PV" to output circuits to clarify the circuits in question.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

Comment on Affirmative:

BOWER, W.: This action has provided practical arc fault protection for PV systems. However, the language now requires arc fault detection and mitigation for ALL systems including single module PV systems that are not on roofs such as those that provide water pumping AND for ac PV modules that have a fault detection function built into the micro-inverter. Single module PV systems often do not have control devices that provide support for an arc fault detection method plus >80V systems are likely by 2014. A separate arc-fault detection devise offers no advantage over a micro-inverter that can perform the same function and should not be added to a listed micro-inverter coupled to a single module. An exception is needed to cover these simple systems.

This comment is not intended to cause the accepted language to be deleted because the requirement is needed. The comment points out there are instances where a separate series arc fault detection device is not needed and only adds complexity and points of failure.

The requirement for manual restart will be difficult for pole-mount systems. Note that the addition of remote restart would have been new material during this comment period.

It will likely be necessary to bring listing standards (for stand-alone components or for functions integrated into other devices) up to date to test for the arc-fault functionality in a variety of devices.

4-106 Log #1066 NEC-P04 **Final Action: Reject**
(690.12 (New))

Submitter: Michael J. Johnston, National Electrical Contractors Association

Comment on Proposal No: 4-253

Recommendation: Continue to accept in principle Proposal 4-253 and revise as follows:

690.12 PV Arrays on Buildings Response to Emergency Shutdown. For PV Systems installed on roofs of buildings, photovoltaic source circuits shall be deenergized from all sources within 10 seconds of when emergency shutdown is initiated or when the PV power source disconnecting means is opened. When the source circuits are deenergized, the maximum voltage at the module and module conductors shall be ~~80~~ less than 50 volts.

Substantiation: CMP-4 has taken a huge step to reduce hazards for first and second responders by accepting the concepts in proposal 4-253. This comment attempts build on the affirmative comments and refine the proposal further by reducing the voltage level to less than 50 volts. No new material or concept is being introduced. NFPA 70E has established 50 volts as a safety threshold. Contact with 50 to 80 volt circuits is still capable of resulting shock and electrocution. This proposed reduction in voltage output limit during emergency shutdown, provides for consistency with those values in NFPA 70E. The reduction in voltage level output also reduces fire ignition possibilities to lower levels.

Panel Meeting Action: Reject

Panel Statement: See panel action on Comment 4-113 and the corresponding substantiation. The original Proposal 4-253 specified module level control. The research has led away from module level to a specified distance from the module at this time.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13 Negative: 1

Explanation of Negative:

STAFFORD, T.: This panel member feels that the safety of first responders and electrical workers who are the first to respond when a fault has occurred should be a primary concern. Not reducing the voltage level to a point where it could be considered touch safe does not allow for a level of safety that could be obtained by accepting this comment. During the ROP stage, the panel accepted the need for a reduced voltage threshold to 80 volts and there has been no technical substantiation to raise that level but evidence does exist to limit voltage threshold(s) to 50 volts.

4-107 Log #1286 NEC-P04 **Final Action: Accept in Principle**
(690.12)

Submitter: Jim Eichner, Schneider Electric - Solar Business

Comment on Proposal No: 4-253

Recommendation: Delete text to read as follows:

690.12 PV Arrays on Buildings Response to Emergency Shutdown.

For PV Systems installed on roofs of buildings, photovoltaic source or output circuits conductors entering the building shall be disconnected from the PV array ~~deenergized from all sources~~ within 10 seconds of when the emergency shutdown is initiated. ~~utility supply is deenergized or when the PV power source disconnecting means is opened.~~

~~When the source circuits are deenergized, the maximum voltage at the module and module conductors shall be 80 volts.~~

Substantiation: Schneider Electric supports reducing hazards faced by fire fighters, but the proposed change has a large impact on the design of PV modules and/or PV combiners without adequate improvement in fire fighter safety to justify the change and its challenges (see Substantiation below). We suggest revising the proposed rule to address conductors inside the building rather than requiring ways to open the series strings of modules.

Substantiation:

1. The arbitrary 80V limit proposed is not based on protection against shock hazard (which would require a much lower number, especially under wet conditions) but rather on convenience. It seems to have been selected to eliminate the need for automatic disconnecting means able to separate the strings of cells within a module that would be required if limit lower than the voltage of one module was selected. However the 80V threshold is likely to be exceed by commercially available modules by 2014, if it hasn't already been exceeded, so the arbitrary limit does not meet either goal - reducing voltages to below shock hazard levels, or allowing solutions external to modules.

2. The proposal presumes a lot of technology development. Systems would require non-existent technology: modules that contain externally controllable switching devices that would open the series strings of modules, or a new type of string combiner that connects to both ends of each module and opens or closes the series connections. Both add expense and a lot of potential points of failure to the system. Furthermore, the proposed system must be able to do its intended function during a fire. The switching devices, control signal wiring, etc. must be able to ensure open circuiting of the string connections, on command, even when the system is potentially engulfed in flames. Creating electronics that can be relied on to function under those conditions is extremely difficult and may in fact not be possible. If it is not possible then the firefighters will not be able to rely on the systems except in conditions where they are reasonably sure that none of the various parts of the system have been exposed to the fire. This seriously undermines the claimed benefits of such a system.

3. The proposed trigger "when the PV power source disconnecting means is opened" is not well defined - there may be many disconnecting means, and many source circuits, and the NEC does not define "PV power source disconnecting means". The intent was likely to disconnect within 10s of activating the emergency shutdown system, whatever that is - whether it is de-energizing the utility, pushing a PV Kill Switch, or whatever - so let's say that.

Panel Meeting Action: Accept in Principle

Panel Statement: See panel action and statement on Comment 4-113, which addresses the concerns of the submitter.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

Comment on Affirmative:

STAFFORD, T.: See comment on 4-106. In addition, this proposal is an improvement over existing conditions that mandate safety for first responders and electrical workers. It is hoped that this comment acceptance is the first of many steps to address the hazards that are present on a PV system that is inoperable. Reducing the threshold voltage of any portion of a PV source circuit or module to a touch safe threshold should be of first concern to all involved with determining the safety of PV installation, operation and maintenance as well as shutdown voltages that are present.

4-108 Log #1352 NEC-P04 **Final Action: Accept in Principle in Part**
(690.12 (New))

Submitter: Joerg Grosshennig, SMA Solar Technology AG
Comment on Proposal No: 4-167
Recommendation: Revise text to read as follows:
~~690.12 PV Arrays on Buildings Response to Emergency Shutdown.~~
~~For PV Systems installed on roofs of buildings, photovoltaic source circuits shall be deenergized from all sources within 10 seconds of when emergency shutdown is initiated or when the PV power source disconnecting means is opened. When the source circuits are deenergized, the maximum voltage at the module and module conductors shall be 80 volts.~~
690.12 Rapid Shutdown of PV Systems on Buildings.
PV system circuits installed on or in buildings shall include a rapid shutdown function that controls specific conductors in accordance with 690.12(A) through (D).
(A) Requirements for controlled conductors apply only to PV system conductors of more than 1.5 meters (5 feet) in length inside a building, or more than 3 meters (10 feet) from a PV array. Exception: Systems smaller than 5 kWp where the inverter is mounted next to the main service panel with less than 7 meters (25 feet) of wiring from the PV array and routed outside the house straight to the inverter with no more than two quarter bends (180 degrees total) should be excluded.
(B) Controlled conductors shall be limited to no more than 30 volts and 1 A within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.
(C) The rapid shutdown initiation methods shall be labeled in accordance with 690.56(B)
(D) Equipment that performs the rapid shutdown shall be listed and identified.
Substantiation: SMA is following the comment from Bill Brooks and the PV Industry Forum for 4-253 with two changes.
(1) The power limitation of 240 VA is not a safe limit (up to 8 A / 30 V). A current limit of 1 A is a safe limit and would allow the operation and control of switching devices at the module. Power ratings of modules are according to standard test conditions (STC) and therefore the maximum power in certain conditions is not clearly defined. (e.g. higher currents due to reflections)
(2) The other difference is the exclusion of small residential PV installations (< 5kWp) on single floor dwellings, where the most common place to install the inverter is at the main service panel, or meter. In these cases the conduit containing the PV conductors exits the PV array, makes one turn and then is run to the inverter. This conduit is so obvious to the firefighter that it can be easily avoided and hence, doesn't pose a serious health risk or restriction in firefighter work.
Panel Meeting Action: Accept in Principle in Part
Reject the exception in (A).
Reject the changes in (B).
Accept in principle the remainder of the changes.
Panel Statement: See panel action and statement on Comment 4-113, which addresses the concerns of the submitter.
The panel rejects the exception in (A) because there is no technical substantiation to limit 5 KW peak or less systems.
The panel rejects the change in (B) because there is no technical substantiation for selection of 1 amp.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14
Comment on Affirmative:
STAFFORD, T.: See Comment for 4-107.

4-109 Log #1454 NEC-P04 **Final Action: Reject**
(690.12)

Submitter: Lee Charles Martin, Sensata Technologies
Comment on Proposal No: 4-253
Recommendation: Replace the title and entire text in the proposal with this revised title and text:
690.12 PV Arrays on Buildings Response to Emergency
Shutdown. For PV Systems installed on roofs of buildings, photovoltaic source circuits shall be de-energized from all sources within 10 seconds of when emergency shutdown is initiated or when the PV power source disconnecting means is opened. When the source circuits are de-energized, the maximum voltage ~~at~~ <u>shall be limited to</u> the <u>voltage output of the individual</u> module ~~and module conductors shall be 80 volts.~~
Substantiation: There are several reasons that the 80V requirement should be replaced with a requirement for explicitly de-energizing to the module level. Two of those reasons are as follows:
First, the 80V limit is a snapshot that risks falling behind or limiting module improvements. As module improvements move to the unsafe region, the voltage issue will again arise and can be addressed.
The second and more important reason is that this allows multiple modules to remain in series for lower voltage modules. This is especially true if the installer is unclear on the voltage rating to be used (Vmp vs. Voc vs. Voc on the coldest day expected).
The above notwithstanding, it should be noted and applauded that the intent to limit power sources on any conductor in the installation to the module level is a tremendous improvement over any policy that allows the voltage to remain at the string level anywhere in the installation. This improvement is, in turn, important for two main reasons.
Specifically:
• Fire protection responders will eventually come in contact with string voltages that they assume have been reduced or de-energized as implied by an emergency "shutdown" status.
• Structural damage that often drives the need for an Emergency Shutdown (e.g. a fire) will result in insulation and isolation breakdown that results in string level voltages being applied to other system conductors that fire protection responders expect to be low voltage or de-energized. Reducing the power sources to the minimum
practical level, specifically the individual module level provides the optimum balance between safety and a cost effective application.
Panel Meeting Action: Reject
Panel Statement: See panel action on Comment 4-113 and the corresponding substantiation. The original Proposal 4-253 specified module level control. The research has led away from module level to a specified distance from the module at this time.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14
Comment on Affirmative:
STAFFORD, T.: See Comment for 4-107.

4-110 Log #1491 NEC-P04 **Final Action: Accept in Principle**
(690.12)

Submitter: John Smirnow, Solar Energy Industries Association
Comment on Proposal No: 4-253
Recommendation: Revise text to read as follows:
~~**690.12 PV Arrays on Buildings Response to Emergency Shutdown.**~~
~~For PV Systems installed on roofs of buildings, photovoltaic source circuits shall be deenergized from all sources within 10 seconds of when emergency shutdown is initiated or when the PV power source disconnecting means is opened. When the source circuits are deenergized, the maximum voltage at the module and module conductors shall be 80 volts.~~
690.12 Rapid Shutdown of PV Systems on Buildings.
PV system circuits installed on or in buildings shall include a rapid shutdown function that controls specific conductors in accordance with 690.12(A) through (D).
(A) Requirements for controlled conductors apply only to PV system conductors of more than 1.5 meters (5 feet) in length inside a building, or more than 3 meters (10 feet) from a PV array.
(B) Controlled conductors shall be limited to no more than 30 volts and 240VA within 10 seconds of rapid shutdown initiation. Voltage and power shall be measured between any two conductors and between any conductor and ground.
(C) The rapid shutdown initiation methods shall be labeled in accordance with 690.56(B).
(D) Equipment that performs the rapid shutdown shall be listed and identified.
Substantiation: 1. This comment is the result of a consensus process established among three groups of stakeholders: 1) CMP4 Firefighter Safety Task Group; 2) SEIA Codes and Standards Working Group; and 3) PV Industry Forum. Participants in these groups included the following individuals:
CMP4 Firefighter Safety Task Group
1. Ward Bower, CMP4 representing SEIA
2. Bill Brooks, CMP4 representing SEIA and Chair of Task Group
3. Bob Davidson, Davidson Code Concepts
4. Mark Earley, Secretary, NFPA
5. Bob James, UL
6. Matt Paiss, City of San Jose Fire Department
7. Jim Rogers, CMP4 representing IAEI
8. Todd Stafford, CMP4 representing IBEW
9. Ronnie Toomer, Chair of CMP4
10. Peter Willse, Global Asset Protection Services
SEIA Codes and Standards Working Group
1. Mark Albers, SunPower
2. Mark Baldassari, Enphase Energy
3. Ward Bower, SEIA
4. Bill Brooks, Brooks Engineering/SEIA
5. Joe Cain, Chair of SEIA Codes and Standards Working Group
6. Keith Davidson, SunTech
7. Darrel Higgs, Dow Solar
8. Lee Kraemer, First Solar
9. Carl Lenox, SunPower
10. Charles Luebke, Eaton
11. Martin Mesmer, E.ON
12. Steve Pisklak, Dow Solar

13. Robert Rynar, First Solar
14. Michael Schenck, First Solar
15. John Smirnow, SEIA
16. Kris VanDerzee, First Solar
17. Leo Wu, SolarCity
18. Tilak Gopalarathnam, REFUsol Incorporated

PV Industry Forum

1. Mark Albers, SunPower
2. Greg Ball, DNV
3. Bill Brooks, Brooks Engineering, lead for 690.12
4. Mark Baldassari, Enphase Energy
5. Ward Bower, SEIA
6. Michael Coddington, NREL
7. Marv Dargatz, SolarEdge
8. Chris Flueckiger. UL
9. Joerg Grosshennig, SMA
10. Darrel Higgs, Dow Solar
11. Dan Lepinski, Exeltech
12. Carl Lenox, SunPower
13. Charles Luebke, Eaton
14. Matt Paiss, City of San Jose Fire Department
15. Steve Pisklak, Dow Solar
16. Jim Rogers, Town of Oak Bluffs
17. Jon Sharp, Ampt
18. Bhima Sheridan, SolarCity
19. John Smirnow, SEIA
20. Holly Thomas, U.S. Dept. of Energy
21. Phil Undercuffler, Outback Power
22. John Wiles, NMSU, Secretary of PV Industry Forum
23. Leo Wu, SolarCity
24. Tim Zgonena, UL

The individuals listed above have worked together to develop a consensus comment on proposals 4-167 and 4-253. Consensus was established among these individuals to make substantial improvements in the safety of PV arrays as it relates to emergency response personnel in the 2014 National Electrical Code (NEC) cycle. The comment period has afforded these organizations and individuals the opportunity to see CMP4's response to proposals in this area and to deliberate on the impact that these proposals will have on safety and the solar industry in general. There is consensus that key elements of proposals of 4-167 and 4-253, both of which were accepted in principle by CMP4, need to be included in the 2014 NEC. This comment focuses on the details of the methods used to provide the desired safety levels. Included in these comments are the broader perspectives of electrical worker safety, system reliability of safety components, and needed standards development to advance these important safety capabilities.

In order to show that the revised language is consistent with the original focus of the CMP4 Firefighter Safety Task Group (TG), here is the main focus and research areas of this task group as outlined by Michael Johnston, Chair of the TCC, on February 2, 2011:

1. The scope of this TG is to address concerns of first responders (fire fighters and others) in regards to the PV system remaining energized after the service disconnecting means has been opened during an emergency event.
2. We should look at the possibility of including disconnects for the DC output circuits in the same location as the normal service disconnects for the building or structure served.
3. Another alternative to look at is to require some type of interlock that provides a means of disconnect for DC output circuits when the service disconnect is opened in an emergency condition.
4. Another item to look at is providing a control circuit disconnect for a PV system output relay. This control circuit disconnect could be clearly marked and located at the normal service disconnection means so an emergency responder could readily disconnect the PV output from the building.
5. Another item to look at is additional marking requirements in Article 230 and 690 that alert first responders and instruct them as to the appropriate course of action to remove the output power from the PV system.
6. We suggest that the panel review the electrical protection requirements in Article 690 to ensure that they provide adequate electrical protection during fault conditions.

The CMP4 Firefighter Safety Task Group has acted consistently with the original focus of task group. The current wording in this comment meets the intent as directed by NFPA.

2. Proposal 4-167 (accepted in principle) provides for shutdown of all dc conductors entering a building. The consensus of the group is that this provision is a substantial and necessary safety improvement. This requirement is also consistent with many local fire service rules that currently exist.
3. Proposal 4-167 (accepted in principle) limits the control of exterior circuits on buildings to larger circuits of 100-amps and higher. Since the concern is shock hazard not limited to current flow, the consensus of the group is that shutdown requirements be consistent regardless of the current levels involved. Therefore the recommendation is that the shutdown safety requirements relate to all systems on buildings.
4. Proposal 4-253 (accepted in principle) establishes a voltage of 80-volts for modules. This requires devices connected to every module which greatly increases the number required switches to create a safe environment for firefighters. Since the product standards for the safety and reliability of these devices have yet to be developed, the safety and reliability issues related to these future devices are likely to be significant over the next several years. Poor reliability will not only negatively impact public perception of the solar industry, but it will expose technicians to greater safety hazards as they will be required to make many more service calls to address product defects. These service calls are often in areas where fall and electrocution hazards are high, increasing the likelihood of workplace accidents. While firefighter safety is the primary focus of these code changes, electrical worker safety needs to be a strong consideration of such large system design changes.
5. Proposal 4-253 proposes 80-volts as a potentially safe condition for firefighters. While 80-volts is certainly safer than 600-volts or 1000-volts. It is not a touch safe condition and still remains as a shock hazard. Rather than supporting a voltage level that is somewhat hazardous, this provision should establish a touch-safe zone that is clearly defined for emergency responders. This allows products to be developed that can create a touch safe environment for the required areas and also allows product development that will enable manufacturers to go well beyond the requirements and develop fully touch safe PV arrays.
6. The consensus of the stakeholders recommends that the Emergency Shutdown, renamed Rapid Shutdown, instead establish a safe zone around a PV array using concepts already introduced in other ROPs and elsewhere in the NEC. This safe zone would be unambiguous and enable personnel to confidently enter buildings without fear of contacting live conductors. Most significantly, the devices used to create a safe zone can be placed in enclosures away from the hot PV modules, greatly improving their reliability and life expectancy.
7. A voltage limit of 30-volts and a power limit of 240VA is established as a safe power limited environment, consistent with international standards including IEC61730, *Photovoltaic (PV) Module Safety Qualification*, that establish safety of PV modules. It also allows for 24-volt control circuits throughout the array that are currently used in products that employ contactors for shutting down combiner boxes.
8. ROP 4-167 (accepted in principle) introduces a requirement for conductors entering a building to become deenergized. This intent is incorporated into the current proposal.
9. ROP 4-325 (accepted) introduces a distance of 1.5m (5 feet) to disconnection means of indoor battery-backup wiring. This distance is recognized as an acceptably short conduit length that allows for best practices in workmanship, and can be applied to PV wires entering a building in addition to conductors in and out of inverters and conductors coming out of a battery.
10. ROP 4-167 (accepted in principle) introduces a requirement to reduce fault current. It is recommended that the IEC 61730 value of 240VA be used in lieu of a new current requirement.
11. The 2012 IFC requires labeling of conduit every 10 feet, which is used here as the boundary for the safe zone in the recommendation. This distance is sufficiently large to include row-to-row spacing on commercial arrays.
12. Both ROP 4-167 (accepted in principle) and ROP 4-253 (accepted in principle) introduce a timing requirement of 10 seconds for the shutdown. This is intended to allow dc-side capacitor banks time to discharge with means other than contactors and shunt-trip devices, and has been acknowledged by the solar industry stakeholders as reasonable.
13. Although NEC section 100 defines the phrase "Voltage to Ground" for ungrounded systems as "the greatest voltage between the given conductor and any other conductor of the circuit", this does not align with the phrase itself and has caused confusion. The phrase "measured between any two conductors and between any conductor and ground" was added for this reason.
14. The means for rapid shutdown was a topic of much discussion at the ROP meeting and among the stakeholders during the comment period and it was decided among the stakeholders that the devices and methods of compliance should be left open to the standards process so long as proper markings are provided and that special products developed to meet the requirement be listed and identified for the purpose.
15. ROP 4-320 (accepted) revises 690.56(B) to include labels for the rapid shutdown function. This is referenced for clarity. A separate comment addresses the need to reword the 4-320 proposal for consistency with this comment.
16. NEC section 100 defines "listed" and "identified". The use of these terms will allow much of the existing hardware already on the market to be used without additional certification, which in turn enables faster implementation in the field.

Panel Meeting Action: Accept in Principle
Panel Statement: See panel action on Comment 4-113, which addresses the concerns of the submitter.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14
Comment on Affirmative:
STAFFORD, T.: See Comment for 4-107.

4-111 Log #1497 NEC-P04 **Final Action: Reject**
(690.12)

Submitter: Timothy P. Zgonena, UL LLC
Comment on Proposal No: 4-253
Recommendation: Propose to reject proposal 690.12 completely.
~~**690.12 PV Arrays on Buildings Response to Emergency Shutdown..** For PV Systems installed on roofs of buildings, photovoltaic source circuits shall be deenergized from~~
~~all sources within 10 seconds of when emergency shutdown is initiated or when the PV power source disconnecting means is opened. When the source circuits are deenergized, the maximum voltage at the module and module conductors shall be 80 volts. **[ROP 4-253]**~~
Substantiation: 690.12 is well intended to increase PV system safety for fire fighters. After further review, 690.12 relies upon a new type of PV module output control device that is required to disconnect or reduce a pv module output terminals or wiring to touch safe level in an effort to prevent electric shock for fire fighters. UL1741 is the standard for most PV electronics equipment and it has a maximum 30V DC voltage limit for wet locations to prevent electric shock. 80V is a significant shock hazard in wet locations.
This 690.12 concept presents technical problems and will take at least 4 years to address and implement. First it requires the development and consensus publication of new product safety requirements within at least two different UL product safety standards (UL1741 and UL1703). The requirements for this new equipment need to include a functional safety evaluation of both the hardware and software such that the equipment operates properly or shuts down safely and enunciates it has faulted, as a result of any single point failure within its hardware or software. After the publication of these future requirements, 690.12 would then require mfrs to design, build and certify the equipment. Addition of any such "PV off" devices incorporated into a PV module or PV module junction box would then require a redesign and recertification of any the PV modules that would include this functionality. These evaluations take multiple months of laboratory testing.
If for any reason a fire fighter questions the presence, functionality or reliability of such a PV off system, they are likely to treat the system as if the functionality did not exist. It is also very important to note that while functional safety standards address the extremes of an equipment's normal and abnormal electrical and environmental operating conditions, the requirements do not include being exposure to flames or high heat of a fire. While PV modules are evaluated for a fire rating, the standards do not include any requirements or evaluation of electrical isolation following the fire exposure to prevent an electric shock.
This proposal should be further developed with the help of a larger section of the PV industry including both the UL1741 and UL1703 standards technical panels to define the PV off functionality and start the development of appropriate requirements.
Panel Meeting Action: Reject
Panel Statement: The substantiation provided by the submitter is correct in that the technology available to the industry today limits the application of Proposal 4-253.
A means for rapid shut down is covered by the panel action on Comment 4-113.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14
Comment on Affirmative:
BOWER, W.: This comment was rejected by the panel based on the premise that 4-113 would be accepted by the TCC. It should be considered as a standby should comment 4-113 be rejected by the TCC. Under those circumstances the panel action on this comment should be to reject the original proposal as well. This panel member believes the original proposal is NOT an acceptable solution for rapid shut down, uses the unacceptable term emergency shutdown and specifies conditions that would cause many unnecessary operations of safety switches when utility systems operate near ANSI limits for voltage. The resulting reliability of the system as required in the original proposal would be so bad that firefighters would ignore the rapid shut down signs and labels and the installed system.
STAFFORD, T.: See comment on 4-106. In addition, this proposal is an improvement over existing conditions that mandate safety for first responders and electrical workers. Reducing the threshold voltage of any portion of a PV source circuit or module to a touch safe threshold should be of first concern to all involved with determining the safety of PV installation, operation and maintenance as well as shutdown voltages that are present. An 80 volts threshold would be a step in the right direction but it does not go far enough.

4-112 Log #1498 NEC-P04 **Final Action: Reject**
(690.12)

Submitter: Timothy P. Zgonena, UL LLC
Comment on Proposal No: 4-253
Recommendation: Propose future effective date.
690.12 PV Arrays on Buildings Response to Emergency Shutdown.. For PV Systems installed on roofs of buildings, photovoltaic source circuits shall be deenergized from
all sources within 10 seconds of when emergency shutdown is initiated or when the PV power source disconnecting means is opened. When the source circuits are deenergized, the maximum voltage at the module and module conductors shall be 80 volts.
Future effective date 2017.
Substantiation: Based upon the below justification it will take significant time to develop requirements and equipment to comply with 690.12.
690.12 is well intended to increase PV system safety for fire fighters. After further review, 690.12 relies upon a new type of PV module output control device that is required to disconnect or reduce a pv module output terminals or wiring to touch safe level in an effort to prevent electric shock for fire fighters. UL1741 is the standard for most PV electronics equipment and it has a maximum 30V DC voltage limit for wet locations to prevent electric shock. 80V is a significant shock hazard in wet locations.
This 690.12 concept presents technical problems and will take at least 4 years to address and implement. First it requires the development and consensus publication of new product safety requirements within at least two different UL product safety standards (UL1741 and UL1703). The requirements for this new equipment need to include a functional safety evaluation of both the hardware and software such that the equipment operates properly or shuts down safely and enunciates it has faulted, as a result of any single point failure within its hardware or software. After the publication of these future requirements, 690.12 would then require mfrs to design, build and certify the equipment. Addition of any such "PV off" devices incorporated into a PV module or PV module junction box would then require a redesign and recertification of any the PV modules that would include this functionality. These evaluations take multiple months of laboratory testing.
If for any reason a fire fighter questions the presence, functionality or reliability of such a PV off system, they are likely to treat the system as if the functionality did not exist. It is also very important to note that while functional safety standards address the extremes of an equipment's normal and abnormal electrical and environmental operating conditions, the requirements do not include being exposure to flames or high heat of a fire. While PV modules are evaluated for a fire rating, the standards do not include any requirements or evaluation of electrical isolation following the fire exposure to prevent an electric shock.
This proposal should be further developed with the help of a larger section of the PV industry including both the UL1741 and UL1703 standards technical panels to define the PV off functionality and start the development of appropriate requirements.
Panel Meeting Action: Reject
Panel Statement: The future effective date is proposed for text that was removed by panel action on Comment 4-113.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14
Comment on Affirmative:
BOWER, W.: No explanation given.
STAFFORD, T.: See comment on 4-106. In addition, this proposal is an improvement over existing conditions that mandate safety for first responders and electrical workers. Reducing the threshold voltage of any portion of a PV source circuit or module to a touch safe threshold should be of first concern to all involved with determining the safety of PV installation, operation and maintenance as well as shutdown voltages that are present. An 80 volts threshold would be a step in the right direction but it does not go far enough.

4-113 Log #1505 NEC-P04 **Final Action: Accept**
(690.12)

Submitter: William F. Brooks, Brooks Engineering
Comment on Proposal No: 4-253
Recommendation: Replace the text of 4-253 with the modified text as shown:
~~690.12 PV Arrays on Buildings Response to Emergency Shutdown.~~
~~For PV Systems installed on roofs of buildings, photovoltaic source circuits shall be deenergized from all sources within 10 seconds of when emergency shutdown is initiated or when the PV power source disconnecting means is opened. When the source circuits are deenergized, the maximum voltage at the module and module conductors shall be 80 volts.~~
690.12 Rapid Shutdown of PV Systems on Buildings.
PV system circuits installed on or in buildings shall include a rapid shutdown function that controls specific conductors in accordance with 690.12(A) through (D).
(A) Requirements for controlled conductors apply only to PV system conductors of more than 1.5 meters (5 feet) in length inside a building, or more than 3 meters (10 feet) from a PV array.
(B) Controlled conductors shall be limited to no more than 30 volts and 240VA within 10 seconds of rapid shutdown initiation. Voltage and power shall be measured between any two conductors and between any conductor and ground.
(C) The rapid shutdown initiation methods shall be labeled in accordance with 690.56(B).
(D) Equipment that performs the rapid shutdown shall be listed and identified.
Substantiation: 1. This comment is the result of a consensus process established among three groups of stakeholders: 1) CMP4 Firefighter Safety Task Group, 2) the SEIA Codes and Standards Working Group, and 3) the PV Industry Forum. Participants in these groups include the following individuals:
CMP4 Firefighter Safety Task Group
1. Ward Bower, CMP4 representing SEIA

2. Bill Brooks, CMP4 representing SEIA and Chair of Task Group
3. Bob Davidson, Davidson Code Concepts
4. Mark Earley, Secretary, NFPA
5. Bob James, UL
6. Matt Paiss, City of San Jose Fire Department
7. Jim Rogers, CMP4 representing IAEI
8.Todd Stafford, CMP4 representing IBEW
9. Ronnie Toomer, Chair of CMP4
10. Peter Willse, Global Asset Protection Services

SEIA Codes and Standards Working Group
1. Mark Albers, SunPower
2. Mark Baldassari, Enphase Energy
3. Ward Bower, SEIA
4. Bill Brooks, Brooks Engineering/SEIA
5. Joe Cain, Chair of SEIA Codes and Standards Working Group
6. Keith Davidson, SunTech
7. Tilak Gopalarathnam, REFUsol Incorporated
8. Darrel Higgs, Dow Solar
9. Lee Kraemer, First Solar
10. Carl Lenox, SunPower
11. Charles Luebke, Eaton
12. Martin Mesmer, E.ON
13. Steve Pisklak, Dow Solar
14. Robert Rynar, First Solar
15. Michael Schenck, First Solar
16. John Smirnow, SEIA
17. Kris VanDerzee, First Solar
18. Leo Wu, SolarCity

PV Industry Forum
1. Mark Albers, SunPower
2. Greg Ball, DNV
3. Bill Brooks, Brooks Engineering, lead for 690.12
4. Mark Baldassari, Enphase Energy
5. Ward Bower, SEIA
6. Michael Coddington, NREL
7. Marv Dargatz, SolarEdge
8. Chris Flueckiger. UL
9. Joerg Grosshennig, SMA
10. Darrel Higgs, Dow Solar
11. Dan Lepinski, Exeltech
12. Carl Lenox, SunPower
13. Charles Luebke, Eaton
14. Matt Paiss, City of San Jose Fire Department
15. Steve Pisklak, Dow Solar
16. Jim Rogers, Town of Oak Bluffs
17. Jon Sharp, Ampt
18. Bhima Sheridan, SolarCity
19. John Smirnow, SEIA
20. Holly Thomas, U.S. Dept. of Energy
21. Phil Undercuffler, Outback Power
22. John Wiles, NMSU, Secretary of PV Industry Forum
23. Leo Wu, SolarCity
24. Tim Zgonena, UL

The individuals listed above have worked together to develop a consensus comment on proposals 4-167 and 4-253. Consensus was established among these individuals to make substantial improvements in the safety of PV arrays as it relates to emergency response personnel in the 2014 National Electrical Code (NEC) cycle. The comment period has afforded these organizations and individuals the opportunity to see CMP4's response to proposals in this area and to deliberate on the impact that these proposals will have on safety and the solar industry in general. There is consensus that key elements of proposals of 4-167 and 4-253, both of which were accepted in principle by CMP4, need to be included in the 2014 NEC. This comment focuses on the details of the methods used to provide the desired safety levels. Included in these comments are the broader perspectives of electrical worker safety, system reliability of safety components, and needed standards development to advance these important safety capabilities.

In order to show that the revised language is consistent with the original focus of the CMP4 Firefighter Safety Task Group (TG), here is the main focus and research areas of this task group as outlined by Michael Johnston, Chair of the TCC, on February 2, 2011:

1. The scope of this TG is to address concerns of first responders (fire fighters and others) in regards to the PV system remaining energized after the service disconnecting means has been opened during an emergency event.
2. We should look at the possibility of including disconnects for the DC output circuits in the same location as the normal service disconnects for the building or structure served.
3. Another alternative to look at is to require some type of interlock that provides a means of disconnect for DC output circuits when the service disconnect is opened in an emergency condition.
4. Another item to look at is providing a control circuit disconnect for a PV system output relay. This control circuit disconnect could be clearly marked and located at the normal service disconnection means so an emergency responder could readily disconnect the PV output from the building.
5. Another item to look at is additional marking requirements in Article 230 and 690 that alert first responders and instruct them as to the appropriate course of action to remove the output power from the PV system.
6. We suggest that the panel review the electrical protection requirements in Article 690 to ensure that they provide adequate electrical protection during fault conditions.

The CMP4 Firefighter Safety Task Group has acted consistently with the original focus of task group. The current wording in this comment meets the intent as directed by NFPA.

2. Proposal 4-167 (accepted in principle) provides for shutdown of all dc conductors entering a building. The consensus of the group is that this provision is a substantial and necessary safety improvement. This requirement is also consistent with many local fire service rules that currently exist.
3. Proposal 4-167 (accepted in principle) limits the control of exterior circuits on buildings to larger circuits of 100-amps and higher. Since the concern is shock hazard not limited to current flow, the consensus of the group is that shutdown requirements be consistent regardless of the current levels involved. Therefore the recommendation is that the shutdown safety requirements relate to all systems on buildings.
4. Proposal 4-253 (accepted in principle) establishes a voltage of 80-volts for modules. This requires devices connected to every module which greatly increases the number required switches to create a safe environment for firefighters. Since the product standards for the safety and reliability of these devices have yet to be developed, the safety and reliability issues related to these future devices are likely to be significant over the next several years. Poor reliability will not only negatively impact public perception of the solar industry, but it will expose technicians to greater safety hazards as they will be required to make many more service calls to address product defects. These service calls are often in areas where fall and electrocution hazards are high, increasing the likelihood of workplace accidents. While firefighter safety is the primary focus of these code changes, electrical worker safety needs to be a strong consideration of such large system design changes.
5. Proposal 4-253 proposes 80-volts as a potentially safe condition for firefighters. While 80-volts is certainly safer than 600-volts or 1000-volts. It is not a touch safe condition and still remains as a shock hazard. Rather than supporting a voltage level that is somewhat hazardous, this provision should establish a touch-safe zone that is clearly defined for emergency responders. This allows products to be developed that can create a touch safe environment for the required areas and also allows product development that will enable manufacturers to go well beyond the requirements and develop fully touch safe PV arrays.
6. The consensus of the stakeholders recommends that the Emergency Shutdown, renamed Rapid Shutdown, instead establish a safe zone around a PV array using concepts already introduced in other ROPs and elsewhere in the NEC. This safe zone would be unambiguous and enable personnel to confidently enter buildings without fear of contacting live conductors. Most significantly, the devices used to create a safe zone can be placed in enclosures away from the hot PV modules, greatly improving their reliability and life expectancy.
7. A voltage limit of 30-volts and a power limit of 240VA is established as a safe power limited environment, consistent with international standards including IEC61730, Photovoltaic (PV) Module Safety Qualification, that establish safety of PV modules. It also allows for 24-volt control circuits throughout the array that are currently used in products that employ contactors for shutting down combiner boxes.
8. ROP 4-167 (accepted in principle) introduces a requirement for conductors entering a building to become deenergized. This intent is incorporated into the current proposal.
9. ROP 4-325 (accepted) introduces a distance of 1.5m (5 feet) to disconnection means of indoor battery-backup wiring. This distance is recognized as an acceptably short conduit length that allows for best practices in workmanship, and can be applied to PV wires entering a building in addition to conductors in and out of inverters and conductors coming out of a battery.
10. ROP 4-167 (accepted in principle) introduces a requirement to reduce fault current. It is recommended that the IEC 61730 value of 240VA be used in lieu of a new current requirement.
11. The 2012 IFC requires labeling of conduit every 10 feet, which is used here as the boundary for the safe zone in the recommendation. This distance is sufficiently large to include row-to-row spacing on commercial arrays.
12. Both ROP 4-167 (accepted in principle) and ROP 4-253 (accepted in principle) introduce a timing requirement of 10 seconds for the shutdown. This is intended to allow dc-side capacitor banks time to discharge with means other than contactors and shunt-trip devices, and has been acknowledged by the solar industry stakeholders as reasonable.
13. Although NEC section 100 defines the phrase "Voltage to Ground" for ungrounded systems as "the greatest voltage between the given conductor and any other conductor of the circuit", this does not align with the phrase itself and has caused confusion. The phrase "measured between any two conductors and between any conductor and ground" was added for this reason.
14. The means for rapid shutdown was a topic of much discussion at the ROP meeting and among the stakeholders during the comment period and it was decided among the stakeholders that the devices and methods of compliance should be left open to the standards process so long as proper markings are provided and that special products developed to meet the requirement be listed and identified for the purpose.
15. ROP 4-320 (accepted) revises 690.56(B) to include labels for the rapid

shutdown function. This is referenced for clarity. A separate comment addresses the need to reword the 4-320 proposal for consistency with this comment.
16. NEC section 100 defines "listed" and "identified". The use of these terms will allow much of the existing hardware already on the market to be used without additional certification, which in turn enables faster implementation in the field.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14
Comment on Affirmative:
BOWER, W.: This panel member believes this is a major step toward fire-fighter safety but the language does not provide for a requirement for the reliability, default modes, annunciation or restart functionality. Reliability is essential and may require new testing during the certification processes. Annunciation can provide and additional degree of confidence that the system is in a safe mode for fire fighter. The environment associated with PV modules and arrays is brutal for electronic devices and failure modes must be failed "safe".
In 690.12(D) the language "(D) Equipment that performs the rapid shutdown shall be listed and identified" does leave open the possibility of using listed equipment that is not suitable for the environment. I lobbied that using the language "(D) Equipment that performs the rapid shutdown shall be listed and identified for the application" but upon further study it was determined that "identified for the application" language could be extended to all components on the dc side of PV systems and that is not the intent. Still the next code cycle should include enough clarifications that only listed for the function of rapid shutdown equipment and devices be included for the rapid shutdown related hardware.
STAFFORD, T.: See Comment for 4-107.

4-114 Log #68 NEC-P04 **Final Action: Accept**
(690.13)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-254a
Recommendation: It was the action of the Correlating Committee that further consideration be given to the comments expressed in the voting and Section 3.2.3 of the NEC Style Manual suggesting use of the acronym (PV) throughout Article 690.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Replace "photovoltaic" with "PV" throughout Article 690 with the following listed below. (These sections are to retain the term photovoltaic).

690.7(E)(3) – The equipment is clearly marked with a label as follows:

WARNING
BIPOLAR PHOTOVOLTAIC ARRAY.
DISCONNECTION OF NEUTRAL
OR GROUNDED CONDUCTORS
MAY RESULT IN OVERVOLTAGE
ON ARRAY OR INVERTER.

690.31 (C) – Single-conductor cable type USE-2 and single-conductor cable listed and labeled as photovoltaic (PV) wire…
690.31(C) – Informational note - do not revise
690.31 (E) (3) Marking and Labeling Required. The following wiring methods and enclosures that contain PV power source conductors shall be marked with the wording "Warning: Photovoltaic Power Source" by means of permanently affixed labels or other approved permanent marking.
690.35(D)(3) Conductors listed and identified as Photovoltaic (PV) Wire installed as exposed, single conductors.
690.35(F) The PV power source shall be labeled with the following warning at each junction box, combiner box, disconnect, and device where energized, ungrounded circuits may be exposed during service:

WARNING
ELECTRIC SHOCK HAZARD.
THE DC CONDUCTORS OF THIS
PHOTOVOLTAIC SYSTEM ARE UNGROUNDED
AND MAY BE ENERGIZED.

690.56(C) - as shown in the meeting action on Comment 4-159, 690.56(C) should have photovoltaic in the plaque/directory.
Panel Statement: The panel accepts the direction of the Correlating Committee to change "photovoltaic" to "PV" throughout Article 690 with exception noted in the panel action.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-115 Log #1606 NEC-P04 **Final Action: Reject**
(690.13 and 690.15)

Submitter: Mark Albers, SunPower Corp.
Comment on Proposal No: 4-254a
Recommendation: Revise text to read as follows:
690.13 Disconnection of PV DC Conductors on Buildings or Other Structures ~~Supplied by a Photovoltaic System.~~ Means shall be provided to disconnect all ungrounded dc conductors of a PV system from all other conductors in a building or other structure.
(A) Location. The PV disconnecting means shall be installed at a readily accessible location either on the outside of a building or structure or inside nearest the point of entrance of the system conductors.
Exception: Installations that comply with 690.31(F) shall be permitted to have the disconnecting means located remote from the point of entry of the system conductors.
The PV system disconnecting means shall not be installed in bathrooms.
(B) Marking. Each PV ~~system~~ disconnecting means shall be permanently marked to identify it as a PV system disconnect.
(C) Suitable for Use. Each PV ~~system~~ disconnecting means shall not be required to be suitable as service equipment.
(D) Maximum Number of Disconnects. The PV ~~system~~ disconnecting means shall consist of not more than six switches or six circuit breakers mounted in a single enclosure, or in a group of separate enclosures.
(E) Grouping. The PV ~~system~~ disconnecting means shall be grouped with other PV disconnecting means for the system in accordance with 690.13(D). A PV disconnecting means shall not be required at the PV module or array location.
(F) DC Combiner Disconnects. The direct current (dc) output of dc combiners mounted on roofs of dwellings or other buildings shall have a load break disconnecting means located in the combiner or within 1.8 m (6 ft) of the combiner. The disconnecting means shall be permitted to be remotely controlled, but shall be manually operable locally when control power is not available.
690.15 Disconnection of PV Equipment from Other Sources.
Means shall be provided to disconnect equipment, such as inverters, batteries, and charge controllers, from all ungrounded conductors of all sources. If the equipment is energized from more than one source, the disconnecting means shall be grouped and identified.
A single source disconnecting means in accordance with 690.17 shall be permitted for the combined ac output of one or more inverters or ac modules in an interactive system.
(A) Utility Interactive Inverters Mounted in Not Readily Accessible Locations. Utility interactive inverters shall be permitted to be mounted on roofs or other exterior areas that are not readily accessible and shall comply with (1) through (4):
(1) A ~~direct-current~~ PV disconnecting means shall be mounted within sight of or in each inverter that will disconnect it from all DC conductors connected to it.
(2) A source ~~n alternating-current~~ disconnecting means shall be mounted within sight of or in each inverter that will disconnect it from all other sources.
(3) The alternating-current output conductors from the inverter and the source ~~an additional alternating-current~~ disconnecting means for the inverter shall comply with 690.13(A).
(4) A plaque shall be installed in accordance with 705.10.
(B) Equipment. Equipment such as PV source circuit isolating switches, overcurrent devices, dc–to–dc converters, and blocking diodes shall be permitted on the PV side of the PV disconnecting means.
~~**(C) DC Combiner Disconnects.** The direct current (dc) output of dc combiners mounted on roofs of dwellings or other buildings shall have a load break disconnecting means located in the combiner or within 1.8 m (6 ft) of the combiner. The disconnecting means shall be permitted to be remotely controlled, but shall be manually operable locally when control power is not available.~~
Substantiation: CMP 4 has made significant improvement in the clarity of the disconnecting means require for PV Systems in section III of article 690. Unfortunately, there is one point of confusion that still remains. The proposed language still references at least 7 different disconnect means (PV System Disconnecting Means, PV Disconnecting Means, Source Disconnecting Means, DC PV Disconnecting Means, AC Disconnecting Means, DC Combiner Disconnecting Means, and Fuse Service Disconnecting Means) with significant overlap between the different disconnect means. The overlap and inconsistent naming causes confusion about what functionality is require for a given disconnecting means. As a result, SunPower proposes to consolidate the terms PV System Disconnecting Means, PV Disconnecting Means, and DC PV Disconnecting Means into one term, PV Disconnecting Means. Similarly, we propose to consolidate Source Disconnecting Means and AC Disconnecting Means into Source Disconnecting Means. The two titles that were selected focus on the functionality provided by the disconnecting means. These changes will greatly improve interpretation of this important section of article 690.
Given these changes, the addition of the DC combiner disconnecting means was moved from 690.15 to 690.13. With the proposed changes, 690.13 is focused on the disconnecting means required for equipment on the PV side of the inverter, which is where the DC Combiner resides. Thus, we feel this new

requirement is more appropriately added in 690.13.

Lastly, I have replaced all instances of photovoltaic with PV to comply with the new style guide requirements.

Panel Meeting Action: Reject

Panel Statement: The term PV system disconnecting and PV disconnecting means is not defined in the NEC. Familiar terms are being changed which could cause confusion with the restructure of the main body of Article 690.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

Comment on Affirmative:

BOWER, W.: The comment provides for excellent clarifications and a reduction of sometimes confusing terminology that is often used in today's code. I agree with the reject because new terminology and changes were not appropriate for the comment period and new definitions will be needed. But this is an area that needs detailed consideration during the next code cycle.

4-116 Log #1607 NEC-P04 **Final Action: Reject**
(690.13 and 690.15)

Submitter: Mark Albers, SunPower Corp.

Comment on Proposal No: 4-274a

Recommendation: Revise text to read as follows:

690.13 <u>**Disconnection of PV DC Conductors on**</u> **Buildings or Other Structure**<u>**s**</u> ~~**Supplied by a Photovoltaic System.**~~ Means shall be provided to disconnect all ungrounded dc conductors of a PV system from all other conductors in a building or other structure.

(A) Location. The PV disconnecting means shall be installed at a readily accessible location either on the outside of a building or structure or inside nearest the point of entrance of the system conductors.

Exception: Installations that comply with 690.31(F) shall be permitted to have the disconnecting means located remote from the point of entry of the system conductors.

The PV system disconnecting means shall not be installed in bathrooms.

(B) Marking. Each PV ~~system~~ disconnecting means shall be permanently marked to identify it as a PV system disconnect.

(C) Suitable for Use. Each PV ~~system~~ disconnecting means shall not be required to be suitable as service equipment.

(D) Maximum Number of Disconnects. The PV ~~system~~ disconnecting means shall consist of not more than six switches or six circuit breakers mounted in a single enclosure, or in a group of separate enclosures.

(E) Grouping. The PV ~~system~~ disconnecting means shall be grouped with other <u>PV</u> disconnecting means for the system in accordance with 690.13(D). A PV disconnecting means shall not be required at the PV module or array location.

<u>**(F) DC Combiner Disconnects.** The direct current (dc) output of dc combiners mounted on roofs of dwellings or other buildings shall have a load break disconnecting means located in the combiner or within 1.8 m (6 ft) of the combiner. The disconnecting means shall be permitted to be remotely controlled, but shall be manually operable locally when control power is not available.</u>

690.15 Disconnection of PV Equipment <u>**from Other Sources**</u>**.**
Means shall be provided to disconnect equipment, such as inverters, batteries, and charge controllers, from all ungrounded conductors of all sources. If the equipment is energized from more than one source, the disconnecting means shall be grouped and identified.

A single <u>source</u> disconnecting means in accordance with 690.17 shall be permitted for the combined ac output of one or more inverters or ac modules in an interactive system.

(A) Utility Interactive Inverters Mounted in Not Readily Accessible Locations. Utility interactive inverters shall be permitted to be mounted on roofs or other exterior areas that are not readily accessible and shall comply with (1) through (4):

(1) A ~~direct-current~~ PV disconnecting means shall be mounted within sight of or in each inverter <u>that will disconnect it from all DC conductors connected to it</u>.

(2) A <u>source</u> ~~n alternating-current~~ disconnecting means shall be mounted within sight of or in each inverter <u>that will disconnect it from all other sources</u>.

(3) The alternating-current output conductors from the inverter and <u>the source</u> ~~an additional alternating-current~~ disconnecting means for the inverter shall comply with 690.13(A).

(4) A plaque shall be installed in accordance with 705.10.

(B) Equipment. Equipment such as PV source circuit isolating switches, overcurrent devices, dc–to–dc converters, and blocking diodes shall be permitted on the PV side of the PV disconnecting means.

~~**(C) DC Combiner Disconnects.** The direct current (dc) output of dc combiners mounted on roofs of dwellings or other buildings shall have a load break disconnecting means located in the combiner or within 1.8 m (6 ft) of the combiner. The disconnecting means shall be permitted to be remotely controlled, but shall be manually operable locally when control power is not available.~~

Substantiation: CMP 4 has made significant improvement in the clarity of the disconnecting means require for PV Systems in section III of article 690. Unfortunately, there is one point of confusion that still remains. The proposed language still references at least 7 different disconnect means (PV System Disconnecting Means, PV Disconnecting Means, Source Disconnecting Means, DC PV Disconnecting Means, AC Disconnecting Means, DC Combiner Disconnecting Means, and Fuse Service Disconnecting Means) with significant overlap between the different disconnect means. The overlap and inconsistent naming causes confusion about what functionality is require for a given disconnecting means. As a result, SunPower proposes to consolidate the terms PV System Disconnecting Means, PV Disconnecting Means, and DC PV Disconnecting Means into one term, PV Disconnecting Means. Similarly, we propose to consolidate Source Disconnecting Means and AC Disconnecting Means into Source Disconnecting Means. The two titles that were selected focus on the functionality provided by the disconnecting means. These changes will greatly improve interpretation of this important section of article 690.

Given these changes, the addition of the DC combiner disconnecting means was moved from 690.15 to 690.13. With the proposed changes, 690.13 is focused on the disconnecting means required for equipment on the PV side of the inverter, which is where the DC Combiner resides. Thus, we feel this new requirement is more appropriately added in 690.13.

Lastly, I have replaced all instances of photovoltaic with PV to comply with the new style guide requirements.

Panel Meeting Action: Reject

Panel Statement: See panel action and statement on Comment 4-115.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-117 Log #11 NEC-P04 **Final Action: Reject**
(690.14(4), Informational Note)

Submitter: Abel Lampa, Innovative Engineering Inc.

Comment on Proposal No: N/A

Recommendation: Please add after paragraph (4).

Informational note: The 6 disconnect rule is only applicable to the AC side of the inverter & not the DC side.

Substantiation: This is just a clarification. One of my contractor here in NJ, who happens to be a part time Township inspector thought that this 6 disconnect rule also applicable with the DC circuits of the inverter. Economically, this is good, if you clarify the code further.

Panel Meeting Action: Reject

Panel Statement: This comment does not comply with Section 4.4.5(b) of the NFPA Regulations Governing Committee Projects in that it does not identify the document, proposal number to which the comment is directed, and paragraph of the document to which the comment is directed.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-118 Log #69 NEC-P04 **Final Action: Accept**
(690.14(A))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 4-264

Recommendation: The Correlating Committee directs that the panel clarify the action on this proposal to correlate with the panel action taken on Proposal 4-278a.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Panel Statement: The panel accepts the recommendation of the Correlating Committee The panel action on Proposal 4-278a is intended to address the concerns of the submitter of Proposal 4-264. The action on Proposal 4-264 should have been "accept in principle" with statement "see panel action and statement on Proposal 4-278a".

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-119 Log #156 NEC-P04 **Final Action: Accept**
(690.14(C)(4))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 9-181b

Recommendation: It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 4 for action in Article 690.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-120 Log #13 NEC-P04 **Final Action: Reject**
(690.14(D)(1))

Submitter: Teri Dwyer, Wells Fargo
Comment on Proposal No: 4-272
Recommendation: Revise text to read as follows:

690.14 Additional Provisions.

Photovoltaic disconnecting means shall comply with 690.14(A) through (D).

(D) Utility-Interactive Inverters Mounted in Not-Readily-Accessible Locations. Utility-interactive inverters shall be permitted to be mounted on roofs or other exterior areas that are not readily accessible. These installations shall comply with (1) through (4):

(1) A direct-current photovoltaic disconnecting means shall be mounted within sight of or in the inverter.

Exception: Where micro-inverters are installed, a direct-current disconnect shall not be required where the dc conductor is 12 in. or less in length, has a connector per 690.33(E)(2) and the ac required disconnect is mounted within 10 ft of the array. Where more than one array is present, the ac disconnect shall be identified to the corresponding array.

Informational Note: The reduced distance and identification requirements for the ac disconnect where micro-inverters are install has been added to facilitate the dc connectors requirement "Do Not Disconnect Under Load."

Substantiation: CMP-4 did not address the substantiation in original proposal within their panel statement, "Current code allows ac disconnect to be remote from the PV array - at ground level - much more than 10 ft. The NEC permits the use of connectors to meet the disconnect requirements of 690.17 Exception."

690.14(D)(1) does not apply to PV arrays at ground level, it is specifically for utility interactive inverters mounted on roofs. Also, as for the NEC permitting the use of connectors as a disconnect means per 690.17 exception, "a connector shall be permitted to be used as an ac or dc disconnecting means, provided that it complies with the requirements of 690.33 and is listed and identified for the use." This exception requires that the connector be listed and identified for the use, currently used connectors are not listed and identified for the use, in fact, they are at best UL recognized components with conditions of acceptability covered by UL category QU2:
http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/showpage.html?&name=QUQ2.GuideInfo&cnnshorttitle=Connectors+for+Use+in+Photovoltaic-Systems+-+Component&objid=1080909233&efgid=1073741824&version=versionless&parent_id=1080909232&sequence=1

The devices covered under this category are incomplete in certain constructional features or restricted in performance capabilities and are intended for use as components of complete equipment submitted for investigation rather than for direct separate installation in the field. The final acceptance of the component is dependent upon its installation and use in complete equipment submitted to UL.

These devices have only been investigated to mate with the same line of connectors/devices within their product family. These devices have not been investigated to mate with any other similar devices from other manufacturers. Currently, there are seventy-two (72) manufactures of these types of products covered by UL, category QUQ2 alone; this does not include the possibility of similar products certified by other NRTLs. Currently, there is no compatibility/configuration standard, since this connector is not permitted to be field installed, is intended for use as components of complete listed equipment and has not been investigated to mate with any other similar devices from other manufacturers, what is the probability that a listed micro-inverter and a listed PV module will have a set of connectors evaluated to be mated together? I would suggest that you have a one (1) in seventy-two (72) chance.
http://database.ul.com/cgi-bomXYV/cgifind.new/LISEXT/1FRAME/stehres.html

Per the UL White Book, the Recognized Component Mark does not provide evidence of listing or labeling, which may be required by installation codes or standards.

Please address original substantiation:

690.14(D)(1) as currently written is practically impossible to comply with when micro-inverters are installed. Currently micro-inverters are being installed and the only dc disconnecting means are the connectors required by 690.33. This type of connector is a recognized component covered by UL category QUQ2 which requires them to be marked "Do Not Disconnect Under Load." Therefore, the need to have the ac disconnect located in close proximity (10 ft) of the associated PV array. These connectors are single-pole latching and locking type connectors which will not permit quick disconnecting without the use of a tool or special knowledge.

Panel Meeting Action: Reject
Panel Statement: Micro-Inverters are not defined. The panel's action and statement on Proposal 4-272 are still valid.

The panel action on Proposal 4-278a incorporated language suitable to the submitter's concern in the substantiation by the revision to the last exception that added the words "for use with specific equipment".

Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-121 Log #14 NEC-P04 **Final Action: Reject**
(690.14(D)(1))

Submitter: David Tringo, City of Weston
Comment on Proposal No: 4-272
Recommendation: Revise text to read as follows:

690.14 Additional Provisions.

Photovoltaic disconnecting means shall comply with 690.14(A) through (D).

(D) Utility-Interactive Inverters Mounted in Not-Readily-Accessible Locations. Utility-interactive inverters shall be permitted to be mounted on roofs or other exterior areas that are not readily accessible. These installations shall comply with (1) through (4):

(1) A direct-current photovoltaic disconnecting means shall be mounted within sight of or in the inverter.

Exception: Where micro-inverters are installed, a direct-current disconnect shall not be required where the dc conductor is 12 in. or less in length, has a connector per 690.33(E)(2) and the ac required disconnect is mounted within 10 ft of the array. Where more than one array is present, the ac disconnect shall be identified to the corresponding array.

Informational Note: The reduced distance and identification requirements for the ac disconnect where micro-inverters are install has been added to facilitate the dc connectors requirement "Do Not Disconnect Under Load."

Substantiation: CMP-4 did not address the substantiation in original proposal within their panel statement, "Current code allows ac disconnect to be remote from the PV array - at ground level - much more than 10 ft. The NEC permits the use of connectors to meet the disconnect requirements of 690.17 Exception."

690.14(D)(1) does not apply to PV arrays at ground level, it is specifically for utility interactive inverters mounted on roofs. Also, as for the NEC permitting the use of connectors as a disconnect means per 690.17 exception, "a connector shall be permitted to be used as an ac or dc disconnecting means, provided that it complies with the requirements of 690.33 and is listed and identified for the use." This exception requires that the connector be listed and identified for the use, currently used connectors are not listed and identified for the use, in fact, they are at best UL recognized components with conditions of acceptability covered by UL category QU2:
http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/showpage.html?&name=QUQ2.GuideInfo&cnnshorttitle=Connectors+for+Use+in+Photovoltaic-Systems+-+Component&objid=1080909233&efgid=1073741824&version=versionless&parent_id=1080909232&sequence=1

The devices covered under this category are incomplete in certain constructional features or restricted in performance capabilities and are intended for use as components of complete equipment submitted for investigation rather than for direct separate installation in the field. The final acceptance of the component is dependent upon its installation and use in complete equipment submitted to UL.

These devices have only been investigated to mate with the same line of connectors/devices within their product family. These devices have not been investigated to mate with any other similar devices from other manufacturers. Currently, there are seventy-two (72) manufactures of these types of products covered by UL, category QUQ2 alone; this does not include the possibility of similar products certified by other NRTLs. Currently, there is no compatibility/configuration standard, since this connector is not permitted to be field installed, is intended for use as components of complete listed equipment and has not been investigated to mate with any other similar devices from other manufacturers, what is the probability that a listed micro-inverter and a listed PV module will have a set of connectors evaluated to be mated together? I would suggest that you have a one (1) in seventy-two (72) chance.
http://database.ul.com/cgi-bomXYV/cgifind.new/LISEXT/1FRAME/stehres.html

Per the UL White Book, the Recognized Component Mark does not provide evidence of listing or labeling, which may be required by installation codes or standards.

Please address original substantiation:

690.14(D)(1) as currently written is practically impossible to comply with when micro-inverters are installed. Currently micro-inverters are being installed and the only dc disconnecting means are the connectors required by 690.33. This type of connector is a recognized component covered by UL category QUQ2 which requires them to be marked "Do Not Disconnect Under Load." Therefore, the need to have the ac disconnect located in close proximity (10 ft) of the associated PV array. These connectors are single-pole latching and locking type connectors which will not permit quick disconnecting without the use of a tool or special knowledge.

Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 4-120.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-122 Log #15 NEC-P04 **Final Action: Reject**
(690.14(D)(1))

Submitter: Joseph Amato, Delaware County
Comment on Proposal No: 4-272
Recommendation: Add new text to read as follows:
690.14 Additional Provisions.
Photovoltaic disconnecting means shall comply with 690.14(A) through (D).
(D) Utility-Interactive Inverters Mounted in Not-Readily-Accessible Locations. Utility-interactive inverters shall be permitted to be mounted on roofs or other exterior areas that are not readily accessible. These installations shall comply with (1) through (4):
(1) A direct-current photovoltaic disconnecting means shall be mounted within sight of or in the inverter.
Exception: Where micro-inverters are installed, a direct-current disconnect shall not be required where the dc conductor is 12 in. or less in length, has a connector per 690.33(E)(2) and the dc required disconnect is mounted within 10 ft of the array. Where more than one array is present, the dc disconnect shall be identified to the corresponding array.
Informational Note: The reduced distance and identification requirements for the ac disconnect where micro-inverters are installed has been added to facilitate the dc connector's requirement "Do Not Disconnect Under Load."
Substantiation: I do not feel as if CMP-4 addressed the substantiation of this proposal. The concern was the use of the micro-inverters that have short DC leads with connectors on the ends being used as the required DC disconnects. AS a Plan reviewer and a inspector out in the field we are having to get permission from the Building Official to accept these non-listed connectors used as disconnects in lieu of other listed type disconnects. 690.17 Exception says, "A connector shall be permitted to be used as an ac or a dc disconnecting means, provided that it complies with the requirements of 690.33 and is listed and identified for the use".
I feel it is a violation of the code as written and either needs manufactures to have these connectors evaluated so they are listed and identified for use or consider this exception proposal to which would at least provide the needed protection for personnel working on this equipment.
Conclusion: I feel the submitter of this proposal is making a reasonable suggestion to correct this problem. If we allow something like this in this situation we open ourselves up to people who will want to use products not listed for other projects.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 4-120.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-123 Log #1361 NEC-P04 **Final Action: Reject**
(690.14(D)(1))

Submitter: Ron B. Chilton, Rep. NC Code Clearing Committee.
Comment on Proposal No: 4-272
Recommendation: Revise Proposal by added text:
690.14. Additional Provisions.
(D) Utility-Interactive Inverters Mounted in Not-Readily-Accessible Locations. Utility-interactive inverters shall be permitted to be mounted on roofs or other exterior areas that are not readily accessible. these installations shall comply with (1) through(4).
(1) A direct-current photovoltaic disconnecting means shall be mounted within sight of or in the inverter.
Exception: Where micro-inverters are installed, a direct-current disconnect shall not be required where the dc conductor is 12 in. or less, has a connector identified in 690.33(E)(1) or (2), and the ac required disconnect is located within 10 ft. if the array. Where more than one array is present, the ac disconnect shall be marked with a label to identify which array it supplies, in a manner acceptable to the Authority Having Jurisdiction.
Substantiation: Many DC connectors supplied with micro-inverters that utilize cords and plugs for installation are not load break rated and should have markings to indicate it is unsafe to attempt to use that connector to disconnect when under load conditions.
Panel Meeting Action: Reject
Panel Statement: The panel action on Proposal 4-278a incorporated language suitable to submitter's concern by the revision of the last exception that added the words "for use with specific equipment".
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-124 Log #70 NEC-P04 **Final Action: Accept**
(690.15)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-275
Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on proposal 4-274a.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the recommendation of the Correlating Committee. The panel action on Proposal 4-274a is intended to address the concerns of the submitter of Proposal 4-275. The action on Proposal 4-275 should have been "accept in principle" with statement "see panel action and statement on Proposal 4-274a".
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-125 Log #1168 NEC-P04 **Final Action: Reject**
(690.15)

Submitter: Greg Pitz, Logos Solar
Comment on Proposal No: 4-274a
Recommendation: Revise text to read as follows:
690.15 Disconnection of Photovoltaic Equipment. Means shall be provided to disconnect equipment, such as inverters, batteries, and charge controllers, from all ungrounded conductors of all source sources. If the equipment is energized from more than one source, the disconnecting means shall be grouped and identified. A single disconnecting means in accordance with 690.17 shall be permitted for the combined ac output of one or more inverters or ac modules in an interactive system.
(A) Utility Interactive Inverters Mounted in Not Readily Accessible Locations. Utility interactive inverters shall be permitted to be mounted on roofs or other exterior areas that are not readily accessible and shall comply with (1) through (4):
(1) ~~A direct-current PV disconnecting means shall be mounted within sight of or in each inverter.~~ A DC disconnecting means shall be installed within sight of the inverter to which it is electrically connected.
(2) ~~An alternating-current disconnecting means shall be mounted within sight of or in each inverter.~~ An AC disconnecting mean shall be installed within sight of the inverter(s) to which it is electrically connected.
(3) The ~~alternating-current~~ AC output conductors from the inverter and an additional ~~alternating-current~~ AC disconnecting means for the inverter shall comply with 690.13(A).
(4) A ~~plaque~~ directory shall be installed in accordance with 705.10.
(B) ~~Equipment~~. Equipment such as PV source circuit isolating switches, overcurrent devices, ~~dc-to-dc~~ DC-to-DC converters, and blocking diodes shall be permitted on the PV side of the PV disconnecting means.
(C) DC Combiner Disconnects. ~~The direct current (dc) output of dc combiners mounted~~ installed on roofs of dwellings or other buildings shall have a load break listed disconnecting means for the output located ~~in the combiner or~~ within 1.8 m (6ft) of the combiner. The disconnecting means ~~shall be permitted to be remotely controlled, but~~ shall be manually operable locally ~~when control power is not available~~ at all times.
Substantiation: A1) A DC disconnect is only connected to one inverter, it isn′t necessarily mounted, and if it is ″in″ the inverter, it is visible, so the wording is unnecessary.
Addition of ″PV″ to text inconsistent. Why hasn′t the descriptor been added to all other parts of this paragraph?
Especially the very next line that is worded identically, except that DC is replaced with AC? Or similar descriptors in any other portions of The Code that use DC generated by sources other than PV? This is the PV article of the code, so of course it is for PV.
A2) An AC disconnect can be connected to more than one inverter, it isn't necessarily mounted, and if it is "in" the inverter, it is visible, so the wording is unnecessary,
A 1 & A2) If multiple inverters, disconnects, combiners, are all in one area, don' t the disconnects mentioned here need to be related to the appropriate inverter(s)?
A3) And other locations - I like Mr Bower's consistency & format preferences,
A4) The wording in 705,10 needs to be changed, as plagues aren't synonymous with directories, but directories may be plaques,
B) Consistency, None of the other lines have given a short top ic description at the start.
C) Same consistency remark as immediately preceding. The "direct current" (spelled out for emphasis) isn't mounted anywhere, so poor sentence construction, The disconnect might be integral to other equipment, so installed versus mounted, I'm sure the omission of "listing" was just an oversight as otherwise all disconnects will meet this criteria, If the
disconnect is integral to the combiner, that is within 1.8m, so unnecessary wording has been removed. Remotely controlled has been removed as this isn't a design manual.
Panel Meeting Action: Reject
Panel Statement: Remote control is a technical requirement that improves safety and is a safety requirement that needs to remain. The changes to AC and DC (capitals) is not in accordance with the NEC Style Manual. Familiar terms are being changed which could cause confusion with the restructure of the main body of Article 690.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-126 Log #1381 NEC-P04 **Final Action: Reject**
(690.15(C))

Submitter: Chad Kennedy, Schneider Electric
Comment on Proposal No: 4-274a
Recommendation: Revise text to read as follows:
(C) DC Combiner Disconnects. The direct current (dc) output of dc combiners ~~mounted on roofs of dwellings or other buildings~~ shall have a load break disconnecting means located in the combiner or within 1.8 m (6 ft) of the combiner and comply with the requirements of 690.17. The disconnecting means shall be permitted to be remotely controlled, but shall be manually operable locally when control power is not available.
Substantiation: Schneider Electric supports the enhancements to safety and fire service operations in the committee action on ROP 4-274a. However, the benefits of having dc combiner disconnects extend beyond just roof installations and the requirements should be extended to apply in general.
Panel Meeting Action: Reject
Panel Statement: This comment to include all systems is too restrictive for some systems. Load break disconnecting means on ground mounted PV system combiners may unnecessarily limit current practices.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 11 Negative: 3
Explanation of Negative:
ROGERS, J.: This comment should be accepted. The submitter is correct that there is no technical merit to limit these requirements to roof top installations. The Panel statement relative to “current practices” is not a good reason to negate the requirement for this additional safety item for ground mounted systems. If the installation of these disconnects is important for roof mounted systems it is equally important for ground mounted systems.
STAFFORD, T.: The safety of installers and maintainers is not limited to the roof. DC disconnects on the output would allow for isolation of typically larger conductors with higher amounts of current.
ZGONENA, T.: The panel should have accepted this comment because it is a safety enhancement. Without the proposed text, the disconnect for ground mounted arrays may be located anywhere, including locations far away or out of sight of the array.

4-127 Log #71 NEC-P04 **Final Action: Accept**
(690.15(C)(4))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-277
Recommendation: The Correlating Committee directs that this proposal be correlated with the action on Proposal 4-254a that revised 690.13(D) for the maximum number of disconnecting means.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise proposed 690.13(D) text as follows:
(D) Maximum Number of Disconnects. The photovoltaic system disconnecting means shall consist of not more than six switches or six circuit breakers mounted in a single enclosure, or in a group of a separate enclosures.
Panel Statement: The panel accepts the recommendation of the Correlating Committee. The section was renumbered from 690.15(C)(4) to 690.13(D) in Proposal 4-254a.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-128 Log #72 NEC-P04 **Final Action: Accept**
(690.17)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-278a
Recommendation: The Correlating Committee directs that the panel clarify the action on this proposal to correlate with the panel action taken on Proposal 4-264.
The Correlating Committee further directs that this proposal be clarified by modifying the accepted text based on the NEC Style Manual by removing the titles in the list of devices and changing the “(a) through (i)” to “(1) through (9).”
In addition, the Correlating Committee directs that the panel reconsider the Informational Notes as related to the use of permissive and mandatory text, in accordance with the NEC Style Manual.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise proposed text of 690.17(A) as follows:
(A) Manually Operable. The disconnecting means for ungrounded PV conductors shall consist of a manually operable switch(es) or circuit breaker(s). The disconnecting means shall be permitted to be power operable with provisions for manual operation in the event of a power supply failure. The disconnecting means shall be one of the following listed devices:
1) An industrial control switch marked for use in PV systems.
2) A molded case circuit breaker marked for use in PV systems
3) A molded case switch marked for use in PV systems.
4) An enclosed switch marked for use in PV systems.
5) An open type switch marked for use in PV systems.
6) A dc rated molded case circuit breaker suitable for backfeed operation.
7) A dc rated, molded case switch suitable for backfeed operation.
8) A dc rated enclosed switch.
9) A dc rated open type switch.
10) A dc rated low voltage power circuit breaker.
Delete Informational Note in 690.17(D)
Panel Statement: The panel accepts the recommendation of the Correlating Committee. See panel statement on Comment 4-118. The informational notes were not necessary and were removed. The panel action on Comment 4-129 was incorporated into this comment.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-129 Log #836 NEC-P04 **Final Action: Accept in Principle in Part**
(690.17)

Submitter: Thomas Hattert, SMA Solar Technology AG
Comment on Proposal No: 4-278a
Recommendation: Revise text to read as follows:
690.17 Disconnect Type.
(A) Manually Operable. The disconnecting means for ungrounded PV conductors shall consist of a manually operable switch(es) or circuit breaker(s). The disconnecting means shall be permitted to be power operable with provisions for manual operation in the event of a power supply failure. The disconnecting means shall be one of the following devices:
(a) PV Industrial Control Switch. A listed industrial control switch marked for use in PV systems.
(b) PV Molded Case Circuit Breaker. A listed molded case circuit breaker marked for use in PV systems
(c) PV Molded Case Switch. A listed molded case switch marked for use in PV systems.
(d) PV Enclosed Switch. A listed, enclosed switch marked for use in PV systems.
(e) PV Open Type Circuit Breaker. A listed, open type circuit breaker marked for use in PV systems.
(~~e~~f) PV Open Type Switch. A listed, open type switch marked for use in PV systems.
(~~f~~g) Molded Case Circuit Breaker. A listed, dc rated molded case circuit breaker suitable for backfeed operation.
(~~g~~h) Molded Case Switch. A listed, dc rated, molded case switch suitable for backfeed operation.
(~~h~~i) Enclosed Switch. A listed, dc rated enclosed switch.
(k) Open Type Circuit Breaker. A listed, dc rated open type circuit breaker.
(~~i~~j) Open Type Switch. A listed, dc rated open type switch.
Informational Note: Devices marked with “line” and “load” are not suitable for backfeed or reverse current.
(B) Simultaneous Opening of Poles. The PV disconnecting means shall simultaneously disconnect all ungrounded supply conductors that it controls from the building or structure wiring system.
(C) Externally Operable and Indicating. The PV disconnecting means shall be externally operable without exposing the operator to contact with live parts and indicate whether in the open or closed position
(D) Disconnection of Grounded Conductor. A switch, circuit breaker, or other device shall not be installed in a grounded conductor if operation of that switch, circuit breaker, or other device leaves the marked, grounded conductor in an ungrounded and energized state.
Exception No. 1: A switch or circuit breaker that is part of a ground-fault detection system required by 690.5, or that is part of an arc-fault detection/interruption system required by 690.11, shall be permitted to open the grounded conductor when that switch or circuit breaker is automatically opened as a normal function of the device in responding to ground faults.
Exception No. 2: A disconnecting switch shall be permitted in a grounded conductor if all of the following conditions are met:
(1) The switch is used only for PV array maintenance.
(2) The switch is accessible only by qualified persons.
(3) The switch is rated for the maximum dc voltage and current that could be present during any operation, including ground-fault conditions.
Informational Note: The grounded conductor may have a bolted or terminal disconnecting means to allow maintenance or troubleshooting by qualified personnel.
(F) Interrupting Rating. The building or structure disconnecting means shall have an interrupting rating sufficient for the maximum circuit voltage and current that is available at the line terminals of the equipment. Where all terminals of the disconnecting means may be energized in the open position, a warning sign shall be mounted on or adjacent to the disconnecting means. The sign shall be clearly legible and have the following words or equivalent:
WARNING
ELECTRIC SHOCK HAZARD.
DO NOT TOUCH TERMINALS.
TERMINALS ON BOTH THE LINE AND LOAD SIDES

MAY BE ENERGIZED IN THE OPEN POSITION.

Exception: A connector shall be permitted to be used as an ac or a dc disconnecting means, provided that it complies with the requirements of 690.33 and is listed and identified for use with specific equipment.

Substantiation: The original proposal would exclude open type circuit breakers that are covered by UL1066. For AC applications these type of breakers are commonly used as disconnecting means. Right now UL 1066 also permits them to have a DC rating up to 300V DC.

Since the open type circuit breakers are able to carry much more current than molded case circuit breakers, it is very likely that they will be used more often for large PV inverters in the future. Although there is no standard yet that covers specific PV open type circuit breakers, it is not assured that there won't be an extension of UL1066 like the extension from UL489 to UL489b or UL98 to UL98b in the next years.

Knowing that open type circuit breakers can have a DC rating right now and are also used for disconnecting means, they should be included in the list of permitted disconnecting types.

Panel Meeting Action: Accept in Principle in Part

Reject the addition of (e).

Revise proposed (k) as last item on list to read:

(k) Low Voltage Power Circuit Breaker. A listed DC rated low voltage power circuit breaker.

Panel Statement: The panel rejects the proposed new (e) because it does not exist at this time.

The proper terminology and description for proposed (k) is as shown in the revised panel action.

The action has been incorporated into Comment 4-128.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-130 Log #1169 NEC-P04 **Final Action: Accept in Part**
(690.17)

Submitter: Greg Pitz, Logos Solar

Comment on Proposal No: 4-278a

Recommendation: Revise text to read as follows:

(13) Simultaneous Opening of Poles. The PV disconnecting means shall simultaneously disconnect all ungrounded supply conductors ~~that it controls from the building or structure wiring system~~.

(D) Disconnection of Grounded Conductor. A switch, circuit breaker, or other device shall not be installed in a grounded conductor ~~if operation of that switch, circuit breaker, or other device leaves the marked, grounded conductor in an ungrounded and energized state.~~

No comments on the rest of the proposal.

Substantiation: (B) Deleted superfluous, confusing. wording.

(D) The only time it is permissible to open a grounded conductor is given in the two exceptions that follow, therefore the previous wording was made more succinct per Style Manual.

Panel Meeting Action: Accept in Part

Reject deletion of the phrase "if operation... :" in (D).

Accept deletion of the phrase "that it controls from the building or structure wiring system" in (B)(3).

Panel Statement: The section number should be (B3) instead of (13).

The panel accepts removing superfluous wording "that it controls from the building or structure wiring system" in (B)(3).

The panel rejects deleting the phrase "if operation... :" in (D) as it is a removes details needed for safety.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-131 Log #73 NEC-P04 **Final Action: Accept**
(690.17(4))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 4-282

Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the panel action on Proposal 4-278a with regard to the placement of the accepted text in 690.17.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Revise the proposed text of 690.17(E) as follows:

(~~F~~E)Interrupting Rating. The building or structure disconnecting means shall have an interrupting rating sufficient for the maximum circuit voltage and current that is available at the line terminals of the equipment. Where all terminals of the disconnecting means may be energized in the open position, a warning sign shall be mounted on or adjacent to the disconnecting means. The sign shall be clearly legible and have the following words or equivalent:

WARNING

ELECTRIC SHOCK HAZARD.

DO NOT TOUCH TERMINALS.

TERMINALS ON BOTH THE LINE AND LOAD SIDES

MAY BE ENERGIZED IN THE OPEN POSITION.

<u>The warning sign(s) or label(s) shall comply with 110.21(B).</u>

Exception: A connector shall be permitted to be used as an ac or a dc disconnecting means, provided that it complies with the requirements of 690.33 and is listed and identified for use with specific equipment."

Panel Statement: The panel accepts the recommendation of the Correlating Committee. The language for Proposal 4-282 is incorporated into 690.17(E) after the warning sign text.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-132 Log #74 NEC-P04 **Final Action: Accept**
(690.31)

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 4-284a

Recommendation: It was the action of the Correlating Committee that the panel action on this proposal be reconsidered and the text be rewritten to use letters rather than numbers for each list item in the sub-list of 690.31(G)(3) in compliance with 2.1.5.3, Level 3 of the NEC Style Manual.

The Correlating Committee directs that the panel change the word "when" to "where" in the first sentence in this proposal and in 690.31(D) since this is not a condition of time.

The Correlating Committee further directs the panel to address the permissive use of the word "may" in the Informational Notes in accordance with the NEC Style Manual.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Revise the proposed Informational Note to 690.31(A) to read as follows:

Informational Note: Photovoltaic modules operate at elevated temperatures when exposed to high ambient temperatures and to bright sunlight. These temperatures routinely exceed 70°C (158°F) in many locations. Module interconnection conductors are available with insulation rated for wet locations and a temperature rating of 90°C (194°F) or greater.

Revise Informational Note to 690.31(C) to read as follows:

Informational Note: Photovoltaic (PV) wire [also photovoltaic (PV) cable] has a nonstandard outer diameter. Conduit fill is calculated using Table 1 of Chapter 9.

Revise 690.31(D) to read as follows:

(D) Multi-conductor Cable. Multi-conductor cable type TC-ER or USE-2 shall be permitted in outdoor locations in PV inverter output circuits <u>where</u> used with utility-interactive inverters mounted in not-readily-accessible locations. The cable shall be secured at intervals not exceeding 1.8m (6 ft.). Equipment grounding for the utilization equipment shall be provided by an equipment grounding conductor within the cable.

Revise 690.31(G) to read read as follows:

(G) Direct-Current Photovoltaic Source and DC Output Circuits On or Inside a Building. Where dc PV source or dc PV output circuits from a building-integrated or other PV systems are run inside a building or structure, they shall be contained in metal raceways, Type MC metal-clad cable that complies with 250.118(10), or metal enclosures from the point of penetration of the surface of the building or structure to the first readily accessible disconnecting means. The disconnecting means shall comply with 690.13(B), (C), and 690.15(A), (B). The wiring methods shall comply with the additional installation requirements in (1) through (4)

(<u>a</u>) Embedded in Building Surfaces. Where circuits are embedded in built-up, laminate, or membrane roofing materials in roof areas not covered by PV modules and associated equipment, the location of circuits shall be clearly marked using a marking protocol that is approved as being suitable for continuous exposure to sunlight and weather.

(b) Flexible Wiring Methods. Where flexible metal conduit (FMC) smaller than metric designator 21 (trade size 3/4) or Type MC cable smaller than 25 mm (1 in.) in diameter containing PV power circuit conductors is installed across ceilings or floor joists, the raceway or cable shall be protected by substantial guard strips that are at least as high as the raceway or cable. Where run exposed, other than within 1.8 m (6 ft) of their connection to equipment, these wiring methods shall closely follow the building surface or be protected from physical damage by an approved means.

(c) Marking or Labeling Required. The following wiring methods and enclosures that contain PV power source conductors shall be marked with the wording Warning: Photovoltaic Power Source" by means of permanently affixed labels or other approved permanent marking:

(1) Exposed raceways, cable trays, and other wiring methods

(2) Covers or enclosures of pull boxes and junction boxes

(3) Conduit bodies in which any of the available conduit openings are unused

(4) Marking and Labeling Methods and Locations. The labels or markings shall be visible after installation. The labels shall be reflective and shall have all letters capitalized with a minimum height of 9.5 mm (3/8 inch) white on red background. PV power circuit labels shall appear on every section of the wiring system that is separated by enclosures, walls, partitions, ceilings, or floors. Spacing between labels or markings, or between a label and a marking, shall not be more than 3 m (10 ft). Labels required by this section shall be suitable for the environment where they are installed.

Panel Statement: The panel accepts the recommendation of the Correlating Committee. In part (D) the word "when" was change to "where". In part (G)

the section numbers were changed to letters. The word "may" was removed from the (A) informational note and changed to "is" in the (C) informational note.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-133 Log #1170 NEC-P04 **Final Action: Reject**
(690.31)

Submitter: Greg Pitz, Logos Solar
Comment on Proposal No: 4-284a
Recommendation: Revise text to read as follows:

(4) Marking and Labeling Methods and Locations. The labels or markings shall be visible after installation. The labels shall be reflective and shall have all letters capitalized with a minimum height of 9.5 mm (3/8 inch) ~~white~~ <u>black</u> on ~~red~~ <u>orange</u> background. PV power circuit labels shall appear on every section of the wiring system that is separated by enclosures, walls, partitions, ceilings, or floors. Spacing between labels or markings, or between a label and a marking, shall not be more than 3 m (10 ft). Labels required by this section shall be suitable for the environment where they are installed.

No comments on the rest of the proposal.

Substantiation: This Comment is to make the Proposal consistent with United States standards (ANSI standards Z35.1-1968, Z53.1-1967, Z535.2, Z535.1-6), international standards (ISO 3864 & 7010:2011), and to make it legal in the USA (OSHA federal laws, 29 CFR 1910.144 & 1910.145).

ANSI is the standards organization in the USA. The ANSI committee on Safety Signs and Colors has been keeping signage in the USA in agreement with the rest of the world since 1998. OSHA regulations are usually closely linked to ANSI standards. The IFC recently adopted the standard mentioned in the proposal, which, unfortunately, was done before checking other existing standards & laws. Attempts are being made to change said IFC standard so that it is in agreement with the standards & federal laws quoted above.

OHSA does not recognize the use of the word ″label″, formally defining all means of notification as ″signs″. ANSI & OSHA explicitly tell us that warning signs are to have black letters & symbols on orange background.

References, including OSHA interpretations of their standards (laws), available upon request.

This comment is also to coordinate with accepted proposal 1-114 Log #847, article 110.21(A) and (B)), markings.

Panel Meeting Action: Reject
Panel Statement: The panel rejects the black on orange OSHA color scheme in favor of the firefighters required color scheme.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-134 Log #1074 NEC-P04 **Final Action: Reject**
(690.31(B))

Submitter: John C. Wiles, Southwest Technology Development Institute, New Mexico State University
Comment on Proposal No: 4-284a
Recommendation: Delete the inserted text and retain the 2011 language.
(B) Identification and Grouping. PV source circuits and PV output circuits shall not be contained in the same raceway, cable tray, cable, outlet box, junction box, or similar fitting as conductors, feeders, branch circuits of other non-PV systems, ~~or inverter output circuits~~ unless the conductors of the different systems are separated by a partition. PV system conductors shall be identified and grouped as required by 690.31(B)(1) through (4). The means of identification shall be permitted by separate color coding, marking tape, tagging, or other approved means.
Substantiation: The panel was in error in accepting the proposal 4-194. The original language of 690.31(B) provides protections specific to the unique nature of PV sources by limiting conductors, feeders or branch circuits of **non-PV** systems within the same raceway, cable tray, cable, outlet box, junction box, or similar fitting as PV source and output circuits, because a typical person servicing a non-PV circuit expects it to be deenergized after opening all OCPD at the service panel, whereas PV source and output circuits may remain energized whenever the sun is shining. This proposal attempts to layer additional theoretical protections against the potential risk to equipment due to a double fault condition. However, the proposed inclusion of "or inverter output circuits" is contrary to the specific nature of solar inverters, places an unrealistic burden on installers and inspectors, and does not provide the safety the submitter intends.
300.3(C)(1) allows conductors of ac and dc circuits to occupy the same equipment wiring enclosure, cable, or raceway, provided all conductors have an insulation rating equal to at least the maximum circuit voltage applied to any conductor within the enclosure, cable, or raceway. Inverters have, by definition, both AC and DC inputs and outputs, and multi-mode inverters may have multiple inputs and outputs. Many manufacturers have developed balance of system components with both AC and DC circuit routing and OCPD to accommodate these multiple inputs and outputs, and enable safe and practical installation of listed inverters. This proposal would call into question whether those products could be installed as designed and intended. Adequate provisions currently exist to ensure safety in photovoltaic systems – Chapter 3 provides the wiring methods required for safety, 690.15, 16 and 17 require that devices be identified if energized from multiple sources, and 690.4(E) requires service on these systems to be performed only by qualified persons.
The 2011 NEC handbook includes commentary which clarifies the intent of this section by specifically stating this "does not permit the alternating-current branch-circuit conductors that supply an exterior luminaire installed near a roof-mounted PV array to share the same raceway or cable with the conductors of PV source circuits or PV output circuits. Conductors directly related to a specific PV system, such as those in dc and ac output power circuits, may be contained in the same raceway as PV source and output conductors, providing they meet the requirements of 690.4(B)(1) through (B)(4) and 300.3(C).
Panel Meeting Action: Reject
Panel Statement: The submitter is correct that there are allowances in Chapter 3 of the NEC for combinations of conductors in cables or raceways provided they all have appropriate insulation levels and are of the proper type circuit classification. That being said it is not commonplace for this to happen and even if it does the systems do not have the same characteristics as other electrical systems and thus have their own Article. Bringing these circuits together within listed equipment is not an issue as the equipment has been evaluated for that, the issue is outside of that equipment. Failures in conductor insulation that impose AC voltages on DC circuits of PV systems would most likely not facilitate over-current devices and could cause catastrophic damage to the circuitry within PV modules leading to module failure and potentially fires. The issue is a matter of workmanlike installations by qualified persons that have the knowledge and ability to route electrical installations and maintain separation all the way from the source to the listed equipment.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-135 Log #1075 NEC-P04 **Final Action: Accept in Principle**
(690.31(C)(1))

Submitter: John C. Wiles, Southwest Technology Development Institute, New Mexico State University
Comment on Proposal No: 4-290
Recommendation: Proposed Text (Modified from Proposal 4-290):
<u>PV source circuits and PV output circuits using single-conductor cable listed and labeled as PV wire of all sizes with or without a CT marking/rating shall be permitted in cable trays provided the cables are secured and supported in accordance with 338.10(B)(4)(b) and are not on or penetrating a building. PV systems using cable trays on buildings must comply with 392.</u>
Substantiation: We want to thank the CMP for considering Proposal 4-290 and request that the proposal be reconsidered. The CMP was concerned about Cable Trays being limited to Industrial Establishments in its Panel Statement. As Jim Rogers pointed out in his comment, this was a misunderstanding. The permissibility of Cable Trays outside of Industrial Establishments is directly addressed in 392.10, which states "… Cable tray installations shall not be limited to industrial establishments …" Nonetheless, after discussing the proposal with representatives of Code Making Panels 7 and 8 as suggested by Jim Rogers, we have modified the proposed modification to streamline the revision request and better align the language with the NEC style and language requirements.
In an attempt to reduce the impact of the requested revision, we have modified the proposed language to reduce its scope to PV Wire only. Also, we have focused the language on permitting the use of these cables in ground mount systems only (systems not on or penetrating a building) and have eliminated the cable tray fill and conductor ampacity guidelines. We have also made it very clear that the cables must continue to meet the support requirements that are currently required in 33810(B)(4)(b). Given that cable trays provide a superior protection and support for the PV Source circuits relative to what is already required in 690, we ask that the CMP reevaluate this proposal and adopt the streamlined language proposed in this comment.
As additional background information, it became clear during conversations with CMP 4 representatives that the problem being addressed by this revision was not well understood. Based on the Working Group's experience with designing ground mount PV systems, AHJ's have difficultly interpreting the NEC requirements for installing single conductor PV Wire cables smaller than #1/0 AWG in cable trays. The difficulty is that section 392 does NOT address installation of single conductor cables smaller than #1/0AWG in cable trays, suggesting that it is not permitted. Similarly, the TC ratings in the standards are not available for single conductor cables smaller than #1/0AWG. Using this line of reasoning, AHJs sometimes reject installing these cables in cable trays. On the other hand, the NEC permits the use of USE-2 or PV wire in PV systems (exposed, outdoor environments 690.31(B)) because these cables are designed for outdoor use. Furthermore, the support requirements for USE cables in exterior locations is only every 4.5 feet as defined in 334.30, which is referenced by 338.10(B)(4)(b). All cable tray designs are superior to both of these conditions in that they provide protection from physical damage for these cables and the maximum support spans are much less than 4.5 feet. As a result, AHJs often approve the use of cable trays in this application. As a PV System design, this uncertainty and contradiction in the NEC adds unnecessary complexity to the design process. Thus, we ask that the CMP revise 690 to resolve this contradiction.
From an engineering standpoint, we learned from conversations with UL representatives that the #1/0 AWG single conductor restriction was imposed long before our application was envisioned. Additionally, the TC rating deals

with spread of flame prevention, which is required for applications inside of buildings. Since the PV Wire standard already includes a flame resistance test, the TC rating adds no value for ground mount PV systems. The TC spread of flame test was designed to prevent cable trays that pass through firewalls from allowing a fire to breech the firewall. Clearly, this requirement is not needed for ground mount PV systems. By eliminating the TC requirement for ground mounted PV systems, it would allow PV Wire cables smaller than #1/0 AWG, which are outside of the scope of the TC standard, to be installed in cable trays. Lastly, ladder style cable trays have rung spacings ranging from 6” to 18”, with spacings between 6” and 12” typically being used for PV systems. Thus, the support provided to the cables in a cable tray is vastly superior to the requirements stipulated in 334.30.

Panel Meeting Action: Accept in Principle

Panel Statement: See panel action and statement on Comment 4-136, which addresses the concerns of the submitter.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13 Negative: 1

Explanation of Negative:

ALLISON, M.: CMP-4’s changes to the proposed language would allow non-CT rated conductors on buildings, which was not the intent of the submitter.

4-136 Log #1511 NEC-P04 **Final Action: Accept in Principle in Part**
(690.31(C)(1))

TCC Action: The Correlating Committee directs that second level subdivision titles be added as follows:
(C)(1) General
(C)(2) Cable Tray
The Correlating Committee directs that the Informational Note be revised to comply with the NEC Style Manual as follows: “Informational Note: Photovoltaic (PV) wire and photovoltaic (PV) cable have a nonstandard outer diameter. See Table 1 of Chapter 9 for conduit fill calculations.”

Submitter: Mark Albers, SunPower Corp.

Comment on Proposal No: 4-290

Recommendation: **Proposed Text *(Modified from Proposal 4-290)*:**

PV source circuits and PV output circuits using single-conductor cable listed and labeled as PV wire of all sizes with or without a Cable Tray marking/rating shall be permitted in cable trays provided the cables are supported at intervals not to exceed 12 in and the cable trays are not on or penetrating a building. PV systems using cable trays on buildings must comply with 392.

Substantiation: I support the comment submitted by the PV Industry Forum. However, since this comment was submitted, a concern was raised that the requirement should be more self-sufficient and not reference Article 338 because it is defining a requirement unique to PV Systems. Consequently, I replaced the reference to 338.10(B)(4)(b) with a
requirement that the cables be supported every 12”. This maximum span is significantly smaller than the 4.5’ required in 338. It is also the largest support span typically used for cable trays currently designed into ground mounted PV systems. Since the insulation used in PV Wire cables is more robust than USE cables, it is very capable of safely spanning 12”.

I have also replaced the reference to CT with Cable Tray as the markings used for cables with the optional designation for use in Cable Trays have many different forms, CT being one of them. The term Cable Tray marking/rating will encompass all of the optional designations that might otherwise be required. As additional supporting documentation, the attached document prepared by Christel Hunter, Engineering Manager at General Cable, summarizes the additional testing required for the optional Cable Tray designations. Clearly, the designation in these two standards only requires the addition of a vertical tray flame test. As stated in the PV Industry Forum Comment Substantiation, this capability is intended to prevent the spread of fire in an indoor application and was not intended to be applied to an outdoor application. Thus, the Cable Tray rating is not necessary for a ground mounted PV system.

Panel Meeting Action: Accept in Principle in Part

The panel rejects the proposed wording “and the cable trays are not on or penetrating a building. PV systems using cable trays on buildings must comply with 392.”

Revise 690.31(C) to read as follows:

(C) Single-Conductor Cable.

(1) Single-conductor cable type USE-2, and single-conductor cable listed and labeled as photovoltaic (PV) wire shall be permitted in exposed outdoor locations in PV source circuits for PV module interconnections within the PV array.

Exception: Raceways shall be used when required by 690.31(A).

(2) PV source circuits and PV output circuits using single-conductor cable listed and labeled as Photovoltaic (PV) wire of all sizes with or without a Cable Tray marking/rating shall be permitted in cable trays installed in outdoor locations provided the cables are supported at intervals not to exceed 30cm (12 in.) and secured at intervals not to exceed 1.4m (4.5’).

Informational Note: Photovoltaic (PV) wire [also photovoltaic (PV) cable] has a nonstandard outer diameter. Conduit fill may be calculated using Table 1 of Chapter 9.

Panel Statement: The panel rejects the proposed wording “and the cable trays are not on or penetrating a building. PV systems using cable trays on buildings must comply with 392.” Outdoor locations is used for clarity and the reference to Article 392 is redundant. The panel acknowledges that PV circuits are allowed in cable trays inside a building but they must meet other applicable code requirements.

The secure interval meets the requirement of 338.10(B)(4)(b) and the support interval exceeds the requirement of 338.10(B)(4)(b).

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13 Negative: 1

Explanation of Negative:

ALLISON, M.: CMP-4’s changes to the proposed language would allow non-CT rated conductors on buildings, which was not the intent of the submitter.

Comment on Affirmative:

BOWER, W.: This panel member noticed two places for editorial changes in this comment. The term Photovoltiac (PV) wire capitalizes Photovoltaic because it is a wire designation. Please change photovoltaic (PV) wire in (C)(1) to Photovoltaic wire. The designation for 4.5 feet should be (4.5 ft) not (4.5’). The informational note also does not capitalize photovoltaic and it should be changed to Photovoltaic.

The panel statement is confusing where it says the support interval exceeds the requirement of 338.10(B)(4)(b). The statement could mean the support is better than required or is out of compliance. It would be better if stated “the support interval exceeds meets the requirement of 338.10(B)(4)(b).” (These are an editorial changes only)

4-137 Log #1171 NEC-P04 **Final Action: Reject**
(690.31(E))

Submitter: Greg Pitz, Logos Solar

Comment on Proposal No: 4-296

Recommendation: Revise text to read as follows:

Marking or Labeling Required. The following wiring methods and enclosures that contain PV power source conductors shall be marked with the wording “WARNING: PHOTOVOLTAIC POWER SOURCE” by means of permanently affixed labels or other approved permanent marking:

(1) Exposed raceways, cable trays, and other wiring methods

(2) Covers or enclosures of pull boxes and junction boxes

(3) Conduit bodies in which any of the available conduit openings are unused

(4) Marking and Labeling Methods and Locations. The labels or markings shall be visible after installation. The labels shall be reflective, shall have all letters capitalized with a minimum height of 9.5 mm (3/8 inch) ~~white~~ black on ~~red~~ orange background. Photovoltaic power circuit labels shall appear on every section of the wiring system that is separated by enclosures, walls, partitions, ceilings, or floors. Spacing between labels or markings, or between a label and a marking, shall not be more than 3 m (10 ft). Labels required by this section shall be suitable for the environment ~~where~~ in which they are installed.

Substantiation: This Comment is to make the Proposal consistent with United States standards (ANSI standards Z35.1-1968, Z53.1-1967, Z535.2, Z535.1-6), international standards (ISO 3864 & 7010:2011), and to make it legal in the USA (OSHA federal laws, 29 CFR 1910.144 & 1910.145).

ANSI is the standards organization in the USA. The ANSI committee on Safety Signs and Colors has been keeping signage in the USA in agreement with the rest of the world since 1998. OSHA regulations are usually closely linked to ANSI standards. The IFC recently adopted the standard mentioned in the proposal, which, unfortunately, was done before checking other existing standards & laws. Attempts are being made to change said IFC standard so that it is in agreement with the standards & federal laws quoted above.

OHSA does not recognize the use of the word ″label″, formally defining all means of notification as ″signs″. ANSI & OSHA explicitly tell us that warning signs are to have black letters & symbols on orange background.

References, including OSHA interpretations of their standards, available upon request.

″Where″ vs ″in which″: The former doesn′t precisely define which environment. Indoor? Outdoor? The site environment?

This comment is also to coordinate with accepted proposal 1-114 Log #847, article 110.21(A) and (B)), markings.

Panel Meeting Action: Reject

Panel Statement: See panel action and statement on Comment 4-133.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-138 Log #1291 NEC-P04 **Final Action: Reject**
(690.31(E))

Submitter: Fred Kracke, Schneider Electric - Solar Business

Comment on Proposal No: 4-296

Recommendation: Revise text to read as follows:

(3) Marking or Labeling Required. The following wiring methods and enclosures that contain PV power source conductors shall be marked with the wording “Photovoltaic Power Source WARNING: PHOTOVOLTAIC POWER SOURCE” by means of permanently affixed labels or other approved permanent marking:

(1) Exposed raceways, cable trays, and other wiring methods

(2) Covers or enclosures of pull boxes and junction boxes

(3) Conduit bodies in which any of the available conduit openings are unused

(4) Marking and Labeling Methods and Locations. The labels or markings shall be visible after installation. ~~The labels shall be reflective, shall have all letters capitalized with a minimum height of 9.5 mm (3/8 inch) white on red background.~~ Photovoltaic power circuit labels shall appear on every section of the wiring system that is separated by enclosures, walls, partitions, ceilings, or floors. Spacing between labels or markings, or between a label and a marking, shall not be more than 3 m (10 ft). Labels required by this section shall be suitable for the environment where they are installed.

Substantiation: ROP 1-114 provides marking requirements and includes reference to ANSI Z535, and applies in general, so Art. 690 should not include the content removed above, relating to colors, letter height, etc.

Panel Meeting Action: Reject

Panel Statement: Removing the description and size of characters is contradictory to 2012 IFC and NFPA 1, *Fire Code*, requirements.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-139 Log #1287 NEC-P04 **Final Action: Accept in Principle in Part**
(690.35)

Submitter: Jim Eichner, Schneider Electric - Solar Business

Comment on Proposal No: 4-302

Recommendation: Revise text to read as follows:

Original ROP 4-302 was as follows:

690.35 C) Ground Fault Protection: All photovoltaic source and output circuits shall be provided with a ground-fault protection device or system that complies with (1) through(4) ~~(3)~~:

(1) <u>Determine the pv input circuit has a minimum acceptable level of isolation prior to export of current,</u>

(2) ~~Detects a ground fault.~~ Detect ground fault(s).

<u>(3)</u> Indicates that a ground fault has occurred

<u>(4)</u> Automatically disconnects all conductors or causes the inverter or charge controller connected to the faulted circuit to automatically cease supplying power to output circuits.

Schneider Electric supports improved GFP and suggests the following improvements to the above proposal (strike-through and underline in the following are relative to the above original proposal):

690.35 C) Ground Fault Protection: All photovoltaic source and output circuits shall be provided with a ground-fault protection device or system that <u>shall</u>: ~~complies with (1) through (4):~~

(1) determine the ~~pv input circuit~~ <u>Photovoltaic Power Source</u> has ~~a minimum acceptable level of~~ isolation <u>from ground</u> prior to export of current,

(2) detect ground fault(s).

(3) ~~Indicates that a ground fault has occurred~~ <u>have an annunciator that provides both a visual or audible indication, and an indication capable of being remotely monitored, that the ground fault protection system has operated</u>

(4) Automatically disconnects all conductors <u>of the faulted circuit</u> or causes the inverter or charge controller connected to the faulted circuit to automatically cease supplying power to output circuits, <u>and</u>

<u>5) be approved for the purpose.</u>

We feel these changes make the proposal more accurate and clear.

Substantiation: The proposal as originally submitted is not as clear as it could be, uses a term that is not defined, could be interpreted as disallowing a commonly accepted method, and does not require approved device or system.

Substantiation:

1. "a minimum acceptable level of" is deleted as per the Panel Statement in the ROP
2. "pv input circuit" is not a defined term - the intent of the requirement is to check the whole array - i.e. the "Photovoltaic Power Source" which is the defined NEC term.
3. "from ground" is added to make it clear what the isolation is with respect to (as opposed to isolation from the AC part of the system, or from other circuits, etc.)
4. in sub-section (3) we propose requiring additional annunciation that is able to be monitored remotely, since a local visual or audible annunciator is useless if the PV plant is 100 miles from the nearest person or on a rooftop that rarely gets accessed
5. in sub-section (4) we propose adding "of the faulted circuit" because it is not necessary to disconnect the entire array if the fault can be localized; we believe this to have been the intent of the existing requirement, but grammatically this change is needed to make that intent clear.
6. sub-section 5) "be approved for the purpose" is added because the proposal contains no values for the required isolation or ground fault detection levels and therefore the equipment standards (UL1741) must be used to determine if the system addresses the requirement properly.
7. to address grammatical problems, the opening sentence is revised to end in "shall", and the word "and" is added between items 4 and 5

Panel Meeting Action: Accept in Principle in Part

Panel Statement: See panel action on Comment 4-141.
The panel rejects the changes in 3). Specific product requirements and the remote monitoring and annunciator belong in the product standard.

The correct section reference is 690.35(C).

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-140 Log #1076 NEC-P04 **Final Action: Accept in Principle**
(690.35(C))

Submitter: John C. Wiles, Southwest Technology Development Institute, New Mexico State University

Comment on Proposal No: 4-302

Recommendation: Revise the text from proposal 4-302 as follows:

(C) Ground-Fault Protection. All photovoltaic source and output circuits shall be provided with a ground-fault protection device or system that complies with (1) through (4):

~~(1) Determine the pv input circuit has isolation prior to export of current~~

(1) ~~(2)~~ Detect<u>s</u> ground fault(s) <u>in the PV array dc current carrying conductors and components</u>

(2) ~~(3)~~ Indicates that a ground fault has occurred

(3) ~~(4)~~ Automatically disconnects all conductors or causes the inverter or charge controller connected to the faulted circuit to automatically cease supplying power to output circuits, and

<u>(4) Be listed for providing PV ground fault protection</u>**.**

Substantiation: Inadequate ground fault protection has caused several fires in PV systems over the last half decade. Clearly ground fault protection (GFP) capabilities need to be improved in new PV systems. As result, we applaud and support the Code Making Panel in addressing this important issue. However, the newly proposed 2014 language does raise very serious concerns. It requires the use of insulation resistance measurements in all systems at some unknown frequency. The statement of "… prior to the export of current" is not enforceable because it is unclear how frequently this test would have to be performed. It could be interpreted to be: 1) before the system is turned on for the first time; 2) every night; or 3) every time the inverter starts up. Furthermore, the new language could be interpreted to mean that the system needs to test for a ground fault <u>only</u> at this undefined time, leaving the system free to operate with a ground fault in between tests.
Additionally, insulation resistance measurements are not universally effective and will not be the best GFP for all PV system designs. Moreover, as new technologies come to market, GFP methods superior to insulation resistance measurements may emerge. We want the 2014 NEC to address the inadequacies of present GFP once and for all and not legislate the use of a specific solution. Additionally, we propose to add a requirement that the GFP be listed for protection PV systems. This will allow the inspector to rely upon the listing to verify the functionality of this extremely important protection system, which will improve the enforceability of the GFP requirements. For these reasons, we request that you adapt 690.35(C) to read as modified above. This will stimulate UL 1741 to be updated to reflect the needs for improved GFP in PV systems and to ensure that the new functional requirements are met without requiring a specific implementation/solution.

Panel Meeting Action: Accept in Principle

Panel Statement: See panel action on Comment 4-141 which addresses the concerns of the submitter.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-141 Log #1492 NEC-P04 **Final Action: Accept**
(690.35(C))

Submitter: John Smirnow, Solar Energy Industries Association

Comment on Proposal No: 4-302

Recommendation: Revise text to read as follows:

(C) Ground-Fault Protection. All photovoltaic source and output circuits shall be provided with a ground-fault protection device or system that complies with (1) through (4):

~~(1) Determine the pv input circuit has isolation prior to export of current~~

(1)~~(2)~~ Detect<u>s</u> ground fault(s) <u>in the PV array dc current carrying conductors and components</u>

(2)~~(3)~~ Indicates that a ground fault has occurred

(3)~~(4)~~ Automatically disconnects all conductors or causes the inverter or charge controller connected to the faulted circuit to automatically cease supplying power to output circuits, and

<u>(4) Be listed for providing PV ground fault protection</u>**.**

Substantiation: This comment is the result of a consensus process established among two groups of stakeholders: 1) the SEIA Codes and Standards Working Group, and 2) the PV Industry Forum. Participants in these groups included the following individuals:

SEIA Codes and Standards Working Group

1. Mark Albers, SunPower
2. Mark Baldassari, Enphase Energy
3. Ward Bower, SEIA
4. Bill Brooks, Brooks Engineering/SEIA
5. Joe Cain, Chair of SEIA Codes and Standards Working Group
6. Keith Davidson, SunTech
7. Darrel Higgs, Dow Solar
8. Lee Kraemer, First Solar
9. Carl Lenox, SunPower
10. Charles Luebke, Eaton
11. Martin Mesmer, E.ON
12. Steve Pisklak, Dow Solar

13. Robert Rynar, First Solar
14. Michael Schenck, First Solar
15. John Smirnow, SEIA
16. Kris VanDerzee, First Solar
17. Leo Wu, SolarCity
18. Tilak Gopalarathnam, REFUsol Incorporated

PV Industry Forum

1. Greg Ball, BEW Engineering
2. Rob Rynar, First Solar
3. Tilak Gopalarathnam, REFUsol Incorporated
4. Mark Albers, SunPower Corporation
5. Tim Zgonena, UL

Inadequate ground fault protection has caused several fires in PV systems over the last half decade. Clearly ground fault protection (GFP) capabilities need to be improved in new PV systems. As result, we applaud and support the Code Making Panel in addressing this important issue. However, the newly proposed 2014 language does raise very serious concerns. It requires the use of insulation resistance measurements in all systems at some unknown frequency. The statement of "… prior to the export of current" is not enforceable because it is unclear how frequently this test would have to be performed. It could be interpreted to be: 1) before the system is turned on for the first time; 2) every night; or 3) every time the inverter starts up. Furthermore, the new language could be interpreted to mean that the system needs to test for a ground fault only at this undefined time, leaving the system free to operate with a ground fault in between tests.

Additionally, insulation resistance measurements are not universally effective and will not be the best GFP for all PV system designs. Moreover, as new technologies come to market, GFP methods superior to insulation resistance measurements may emerge. We want the 2014 NEC to address the inadequacies of present GFP once and for all and not legislate the use of a specific solution. Additionally, we propose to add a requirement that the GFP be listed for protection PV systems. This will allow the inspector to rely upon the listing to verify the functionality of this extremely important protection system, which will improve the enforceability of the GFP requirements. For these reasons, we request that you adapt 690.35(C) to read as modified above. This will stimulate UL 1741 to be updated to reflect the needs for improved GFP in PV systems and to ensure that the new functional requirements are met without requiring a specific implementation/solution.

Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14
Comment on Affirmative:
BOWER, W.: The term photovoltaic should be PV. (This is an editorial change only)

4-142 Log #1081 NEC-P04 **Final Action: Accept in Principle**
(690.35(D))

TCC Action: The Correlating Committee directs that the Panel Action on this Comment be reported as "Accept in Principle" and in addition to the revisions accepted by the Panel, revise 690.35(D)(1) as accepted in Proposal 4-305a to read as follows: "(1) Metallic or nonmetallic jacketed multiconductor cables,"
The Correlating Committee notes that the reference to Proposal 4-403 on this comment is incorrect as that proposal deals with Section 705.12(D)(7). The proper reference is Proposal 4-303.
Submitter: John C. Wiles, Southwest Technology Development Institute, New Mexico State University
Comment on Proposal No: 4-403
Recommendation: Revise 690.35(D) as follows adding an additional item.
690.35(D) The photovoltaic source conductors shall consist of the following:
(1) Nonmetallic jacketed multiconductor cables
(2) Conductors installed in raceways~~, or~~
(3) Conductors listed and identified as Photovoltaic (PV) Wire installed as exposed, single conductors, or
(4) Direct-buried conductors Conductors that are direct-buried and identified for direct-burial use.
Substantiation: Clarifies intent and language of previously rejected proposal. It is believed that the proposal was originally rejected because the language was incomplete and could be interpreted to allow use of direct-burial conductors anywhere in the PV system. The revised language clarifies that PV source conductors can be direct-buried underground as long as the conductors are identified for such use. "Direct-buried" means physically installed underground, not listed for direct burial. The language is consistent with other parts of the code.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14
Comment on Affirmative:
BOWER, W.: The article still needs a title. This panel member suggests PV Source Conductors. The language should read "The photovoltaic PV source conductors shall consist of one or more of the following: The accepted material uses the term "or" in the list (1) through (4) an inconsistent manner. By adding "one or more of" in the stem the use of the term "or" can be dropped in the list (1) through (4). (This is an editorial change and suggests the title addition)

4-143 Log #75 NEC-P04 **Final Action: Accept**
(690.35(D)(1))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-305a
Recommendation: The Correlating Committee directs that appropriate first level subdivision titles be added throughout 690.35. See 2.1.5.2 of the NEC Style Manual.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Add the following titles to 690.35(D), (E), (F), and (G).
(D) Conductors. The photovoltaic source conductors...".
(E) Battery Systems. The photovoltaic power system direct-current circuits...".
(F) Marking. The photovoltaic power source...".
(G) Equipment. The inverters or charge controllers...".
Panel Statement: The panel accepts the recommendation of the Correlating Committee to add titles to the sections.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-144 Log #76 NEC-P04 **Final Action: Accept**
(690.41)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-307
Recommendation: The Correlating Committee directs that the panel rewrite this section as multiple sentences for clarity.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the recommendation of the Correlating Committee. The recommendation was accomplished by the panel action taken on Comment 4-147.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-145 Log #1077 NEC-P04 **Final Action: Accept in Principle**
(690.41)

Submitter: John C. Wiles, Southwest Technology Development Institute, New Mexico State University
Comment on Proposal No: 4-307
Recommendation: Replace the text of 4-307 with the modified text as shown:
690.41 System Grounding. ~~For a photovoltaic power source, systems shall comply with 690.35, or one conductor of a 2-wire system with a photovoltaic system voltage over 50 volts, but not greater than 300 volts, and the reference (center tap) conductor of a bipolar system shall be solidly grounded or shall use other methods that accomplish equivalent system protection in accordance with 250.4(A) and that utilize equipment listed and identified for the use.~~ **[ROP 4–307]**
690.41 System Grounding. Photovoltaic systems shall comply with one of the following:
(1) Ungrounded systems shall comply with 690.35 or
(2) Grounded 2-wire systems shall have one conductor grounded or be impedance grounded, and the system shall comply with 690.5 or
(3) Grounded bipolar systems shall have the reference (center tap) conductor grounded or be impedance grounded, and the system shall comply with 690.5 or
(4) Use other methods that accomplish equivalent system protection in accordance with 250.4 (A) with equipment listed and identified for the use.
Substantiation: The reformatting as a numbered list is in response to the TCC request.
Sentence structure was modified to create parallel construction per the NEC Style Manual.
Restricting PV systems operating over 300 volts to have only ungrounded PV arrays is unnecessary for improved safety and imposes severe constraints on the design and development of future (demand response, intelligent) PV systems where other renewable resources will be interacting with PV. The US has successfully and safely operated grounded electrical systems at 600 volts and higher for more than a century. Safety issues in grounded PV systems are being addressed in both the UL Standards and in other sections of the NEC. This restriction, if instituted, would prevent the use of one of the more widely installed, highest efficiency PV modules in the world. Both small residential and large commercial installations would be impacted with no improvements in safety. Technology versus Safety would likely be compromised because additional less-efficient modules would have to be installed decreasing safety (both roof and electrical) and system reliability could be compromised.
The reference to "over 50" volts has been deleted since the list now includes all types of systems at any voltage.
Removing the "solidly" requirement makes the Code language consistent with

the PV inverters and other equipment that is manufactured and listed to UL Standards where an overcurrent device is allowed to make the dc grounding bonding jumper as a part of the NEC required ground fault protection device. Adding the allowance for impedance grounding and the reference the 690.5 adds clarity when grounded 2-wire and bipolar PV systems are installed.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and statement on Comment 4-147, which addresses the concerns of the submitter.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-146 Log #1290 NEC-P04 **Final Action: Reject**
(690.41)

Submitter: Fred Kracke, Schneider Electric - Solar Business
Comment on Proposal No: 4-307
Recommendation: Proposal 4-307 should be rejected for the reasons below.
Substantiation: Schneider Electric recommends rejecting this proposal and keeping the existing 690.41 from the 2011 NEC.

Substantiation: This proposal is intended to reduce fire hazards from grounded arrays, under the assumption that floating arrays are less prone to fire hazard than grounded systems. However actions by the code panel in the 2014 ROP will significantly improve ground fault protection for grounded systems, and we have already added arc fault protection in the 2011 NEC but it is just beginning to be implemented. Those improvements will accomplish more in reduction of the fire hazard than limiting the DC voltage to 300V for grounded systems, and should be allowed to be implemented for some period of time before considering further actions as impactful as the banning of grounded systems in this proposal. Grounded systems, if properly protected, have some benefits such as reduced occurrence of Potential Induced Degradation (PID) that affects module performance and lifetime, and should not be banned outright.
Panel Meeting Action: Reject
Panel Statement: See panel action and statement on Comment 4-147. The submitter's substantiation concerns are addressed by the panel action taken on Comment 4-147.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-147 Log #1493 NEC-P04 **Final Action: Accept in Principle**
(690.41)

TCC Action: The Correlating Committee directs that the text be editorially revised to be consistent with the introductory text as follows: "(4) Other methods that accomplish equivalent system protection in accordance with 250.4(A) with equipment listed and identified for the use".
Submitter: John Smirnow, Solar Energy Industries Association
Comment on Proposal No: 4-307
Recommendation: Revise text to read as follows:

690.41 System Grounding. ~~For a photovoltaic power source, systems shall comply with 690.35, or one conductor of a 2-wire system with a photovoltaic system voltage over 50 volts, but not greater than 300 volts, and the reference (center tap) conductor of a bipolar system shall be solidly grounded or shall use other methods that accomplish equivalent system protection in accordance with 250.4(A) and that utilize equipment listed and identified for the use.~~ **[ROP 4–307]**

690.41 System Grounding. <u>Photovoltaic systems shall comply with one of the following:</u>
(1) <u>Ungrounded systems shall comply with 690.35 or</u>
(2) <u>Grounded 2-wire systems shall have one conductor grounded or be impedance grounded, and the system shall comply with 690.5 or</u>
(3) <u>Grounded bipolar systems shall have the reference (center tap) conductor grounded or be impedance grounded, and the system shall comply with 690.5 or</u>
<u>(4) Use other methods that accomplish equivalent system protection in accordance with 250.4 (A) with equipment listed and identified for the use.</u>
Substantiation: This comment is the result of a consensus process established among two groups of stakeholders: 1) the SEIA Codes and Standards Working Group, and 2) the PV Industry Forum. Participants in these groups included the following individuals:

SEIA Codes and Standards Working Group
1. Mark Albers, SunPower
2. Mark Baldassari, Enphase Energy
3. Ward Bower, SEIA
4. Bill Brooks, Brooks Engineering/SEIA
5. Joe Cain, Chair of SEIA Codes and Standards Working Group
6. Keith Davidson, SunTech
7. Darrel Higgs, Dow Solar
8. Lee Kraemer, First Solar
9. Carl Lenox, SunPower
10. Charles Luebke, Eaton
11. Martin Mesmer, E.ON
12. Steve Pisklak, Dow Solar
13. Robert Rynar, First Solar
14. Michael Schenck, First Solar
15. John Smirnow, SEIA
16. Kris VanDerzee, First Solar
17. Leo Wu, SolarCity
18. Tilak Gopalarathnam, REFUsol Incorporated

PV Industry Forum
1. Greg Ball, BEW Engineering
2. Robert Rynar, First Solar
3. Bill Brooks, Brooks Engineering
4. Jim Rogers, Town of Oak Bluffs
5. Eric Seymour, Advanced Energy Industries
6. John Smirnow, SEIA
7. Keith Davidson, Suntech Power
8. Mark Albers, SunPower Corporation
9. Marv Dargatz, SolarEdge
10. Phil Undercuffler, Outback Power
11. Lee Kraemer, First Solar Robert Rynar, First Solar
12. Michael Schenck, First Solar

The reformatting as a numbered list is in response to the TCC request.

Sentence structure was modified to create parallel construction per the NEC Style Manual.

Restricting PV systems operating over 300 volts to have only ungrounded PV arrays is unnecessary for improved safety and imposes severe constraints on the design and development of future (demand response, intelligent) PV systems where other renewable resources will be interacting with PV. The US has successfully and safely operated grounded electrical systems at 600 volts and higher for more than a century. Safety issues in grounded PV systems are being addressed in both the UL Standards and in other sections of the NEC.

This restriction, if instituted, would prevent the use of one of the more widely installed, highest efficiency PV modules in the world. Both small residential and large commercial installations would be impacted with no improvements in safety. Technology versus Safety would likely be compromised because additional less-efficient modules would have to be installed decreasing safety (both roof and electrical) and system reliability could be compromised.

The reference to "over 50" volts has been deleted since the list now includes all types of systems at any voltage.

Removing the "solidly" requirement makes the Code language consistent with the PV inverters and other equipment that is manufactured and listed to UL Standards where an overcurrent device is allowed to make the dc grounding bonding jumper as a part of the NEC required ground fault protection device.

Adding the allowance for impedance grounding and the reference the 690.5 adds clarity when grounded 2-wire and bipolar PV systems are installed.
Panel Meeting Action: Accept in Principle
Revise 690.41 to read as follows:

690.41 System Grounding. Photovoltaic systems shall comply with one of the following:
(1) Ungrounded systems shall comply with 690.35
(2) Grounded 2-wire systems shall have one conductor grounded or be impedance grounded, and the system shall comply with 690.5
(3) Grounded bipolar systems shall have the reference (center tap) conductor grounded or be impedance grounded, and the system shall comply with 690.5
(4) Use other methods that accomplish equivalent system protection in accordance with 250.4 (A) with equipment listed and identified for the use.
Panel Statement: The panel removed the word "or" from the items in the list.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14
Comment on Affirmative:

BOWER, W.: Item (4) of the list is somewhat awkward. The term "Use" to begin the sentence that ends with identified for the use is superfluous and should be deleted. The item should read "(4) Use Other methods that accomplish equivalent system protection in accordance with 250.4 (A) with equipment listed and identified for the use." (This is an editorial change only)

4-148 Log #899 NEC-P04 **Final Action: Reject**
(690.43(E))

Submitter: Paul Kovalov, Burndy LLC
Comment on Proposal No: 4-308
Recommendation: Revise text to read as follows:

690.43 (E) Adjacent Modules. Devices identified and listed for bonding the metallic frames of PV modules shall be permitted to bond the exposed metallic frames of PV modules to the metallic frames of adjacent PV modules<u>, only when such PV modules are listed and identified for the purpose of grounding and bonding</u>.
Substantiation: The joints connecting each separate section of a PV module frame, and the frame as a whole, are not tested or listed as bonding/grounding devices. The joints are evaluated for continuity within the frame so that a connection to the Equipment Grounding Conductor (EGC) can be made on only one (of the typically 4) sections of the PV module frame. By bonding the frames of adjacent PV module together, without bonding them to a continuous conductor, a device not listed for grounding the metallic frames of PV modules (the connection at the corners of each frame) is introduced into the ground path. The requirements for electrical bonds within a module frame are different from the requirements for bonding and grounding devices used for connection to the EGC.

Panel Meeting Action: Reject
Panel Statement: This comment does not comply with Section 4.4.5(b) of the NFPA Regulations Governing Committee Projects in that it does not identify the document, proposal number to which the comment is directed, and paragraph of the document to which the comment is directed.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-149 Log #1234 NEC-P04 **Final Action: Accept in Principle**
(690.45)

Submitter: Richard E. Loyd, Sun Lakes, AZ
Comment on Proposal No: 4-308a
Recommendation: Revise text to read as follows:
690.45 Size of Equipment Grounding Conductors. Equipment Grounding conductors for PV source and PV output circuits shall be sized in accordance with ~~Table 250.122~~ Part IVArticle 250. Where no overcurrent protective device is used in the circuit, an assumed overcurrent device rated at the PV maximum circuit current shall be used to determine the size of wire type equipment grounding conductor in Table 250.122.
Increases in equipment grounding conductor size to address voltage drop considerations shall not be required. An equipment grounding conductor shall not be smaller than 14 AWG.
Substantiation: There is some who interpret the present language to limit equipment grounding to only wire types. This change will clarify that any suitable equipment grounding conductors listed in Section 250.118 are acceptable.
Panel Meeting Action: Accept in Principle
Revise text to read as follows:
690.45 Size of Equipment Grounding Conductors. Equipment Grounding conductors for PV source and PV output circuits shall be sized in accordance with ~~Table~~ 250.122. Where no overcurrent protective device is used in the circuit, an assumed overcurrent device rated at the PV maximum circuit current shall be used when applying Table 250.122.
Increases in equipment grounding conductor size to address voltage drop considerations shall not be required. An equipment grounding conductor shall not be smaller than 14 AWG.
Panel Statement: The panel accept the concept and corrects the reference to Part IV Article 250 to 250.122. The change to "when applying" simplifies the reference to Table 250.122.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-150 Log #77 NEC-P04 **Final Action: Accept**
(690.46)

TCC Action: The Correlating Committee directs that the text be revised for clarity and conformance with the NEC Style Manual as follows: "For PV modules, equipment grounding conductors smaller than 6 AWG shall comply with 250.120(C)".
Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-309
Recommendation: The Correlating Committee directs that this proposal be reconsidered and the use of the term "solid" be clarified with respect to the use of equipment grounding conductors and grounding electrode conductors.
The Correlating Committee further directs that this proposal be clarified with respect to the use of the phrase "of 6 AWG and smaller", as it applies to equipment grounding conductors and grounding electrode conductors.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise proposed 690.46 text to read as follows.
690.46 Array Equipment Grounding Conductors. Equipment grounding conductors for PV modules smaller than 6 AWG shall comply with 250.120(C). Where installed in raceways, equipment grounding and grounding electrode conductors not larger than 6 AWG shall be permitted to be solid.
Panel Statement: The panel accepts the recommendation of the Correlating Committee. The language was changed for clarity.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14
Comment on Affirmative:
BOWER, W.: The new sentence structure is still awkward. It now reads "Equipment grounding conductors for PV modules smaller than 6 AWG shall comply with 250.120(C). The PV modules are not smaller than 6 AWG. In order to clarify the sentence it is recommended that it read "Equipment grounding conductors for PV modules sized smaller than 6 AWG that are used on PV modules shall comply with 250.120(C). (This is an editorial change only)

4-151 Log #78 NEC-P04 **Final Action: Accept in Principle**
(690.47(B), 690.47(C)(3))

TCC Action: The Correlating Committee understands that the only revision is to add a new sentence to to the end of 2011 text of 690.47(C)(3).
Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-310a
Recommendation: The Correlating Committee directs that Panel 4 clarify the panel action on this proposal by adding the word "for" to the final phrase of the text appended to 690.47(B) as follows: "…and for the ground-fault detection reference for ungrounded PV systems".
The Correlating Committee also directs that Panel 4 clarify the term "combined bonding grounding conductor" in the proposed revised text for 690.47(C)(3).
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept in Principle
Add the following sentence to the end of existing 2011 text of 690.47(C)(3):
For ungrounded systems, this conductor shall be sized in accordance with 250.122 and shall not be required to be larger than the largest ungrounded phase conductor.
Panel Statement: The panel revises Proposal 4-310a to remove the objectionable language as recommended by the Correlating Committee and CMP 5. A new sentence is added to the end of existing 690.47(C)(3) to acknowledge the use of an equipment grounding conductor for ground fault sensing on ungrounded systems.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-152 Log #277 NEC-P04 **Final Action: Accept in Principle**
(690.47(B) and 690.47(C)(3))

Submitter: Code-Making Panel 5,
Comment on Proposal No: 4-310a
Recommendation: Code-Making Panel 5 recommends rejecting this proposal.
Substantiation: The proposed language is unclear and uses undefined terms such as "equipment grounding system" and "grounding bonding conductor." It is also unclear if the proposed language modifies or enhances existing requirements in Article 250. For example, the proposal seems to restate the requirement in Article 250 that only one grounding electrode system is permitted for all of the wiring systems installed in a building or structure.
This comment was developed by a CMP-5 Task Group and balloted through the entire panel with the following ballot results:
16 Eligible to Vote
15 Affirmative
1 Ballot Note Returned (W.J. Helfrich)
The following AFFIRMATIVE comments on vote were received:
T.N. BOWMER: I agree with CMP-5's recommendation to Reject the proposal and the CMP-5 statement. The current language in 690.47(B) and 640.47(C)(3) are sufficiently clear.
P. SIMMONS: This proposal is an example of the provisions stated in 90.3 in that general grounding and bonding requirements reside in Article 250 and amendments or modification of the general rules can be made in Article 690. Minor editorial corrections can be made to make this proposal acceptable. The TCC made a required change to 690.47(B). While it is better for Code Panels to use defined terms, it is most important that the rule is clear. If CMP-4 feels the rule is important to Solar PV systems, it is suggested it be revised as follows:
690.47(C)(3) Combined Direct-Current Grounding Electrode Conductor, PV Bonding Jumper,
and Alternating-Current Equipment Grounding Conductor.
A combined dc grounding electrode conductor, PV bonding jumper, and ac equipment grounding
conductor shall comply with all the following:
1. Be unspliced or spliced in accordance with applicable requirements of 250.64(C)
2. Be connected to the connection points for the dc grounding electrode conductor or PV bonding jumper
3. Be routed with the ac circuit conductors
4. Be connected to the terminal bar for the grounded conductor or equipment grounding conductor terminal bar located in the service equipment or in the first disconnecting means for a separately derived system
5. Be the larger of the sizes specified by 250.122 based on the rating of the inverter output circuit overcurrent device or in 250.168 or 250.166
6. Be installed in accordance with 250.64(E) if applicable
Panel Meeting Action: Accept in Principle
Panel Statement: CMP 4 acknowledges the concerns expressed by CMP 5 and the Correlating Committee. As a result, CMP 4 acts on Comment 4-151 and retains only language that is necessary to facilitate ground fault detection on ungrounded systems. The remainder of Proposal 4-310a is rejected.
See panel action and statement on Comment 4-151 which addresses the concerns of the submitter.
Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-153 Log #79 NEC-P04 **Final Action: Accept in Principle**
(690.47(C)(2))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-312
Recommendation: The Correlating Committee directs that this proposal be clarified by adding "by a" before "connector listed for grounding and bonding" as an editorial correction.
This action will be considered a public comment.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept in Principle
Panel Statement: The panel accepts the intent of the Correlating Committee. See panel action on Comment 4-154.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-154 Log #530 NEC-P04 **Final Action: Accept**
(690.47(C)(2))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 4-312
Recommendation: Revise text to read as follows:
690.47 Rounding Electrode System.
(C) Systems with Alternating-Current and Direct-Current Grounding Requirements.
(2) Common Direct-Current and Alternating-Current Grounding Electrode. A dc grounding electrode conductor of the size specified by 250.166 shall be run from the marked dc grounding electrode connection point to the ac grounding electrode. Where an ac grounding electrode is not accessible, the dc grounding electrode conductor shall be connected to the ac grounding electrode conductor in accordance with 250.64(C)(1), 250.64(C)(2), or <u>using a</u> connector listed for grounding and bonding. **[ROP 4–312]**
Substantiation: The "or" list *250.64(C)(1), 250.64(C)(2), or connector* lacks parallelism for the third item.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-155 Log #1001 NEC-P04 **Final Action: Accept**
(690.47(D))

Submitter: David Clements, International Association of Electrical Inspectors
Comment on Proposal No: 4-314
Recommendation: Accept proposal 4-315 as submitted.
Substantiation: This concept of the proposed language should have been accepted with the recommended action to add new text as there is currently no 690.47(D) to revise. During the 2011 code making process a proposal was submitted to delete this section, 4-238 Log #2509 NEC-p04. This proposal was rejected by the panel. During the rewrite of this Article, this paragraph was apparently left out and does not appear in the 2011 code. This section needs to be in the code to make it clear that PV arrays require an additional grounding electrode system.
Panel Meeting Action: Accept
Panel Statement: The assumption has been made that the correct proposal in the recommendation is 4-314.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 10 Negative: 4
Explanation of Negative:
BOWER, W.: Accepting this comment and proposal 4-315 results in extraordinary expenses with little or no safety advantages for many PV systems, and is often one step too far for requirements for safety. The grounding methods specified in the proposal are not always consistent with grounding methods used for lightning protection and if the purpose of the additional electrode is lightning protection then the requirements spelled out in NFPA 780 should be used. Further, the additional electrode for grounding can lead to a ground loop with continuous earth generated currents resulting in accelerated corrosion of connections and frames resulting in loss of all ground connections.
The effectiveness of the additional grounding electrode will vary according the location of the electrode and the site of possible ground faults by external sources. The requirement is unclear. 690.47(D) says that the electrode must be "as close as practicable" to the PV array. This statement is clearly unenforceable since the practicability of locating an additional electrode is open to far too much subjectivity. This puts enforcement, designers and electricians at odds when their respective interpretations differ. The exceptions are also unclear. If the electrode is not required, does an electrode conductor still need to be run? It does not say. What is a load integral with an array? That is just another unclear statement in the proposal.
As far as applying the new requirements to smaller residential systems the additional electrode for array grounding can double the installation time and costs with little or no safety advantage. Again if lightning protection is the purpose, then the NFPA 780 requirements should dictate methodology. Some exceptions are absolutely necessary for these systems.
As for very large ground mount arrays that are now measuring miles by miles in size, where does this additional electrode reside? The same question can be asked for warehouse systems that measure city blocks long? Installation per 250.52 does not provide a location for the additional grounding electrode, just the acceptable methods. Article 260.166 only specifies the required sizes of the conductors. 250.54 does allow for multiple addition grounding electrodes, but the issues for system operation and especially ground fault protection are not studied in any detail yet.
The compromise that the panel agreed upon with an overwhelming vote at the proposal review meeting in January 2012 should be reconsidered. The panel vote kept the provision for grounding ground-mounted arrays but removed the ambiguous language related to roof mounting. By voting down the split decision (8 to 5 --insufficient to pass with the required 2/3 vote) at the comment review meeting in Redondo Beach in December 2012, the panel is simply stating that the old version of 690.47(D) needs revising to be useful for safety. Since the panel statement in the 2008 NEC cycle clearly acknowledges that they intended 690.47(D) for lightning protection and not for the safety issue of local earth potential, it appears that CMP13 was attempting to establish lightning requirements for safety reasons whereas the rest of the code does not require lightning protection for safety. Those that are concerned about providing lightning protection, which should include those installing PV systems in lightning prone areas, should follow NFPA780. NFPA780 is currently being updated to include additional detail on how to protect PV systems.
To help the panel properly come to a final decision on this issue, the history of this provision is provided. It began with the 2008 NEC. It all started with a proposal that Brooks helped develop with the PV industry. This proposal addressed PV installations where the PV array is mounted on a separate building or structure and the dc conductors are run to a different structure where the inverter and service entrance are located. In this case it can be argued that the structure that supports the PV array is required to have a grounding electrode as required by 250.52.
The 2008 NEC contained an article 690.47(D), however, in the field, it has been reported that many contractors were not installing electrodes and jurisdictions were missing the importance of having this electrode at the separate structure. The purpose of this electrode is two-fold. The primary safety concern is to hold the frames of the PV array on the separate structure to as close to local earth potential as possible --rather than relying on a long equipment grounding conductor to reference to an electrode on another structure. This is a potential shock hazard and why separate structures should always be grounded to a local electrode. The secondary purpose of the electrode on the separate structure is to provide a simple and direct path to earth for any static charge that may build up in storm activity. Hence the 2008 version created more issues than it solved and proposal 4-315 is a virtual duplication of the 2008 version of 690.47(D) except for the exceptions that did provide some clarifications. The 2011 version of the code did not include 690.47(D) at all and that appears to be a processing error.
An unintended consequence of a wide variety of installs of additional grounding electrodes is the possible interference with required ground-fault protection for PV arrays due to earth generated currents or noise in the ground loop. Published data is not yet available for the redundant grounding system of the additional grounding electrode and no study results are published.
Rejecting this comment and accepting Comment 4-158 brings the code to a neutral point where lightning protection is covered by NFPA 780 and additional electrodes, when determined to be necessary, are already covered by 250.52, 250.54 and 250.166.
One alternative being circulated among the panel is also to reject this comment and accept proposal 4-315 as modified below:
1. Reject comment 4-155, which will return the language to the action taken by the panel on proposal 4-315.
(D) Additional Electrodes for Array Grounding.
Grounding electrodes shall be installed in accordance with 250.52 at the location of all ground- and pole-mounted photovoltaic arrays. The electrodes shall be connected directly to the array frame(s) or structure. The dc grounding electrode conductor shall be sized according to 250.166. Additional electrodes are not permitted to be used as a substitute for equipment bonding or equipment grounding conductor requirements. [ROP 4 -315]
then
2. Accept in part comment 4-156 to accept the phrase, "Mounting poles or structures meeting the requirements of 250.52 shall be acceptable."
3. Accept comment 4-157 as proposed.
The result is the following:
690.47(D) Additional Auxiliary Electrodes for Array Grounding. A grounding electrode shall be installed in accordance with 250.52 and 250.54 at the location of all ground- and pole-mounted photovoltaic arrays. The electrodes shall be connected directly to the array frame(s) or structure. Mounting poles or structures meeting the requirements of 250.52 shall be acceptable. The dc grounding electrode conductor shall be sized according to 250.166. Additional electrodes are not permitted to be used as a substitute for equipment bonding or equipment grounding conductor requirements.
FRIES, R.: the panel-approved show of hands vote resulted in language that severely penalizes all small PV installations and is not a requirement that will make a small PV system operation any more safe that it already is.

Additionally, the following is what is needed but will not likely be approved by the TCC since it has not had thorough public approval or comments.
This is the recommended language.
1. Reject comment 4-155 which will return the language to the action taken by the panel on proposal 4-315.
Proposal 4-315:
(D) Additional Electrodes for Array Grounding.
Grounding electrodes shall be installed in accordance with 250.52 at the location of all ground- and pole-mounted photovoltaic arrays. The electrodes shall be connected directly to the array frame(s) or structure. The dc grounding electrode conductor shall be sized according to 250.166. Additional electrodes are not permitted to be used as a substitute for equipment bonding or equipment grounding conductor requirements. [ROP 4–315]
2. Accept in part comment 4-156 to accept the phrase, "Mounting poles or structures meeting the requirements of 250.52 shall be acceptable."
3. Accept comment 4-157 as proposed.
The final language after taking these actions will read:
690.47(D) Additional Auxiliary Electrodes for Array Grounding. A grounding electrode shall be installed in accordance with 250.52 and 250.54 at the location of all ground- and pole-mounted photovoltaic arrays. The electrodes shall be connected directly to the array frame(s) or structure. Mounting poles or structures meeting the requirements of 250.52 shall be acceptable. The dc grounding electrode conductor shall be sized according to 250.166. Additional electrodes are not permitted to be used as a substitute for equipment bonding or equipment grounding conductor requirements.

MCDANIEL, R.: This comment should have been Accepted in Principal. Accepting this proposal will REQUIRE additional grounding electrodes to ground PV arrays mounted on buildings. The requirement should permit arrays mounted on buildings to connect to the building's Grounding Electrode System.

WILLS, R.: Reject: lightning protection can and should be recommended, but not mandated, in the NEC.
The 2011 causes many problems in the field. It uses imprecise terms such as "as close as practicable".
I support Bill Brooks view and recommendation on this.

Comment on Affirmative:
STAFFORD, T.: This panel member agrees that the initial intent during the 2008 code cycle to provide additional paths to ground at or near the array was correct. The 2014 code will restore that requirement.

4-156 Log #1078 NEC-P04 **Final Action: Accept in Principle in Part**
(690.47(D))

Submitter: John C. Wiles, Southwest Technology Development Institute, New Mexico State University
Comment on Proposal No: 4-315
Recommendation: Revise the proposed text as follows
(D) Additional Electrodes for Array Grounding.
Grounding electrodes shall be installed in accordance with 250.52 at the location of all ground- and pole-mounted photovoltaic arrays. The electrodes shall be connected directly to the array frame(s) or structure. <u>Mounting poles or structures meeting the requirements of 250.52 shall be acceptable.</u> The dc grounding electrode conductor shall be sized according to 250.166. <u>Bonding this grounding electrode to other grounding electrodes in the system shall not be required.</u> Additional electrodes are not permitted to be used as a substitute for equipment bonding or equipment grounding conductor requirements.
Substantiation: The first added sentence allows the use of the mounting poles and structures to meet this requirement where they meet 250.52 requirements. Adding the second sentence shown removes any confusion in this area. The required equipment-grounding conductor connects all grounding electrodes together. An additional bonding connection between electrodes which may be hundreds or thousands of feet apart is not required or warranted, and will create parallel paths of currents in the equipment-grounding conductor. This requirement now follows practice established in 250.54 and in 250.32.
A note to CMP-4. The panel actions as published in the Draft NEC and the panel statements are not consistent and are confusing. The original proposal did not include roof top installations. The panel actions added roof top installations. The panel statement said that roof top installations were not to be included. The draft NEC follows the original proposal, not the panel actions, and does not include roof top installations.
We agree with the panel statement and the draft NEC. **Do not include roof-top installations.**
Panel Meeting Action: Accept in Principle in Part
The panel rejects the additional text: Bonding this grounding electrode to other grounding electrodes in the system shall not be required.
Panel Statement: The intent of the submitter is already met in Proposal 4-314 recognizes the use of mounting poles and structures.
The requirement to bond grounding electrodes to one another is only at a single building or structure not at separate locations. This requirement is already covered in Article 250.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 12 Negative: 2
Explanation of Negative:
BOWER, W.: This panel member believes it best to vote negative on the panel decision. If 4-155 is rejected and 4-158 is accepted then this comment must be rejected.
WILLS, R.: Accept in part: accept the phrase, "Mounting poles or structures meeting the requirements of 250.52 shall be acceptable."
This per Bill Brooks recommendation.

4-157 Log #1200 NEC-P04 **Final Action: Accept in Principle**
(690.47(D))

Submitter: Marvin Hamon, Hamon Engineering
Comment on Proposal No: 4-315
Recommendation: Revise text to read as follows:
690.47(D) Additional <u>Auxiliary</u> Electrodes for Array Grounding. <u>A</u> ~~G~~grounding electrodes shall be installed in accordance with 250.52 <u>and 250.54</u> at the location of all ground- and pole-mounted photovoltaic. The electrodes shall be connected directly to the array frame(s) or structure. The dc grounding electrode conductor shall be sized according to 250.166.
Additional electrodes are not permitted to be used as a substitute for equipment bonding or equipment grounding conductor requirements.
Substantiation: Change plural to singular to indicate that multiple grounding electrodes are not necessarily a requirement. One grounding electrode may be all that is needed and would follow the wording of 250.32.
Add the term "Auxiliary" to indicate that this grounding electrode is not required to be tied into the premises grounding electrode system and if multiple grounding electrodes are installed they do not need to be bonded together by a dedicated bonding conductor. The PV array grounding electrode system is a separate standalone structure and 250.50 does not require the grounding electrode systems of different structures to be bonded together. The equipment grounding conductor is sized based on 250.166 and will serve to bond the electrodes in the PV array together. A separate bonding conductor would be duplicative. All this can be written out in the article or the wording change to Auxiliary and reference to 250.54 will do the same thing.
Panel Meeting Action: Accept in Principle
The panel accepts the addition of the words "auxiliary", "and 250.54" and the change to "a grounding".
Panel Statement: See panel action and statement on Comment 4-155.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 12 Negative: 2
Explanation of Negative:
BOWER, W.: This comment provides an improvement over the original proposal in that more than one additional electrode is allowed. Still I see ground loops being created and the uncertainty of proper operation of ground fault and arc fault protection is a major concern. This comment does not improve the original proposal or comment 4-155 enough approve it. I reject based on the uncertainties and enforcement concerns of comment 4-155. This comment must be rejected if 4-155 is rejected and 4-158 is accepted.
WILLS, R.: Accept comment 4-157 as originally proposed. 690.47(D) should then read:
690.47(D) Additional <u>Auxiliary</u> Electrodes for Array Grounding. <u>A</u> grounding electrode shall be installed in accordance with 250.52 <u>and 250.54</u> at the location of all ground- and pole-mounted photovoltaic arrays. The electrodes shall be connected directly to the array frame(s) or structure. <u>Mounting poles or structures meeting the requirements of 250.52 shall be acceptable.</u> The dc grounding electrode conductor shall be sized according to 250.166. Additional electrodes are not permitted to be used as a substitute for equipment bonding or equipment grounding conductor requirements.

4-158 Log #1201 NEC-P04 **Final Action: Reject**
(690.47(D))

Submitter: Marvin Hamon, Hamon Engineering
Comment on Proposal No: 4-315
Recommendation: Delete text to read as follows:
~~690.47(D) Additional Electrodes for Array Grounding. Grounding electrodes shall be installed in accordance with 250.52 at the location of all ground- and pole-mounted photovoltaic. The electrodes shall be connected directly to the array frame(s) or structure. The dc grounding electrode conductor shall be sized according to 250.166. Additional electrodes are not permitted to be used as a substitute for equipment bonding or equipment grounding conductor requirements.~~
Substantiation: Request that the CMP reject this proposal in its entirety. The substantiation given for this proposal is not a technical substantiation but only states that the submitter thinks that the section was deleted from the 2011 NEC in error. A review of the 2011 ROC shows that the final vote of the CMP was clearly to delete 690.47(D) from the 2011 NEC.
This article wording was initially added to the 2008 NEC for the purpose of mitigating the effects of lightening strikes but the NEC does not promulgate safety requirements relating to lightning. Article 250.54 allows the addition of grounding electrodes if desired in the PV array.
Panel Meeting Action: Reject
Panel Statement: The panel has reinstated the requirement in 690.47(D) because the installation of auxiliary grounding electrodes increases safety.
See panel action and statement on Comment 4-155.
Number Eligible to Vote: 14

Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
BOWER, W.: This panel member votes to reject the reject on this comment (in other words Accept). Please see my ballot comments on 4-155. Comment 4-155 rejects the original proposal and will give valuable time to study the effects of the additional electrode, the added safety versus costs, and the overall long term effects of ground loops on large systems. Accepting this comment allows 250.52, 250.54 and 250.166 to cover the additional electrode methods. Guidelines need to be published in the 2014 NEC Handbook for determination of the need for additional grounding electrodes.

4-159 Log #1506 NEC-P04 **Final Action: Accept in Principle in Part**
(690.56(B))

Submitter: William F. Brooks, Brooks Engineering
Comment on Proposal No: 4-320
Recommendation: Revise the text proposed by 4-320 with the modified text as shown:
(B) Facilities with Utility Services and PV Systems. Buildings or structures with both utility service and a photovoltaic system shall have a permanent plaque or directory providing the location of the service disconnecting means and the photovoltaic system disconnecting means if not located at the same location. The marking shall be in accordance with 690.31(E). For PV systems complying with 690.12, the plaque or directory shall include the <u>following</u> wording <u>or equivalent:</u> <u>PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN. OPERATION OF RAPID SHUTDOWN REDUCES VOLTAGE OF PV SYSTEM CONDUCTORS TO NO MORE THAN 30 VOLTS INSIDE BUILDING AND 10 FEET FROM ARRAY</u>. ~~MAXIMUM VOLTAGE AT ARRAY 80VDC AFTER SHUTDOWN~~
<u>The warning sign(s) or label (s) shall comply with 110.21(B).</u>
Substantiation: The rewording is necessary for consistency with the significant rewording of 690.12 that is referenced in 690.56(B). The words “following” and “or equivalent” were added to the sentence before the sign language so that products that exceed these requirements can reword the sign to accurately state additionally where voltage is reduced. The reference to 110.21(B) was added for consistency with other additions throughout this Code.
Panel Meeting Action: Accept in Principle in Part
Reject the plaque wording.
Reject the last sentence in (B).
Revise the proposed text to read as follows:
(B) Facilities with Utility Services and PV Systems.
Buildings or structures with both utility service and a PV system shall have a permanent plaque or directory providing the location of the service disconnecting means and the PV system disconnecting means if not located at the same location. The warning sign(s) or label (s) shall comply with 110.21(B).
(C) Facilities with Rapid Shutdown Buildings or structures with both utility service and a PV system, complying with 690.12, shall have a permanent plaque or directory including the wording:
PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN
The plaque or directory shall be reflective and shall have all letters capitalized with a minimum height of 9.5 mm (3⁄8 in.) white on red background.
Panel Statement: The new 690.56(C) was formed entitled “Facilities with Rapid Shutdown” with revised language. The sign configuration is according to NFPA 1, *Fire Code*, 2012. The panel rejected the lengthy plaque wording. The panel rejects the last sentence in (B) since it was incapable with the requirements of 110.21(B).
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-160 Log #80 NEC-P04 **Final Action: Accept**
(690.71 (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-323
Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 4-375 as directed by the Correlating Committee.
This action will be considered a public comment.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the recommendation of the Correlating Committee. CMP 4 restored Part VIII of Article 690 in its entirety with all associated accepted proposals (4-324, 4-325, 4-326) by panel actions taken on Comments 4-192 and 4-193.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-161 Log #81 NEC-P04 **Final Action: Accept**
(690.71)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-324
Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 13-33.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise 690.71(B)(1) to read as follows:
(1) Operating Voltage. Storage batteries for dwellings shall have the cells connected so as to operate at a nominal voltage of 50 volts or less.
Panel Statement: The panel accepts the recommendation of the Correlating Committee.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-162 Log #643 NEC-P04 **Final Action: Accept**
(690.80)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-327
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.
The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.
It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the “ voltage threshold level” of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.
NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.
There are meters and other test instruments readily available for use to day at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:
Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc
Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc
In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.

4-163 Log #644 NEC-P04 **Final Action: Accept**
(690, Part IX Title)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-328
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the “ voltage threshold level” of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use to day at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc

Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.

4-164 Log #680 NEC-P04 **Final Action: Accept**
(690.80)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-327
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.

4-165 Log #681 NEC-P04 **Final Action: Accept**
(690, Part IX Title)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-328
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
STAFFORD, T.: See comment 4-3.

4-166 Log #1288 NEC-P04 **Final Action: Reject**
(690.80)

Submitter: Jim Eichner, Schneider Electric - Solar Business
Comment on Proposal No: 4-327
Recommendation: None provided.
Substantiation: Schneider Electric supports the increase of the low voltage limit from 600V to 1000V in proposal 4-327 and throughout the NEC. In particular for PV this change will provide relief from requirements in Art. 490 that are excessive for PV systems that do not operate at the higher voltage levels that Art. 490 was originally intended to cover.
We recommend that further increases for PV systems up to 1500V or 2000V be considered in future code cycles.
Panel Meeting Action: Reject
Panel Statement: The comment has no recommendation. This comment does not comply with Section 4.4.5(c) of the NFPA Regulations Governing Committee Projects in that it does not provide text of the comment, including the wording to be added, revised (and how revised), or deleted.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

ARTICLE 692 — FUEL CELL SYSTEMS

4-167 Log #463 NEC-P04 **Final Action: Accept**
(692.2.Fuel Cell)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 4-332
Recommendation: Revise text to read as follows:
Fuel Cell. An electrochemical system that consumes fuel to produce an electric current. <u>In such cells the</u> ~~The~~ main chemical reaction used ~~in a fuel cell~~ for producing electric power is not combustion. However, there may be sources of combustion used within the overall ~~fuel~~ cell system such as reformers/fuel processors.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term and the NEC manual of style does not permit the definition to contain the defined term. Definitions are not requirements. The proposed changes eliminate the defined term. If the CMP believes that this information is a requirement it should place it somewhere else in Article 692.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Suggested informational notes as an alternative:
<u>**Informational Note**: The main chemical reaction used in a fuel cell for producing electric power is not combustion. However, there may be sources of combustion used within the overall fuel cell system such as reformers/fuel processors.</u>
Panel Meeting Action: Accept
Panel Statement:
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-168 Log #464 NEC-P04 **Final Action: Accept**
(692.2.Fuel Cell System)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 4-333
Recommendation: Revise text to read as follows:
Fuel Cell System. The complete aggregate of equipment used to convert chemical fuel into usable electricity<u>, and typically consisting</u> ~~. A fuel cell system typically consists~~ of a reformer, stack, power inverter, and auxiliary equipment.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term and the NEC manual of style does not permit the definition to contain the defined term. Definitions are not requirements. The proposed changes eliminate the defined term. If the CMP believes that this information is a requirement it should place it somewhere else in Article 692.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Suggested informational notes as an alternative:
<u>**Informational Note**: A fuel cell system typically consists of a reformer, stack, power inverter, and auxiliary equipment.</u>
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-169 Log #465 NEC-P04 **Final Action: Accept**
(692.2.Output Circuit and Informational Note (New))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 4-335
Recommendation: Revise text to read as follows:
Output Circuit. The conductors used to connect the fuel cell system to its electrical point of delivery. ~~In the case of sites that have series- or parallel-connected multiple units, the term *output circuit* also refers to the conductors used to electrically interconnect the fuel cell system(s).~~
<u>**Informational Note**: In the case of sites that have series- or parallel-connected multiple units, the term *output circuit* also refers to the conductors used to electrically interconnect the fuel cell system(s).</u>
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term and the NEC manual of style does not permit the definition to contain the defined term. Definitions are not requirements. If the CMP believes that this information is a requirement it should place it somewhere else in Article 692.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-170 Log #645 NEC-P04 **Final Action: Accept**
(692.80)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-342
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use to day at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc

Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 12 Negative: 2

Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative vote on Comment 4-2.

4-171 Log #646 NEC-P04 **Final Action: Accept**

(692, Part VIII Title)

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 4-343

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use to day at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc

Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 12 Negative: 2

Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative vote on Comment 4-2.

4-172 Log #682 NEC-P04 **Final Action: Accept**

(692.80)

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 4-342

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 12 Negative: 2

Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative vote on Comment 4-2.

4-173 Log #683 NEC-P04 **Final Action: Accept**

(692, Part VIII Title)

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 4-343

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 12 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative vote on Comment 4-2.

ARTICLE 694 — WIND ELECTRIC SYSTEMS

4-174 Log #466 NEC-P04 **Final Action: Accept in Principle in Part**
(694.2.Rated Power)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 4-348
Recommendation: Revise text to read as follows:
~~**Rated Power.** The wind turbines output power at a wind speed of 11 m/s (24.6 mph). If a turbine produces more power at lower wind speeds, the rated power is the wind turbines output power at a wind speed less than 11 m/s that produces the greatest output power.~~
~~**Informational Note:** The method for measuring wind turbine power output is specified in IEC 61400-12-1, *Power Performance Measurements of Electricity Producing Wind Turbines*.~~
<u>**694.4 Rated Power**</u>
<u>**694.4.1** Rated power shall be the wind turbines output power at a wind speed of 11 m/s (24.6 mph), except as indicated in 694.4.2.</u>
<u>**694.4.2** If a turbine produces more power at lower wind speeds, the rated power shall be the wind turbines output power at a wind speed less than 11 m/s that produces the greatest output power.</u>
<u>**Informational Note:** The method for measuring wind turbine power output is specified in IEC 61400-12-1, *Power Performance Measurements of Electricity Producing Wind Turbines*.</u>
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term and the NEC manual of style does not permit the definition to contain the defined term. It also contains requirements not allowed in definitions. It is probably best to eliminate this from the definition section altogether and incorporate this information as a requirement somewhere else in Article 694, for example as 694.4.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Panel Meeting Action: Accept in Principle in Part
Reject moving definition out of 690.2
Revise rated power definition to read as follows:
Rated Power. The output power of a wind turbine at its rated wind speed.
Informational Note: The method for measuring wind turbine power output is specified in IEC 61400-12-1, Power Performance Measurements of Electricity Producing Wind Turbines.
Panel Statement: The panel accepts the submitter's proposal to correct the style manual infraction. The panel eliminated extraneous text of product specific wind speed ratings that is better addressed in product standards. As 694 applies to both large and small turbines, the revised text is now correct for all turbines. Additional proposed sections are unnecessary.
Style Manual 2.2.2.2 requires definitions to be in section.2.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

4-175 Log #82 NEC-P04 **Final Action: Accept**
(694.7(B))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-353
Recommendation: The Correlating Committee directs that the panel clarify the action on this proposal to correlate with the panel action taken on Proposal 4-354.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the recommendation of the Correlating Committee. The panel action on Comment 4-178 addresses the Correlating Committee's concerns.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

4-176 Log #83 NEC-P04 **Final Action: Accept**
(694.7(B))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-354
Recommendation: The Correlating Committee directs that the panel clarify the action on this proposal to correlate with the Panel action taken on Proposal 4-353.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the recommendation of the Correlating Committee. The panel action on Comment 4-178 addresses the Correlating Committee's concerns.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

4-177 Log #1455 NEC-P04 **Final Action: Accept in Principle**
(694.7(B))

Submitter: Robert H. Wills, Intergrid, LLC
Comment on Proposal No: 4-353
Recommendation: Recommendation: Revise Clause 694.7(B) as follows:
(B) Equipment. ~~Inverters used in small w~~ Wind electric systems <u>electrical</u> equipment, <u>electrical</u> subassemblies and <u>electrical</u> components shall be ~~identified and~~ listed for the application.
(Deletes are from 4-354. Inserts are new to this comment)
Substantiation: The original (2011) language was "Inverters used in small wind electric systems shall be identified and listed for the application.". The intent of the change is to require that other <u>**electrical**</u> equipment be listed, but the change proposed in 4-354 resulted in a much broader requirement – potentially that <u>**all**</u> equipment, subassemblies and components (including mechanical and passive components, nuts and bolts..) would need to be listed. The change proposed here clarifies that the listing requirement is only for electrical devices. The repeated use of the word "electrical" is awkward, but does eliminate ambiguity.
Panel Meeting Action: Accept in Principle
Panel Statement: See panel action and statement on Comment 4-178 which addresses the submitter's concerns.
Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

4-178 Log #1456 NEC-P04 **Final Action: Accept in Principle**
(694.7(B))

TCC Action: The Correlating Committee directs that the Informational Note be deleted because it does not comply with the NEC Style Manual as it contains a permissive statement of compliance.
Submitter: Robert H. Wills, Intergrid, LLC
Comment on Proposal No: 4-353
Recommendation: Recommendation: Revise Clause 694.7(B) as follows:
(B) Equipment. ~~Inverters used in small w~~ Wind electric systems ~~equipment, subassemblies components~~ shall be ~~identified and~~ listed for the application.
Substantiation: The original (2011) language was "Inverters used in small wind electric systems shall be identified and listed for the application.".
Proposal 4-354 broadened the scope to include all equipment, subassemblies and components.
This has two problems:
1/ it implies that non-electrical components are required to be listed
2/ it implies that individual components are required to be listed even if the complete wind electric system is listed "as a system". This is akin to requiring that all components in a listed TV be themselves listed.
This change proposed here encompasses the intent of proposal 4-353 and 4-354 (that NRTLs review and list wind electric systems for safety), without the problems noted above.
Panel Meeting Action: Accept in Principle
Revise 694.7(B) Equipment to read as follows:
694.7(B) Equipment. Wind electric systems shall be listed and labeled for the application.
Informational Note: Compliance with this requirement may be achieved by field evaluation.
Panel Statement: The addition of the words "and labeled" addresses Comment 4-175. The term "labeled" is used rather than "marked" as the former is a defined term. The informational note was added to recognize the possible need for field evaluations of wind turbines.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

4-179 Log #84 NEC-P04 **Final Action: Accept**
(694.7(E))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-355
Recommendation: The Correlating Committee directs that the panel clarify the action on this proposal because it has introduced changes to the existing text other than what is shown legislatively.
The Correlating Committee further directs that the accepted text shall comply with the NEC Style Manual.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the recommendation of the Correlating Committee. See panel action on Comment 4-180.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

4-180 Log #1573 NEC-P04 **Final Action: Accept**
(694.7(E))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 4-355
Recommendation: Reject the proposal.
Substantiation: The submitter notes that the text that was imported for this proposal did not correctly correspond to current (2011) NEC text, and the actual wording is correct. The submitter apologizes for the error.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

4-181 Log #647 NEC-P04 **Final Action: Reject**
(694.10(A))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-357
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.
The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.
It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.
NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.
There are meters and other test instruments readily available for use to day at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:
Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc
Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc
In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.
Panel Meeting Action: Reject
Panel Statement: The panel action on the proposal was accept in part not accept in principle.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Negative: 1
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.

4-182 Log #684 NEC-P04 **Final Action: Accept**
(694.10(A))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-357
Recommendation: Continue to Accept in Part.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.
The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.
The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The

success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 11 Negative: 2
Explanation of Negative:
STAFFORD, T.: See comment on 4-3.
ZINNANTE, V.: See my Explanation of Negative vote on Comment 4-2.

4-183 Log #157 NEC-P04 **Final Action: Accept**
(694.22(C)(4))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-181c
Recommendation: It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 4 for action in Article 694.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

4-184 Log #531 NEC-P04 **Final Action: Reject**
(694.23)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 4-364a
Recommendation: Revise text to read as follows:
694.23 Turbine Shutdown. [ROP 4–364a]
(A) Manual Shutdown.
Exception: *Turbines with a ~~swept area of less than 50 m2~~ blade length of 4 m (13 ft) or less shall not be required to have a manual shutdown button or switch.*
Substantiation: Why make it hard?
Panel Meeting Action: Reject
Panel Statement: The convention of the wind industry is to categorize turbine size by swept area rather than blade length. The blade length does not account for the diameter of the hub. No technical substantiation was provided by the submitter to justify the change.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

4-185 Log #85 NEC-P04 **Final Action: Accept**
(694.40)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-370a
Recommendation: The Correlating Committee directs that the panel clarify the text in (A) with respect to the use of the word "grounded".

The Correlating Committee further directs that this proposal be forwarded to Code-Making Panel 5 for comment.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the recommendation of the Correlating Committee. The Correlating Committee's request to clarify use of the term "grounded" is satisfied by the panel action on Comment 4-186.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

4-186 Log #278 NEC-P04 **Final Action: Accept in Principle in Part**
(694.40)

Submitter: Code-Making Panel 5,
Comment on Proposal No: 4-370a
Recommendation: Code-Making Panel 5 recommends amending 694.40 as follows:
694.40 Equipment Grounding:
(A) General. Exposed non-current-carrying metal parts of towers, turbine nacelles, other equipment, and conductor enclosures shall be grounded in accordance with Parts IV, V and VI of Article 250. ~~Turbine output circuits shall be permitted to be grounded but shall not be required to be grounded.~~ Attached metal parts such as turbine blades and tails that ~~have no source of electrical energization~~ that are not likely to become energized ~~are~~ shall not be required to be grounded or bonded.
(B) Tower Grounding and Bonding
(1) ~~Auxiliary~~ Grounding Electrodes and Grounding Electrode Conductors. A wind turbine tower shall be connected to a grounding electrode system. ~~one or more auxiliary grounding electrodes to limit voltages imposed by lightning. The auxiliary grounding electrodes shall comply with 250.52(A) in form and 250.54 for connections using a grounding electrode conductor that complies with 250.166 for dc systems and 250.62 through 250.70 for ac systems. Electrodes that are part of the tower foundation and meet the requirements for concrete encased electrodes in accordance with 250.52(A)(3) shall be acceptable. A grounded metal tower support shall be considered acceptable where meeting the requirements of 250.136(A).~~ Where installed in close proximity to galvanized foundation or tower anchor components, galvanized grounding electrodes shall be used.
Informational Note: Copper and copper-clad grounding electrodes, where used in highly conductive soils, can cause electrolytic corrosion of galvanized foundation and tower anchor components.
~~(2) Tower Bonding. An equipment grounding conductor or supply side bonding jumper shall connect a turbine to the main or system bond and premises grounding system in accordance with 250.110.~~
~~(3) Tower Connections. Equipment grounding conductors and grounding electrode conductors, where used, shall be connected to the metallic tower by exothermic welding, listed lugs, listed pressure connectors, listed clamps, or other listed means. Devices, such as connectors and lugs, shall be suitable for the material of the conductor and the structure to which the devices are connected. Where practicable, contact of dissimilar metals shall be avoided anywhere in the system to eliminate the possibility of galvanic action and corrosion. All mechanical elements used to terminate these conductors shall be accessible.~~
~~(4) Lightning Protection. Where a lightning protection system is present, its ground terminals shall be bonded to the tower grounding electrode system as required by 250.106. Where the tower is remote from the building or structure served, the tower grounding electrode system shall be permitted to be made a part of the lightning protection system.~~
Informational Note: See NFPA 780-2011, Standard for the Installation of Lightning Protection Systems, Informative Annex N, Wind Turbine Generator System
(~~5~~2) Guy Wires. Guy wires used to support turbine towers shall not be required to be connected to an equipment grounding or bonding conductor or to comply with the requirements of 250.110.
Informational Note: Guy wires supporting grounded towers are unlikely to become energized. Grounding of metallic guy wires may be required by lightning codes. ~~See 694.40(B)(4).~~
Substantiation: In 694.40(A), Code-Making Panel 5recommends revising the text for clarity and compliance with the style manual. The requirement for grounding turbine output circuits does not belong in the Equipment Grounding section and should be relocated.

In 694.40(B)(1), Code-Making Panel 5has determined that the grounding electrodes described do not fit the definition of an auxiliary grounding electrode but agrees that a clear requirement for the installation of a grounding electrode system at the tower location is necessary. Text that restates the requirements of Article 250 has been deleted. Duplicating requirements already found in other sections of the Code creates confusion.

In 694.40(B)(2), Code-Making Panel 5 recommends deleting this section because it is unclear and does not appear to introduce requirements that are not found in Article 250. Duplicating requirements already found in other sections of the Code creates confusion. It is not clear if this section is intended to refer to tower bonding, turbine bonding or the connection to the premises wiring system grounding and bonding conductors. Furthermore, this section uses terms that are not defined such as "main or system bond."

In 694.40(B)(3), Code-Making Panel 5 recommends deleting this section because it does not appear to introduce requirements that are not already found in Article 250. The requirements for avoiding contact of dissimilar metals are found in 110.14. Duplicating requirements already found in other sections of the Code creates confusion.

In 694.40(B)(4), Code-Making Panel 5 recommends deleting this section because the requirements are already found in Article 250. Duplicating requirements already found in other sections of the Code creates confusion. The Informational Note should be relocated to another section or deleted.

In 694.40(B)(5), the section has been renumbered and the reference to

694.40(B)(4) in the Informational Note has been deleted because the section has been deleted.

This comment was developed by a CMP-5 Task Group and balloted through the entire panel with the following ballot results:

16 Eligible to Vote

15 Affirmative

1 Ballot Note Returned (W.J. Helfrich)

The following AFFIRMATIVE comments on vote were received:

T.N. BOWMER: I concur in general with the CMP5 recommended changes but do not fully agree with the substantiation; in particular, I agree with CMP5 proposed changes to proposed 694.40 (A) and introduction of reference to Parts IV, V and VI of Article 250. However, I disagree that duplication of requirements that are already found in other sections of the code necessarily creates confusion. For example, the text in section 690.40 (B) items (1), (2), (3) and (4) is useful information to have explicitly referenced in Article 694 and it could be included in a informational note. Secondly, I disagree with the removal of the sentence "Turbine output circuits shall be permitted to be grounded but shall not be required to be grounded" from article 690.40. This observation on output circuits should be included somewhere in the Article 690.

P. SIMMONS: Revise CMP-5's recommendation in part as follows:

694.40 Equipment Grounding and Bonding

(A) General. Exposed non-current-carrying metal parts of towers, turbine nacelles, other equipment, and conductor enclosures shall be grounded and bonded in accordance with Parts IV, V and VI of Article 250.

(B)(1) Grounding Electrodes and Grounding Electrode Conductors. A wind turbine tower shall be connected to a grounding electrode or grounding electrode system in compliance with Part III of Article 250. Statement: 694.40 covers both grounding and bonding so the bold-face title and text of (A) must contain both words.

The text in (B)(1) requires revision since a single grounding electrode may satisfy the requirements and not be referred to as a grounding electrode system. The sentence should contain the reference to Part III of Article 250 as that is the part where the selection and installation requirements for grounding electrodes and grounding electrode conductors are located.

Panel Meeting Action: Accept in Principle in Part

Reject the deletion of (B)(2) and (B)(3).

Revise 694.40 to read as follows:

694.40 Equipment Grounding:

(A) General. Exposed non-current-carrying metal parts of towers, turbine nacelles, other equipment, and conductor enclosures shall be grounded in accordance with Parts IV, V and VI of Article 250. Attached metal parts such as turbine blades and tails that that are not likely to become energized shall not be required to be grounded or bonded.

(B) Tower Grounding and Bonding

(1) Grounding Electrodes and Grounding Electrode Conductors. A wind turbine tower shall be connected to a grounding electrode system. Where installed in close proximity to galvanized foundation or tower anchor components, galvanized grounding electrodes shall be used.

Informational Note: Copper and copper-clad grounding electrodes, where used in highly conductive soils, can cause electrolytic corrosion of galvanized foundation and tower anchor components.

(2) Bonding Conductor. Equipment grounding conductors or supply side bonding jumpers as applicable shall be required between turbines, towers and the premises grounding system in accordance with Parts V and VI of Article 250.

(3) Tower Connections. Equipment grounding conductors and grounding electrode conductors, where used, shall be connected to metallic towers using listed means. All mechanical elements used to terminate these conductors shall be accessible.

(4) Guy Wires. Guy wires used to support turbine towers shall not be required to be connected to an equipment grounding or bonding conductor or to comply with the requirements of 250.110.

Informational Note: Guy wires supporting grounded towers are unlikely to become energized. Grounding of metallic guy wires may be required by lightning codes. For information on lightning protection systems, see NFPA 780-2011, Standard for the Installation of Lightning Protection Systems, Informative Annex N, Wind Turbine Generator Systems.

Panel Statement: The panel simplified and clarified the proposed language. It is important to state the requirement for bonding as turbines are often located far from the premises and some installers wrongly assume that electrodes can perform the bonding function.

The proposed language for (B)(3) [Tower Connections] is retained in part to ensure that a reliable connection is made to the tower, and to maintain the important requirement for accessibility to connections (for inspection) which is not included in Article 250.

The informational notes were combined for clarity.

Number Eligible to Vote: 13

Ballot Results: Affirmative: 13

4-187 Log #648 NEC-P04 **Final Action: Accept**

(694.80)

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 4-373

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use to day at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc

Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

Panel Meeting Action: Accept

Number Eligible to Vote: 13

Ballot Results: Affirmative: 11 Negative: 2

Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative vote on Comment 4-2.

4-188 Log #649 NEC-P04 **Final Action: Accept**

(694, Part IX)

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 4-374

Recommendation: Continue to Accept in Principle.

Substantiation: This comment is submitted by a single individual and does not represent the work or input of the high voltage task group (HVTG). This comment attempts to address concerns stated in the negative. Safety of all electrical workers must be the first consideration when the technical committee considers raising the voltage threshold. This submitter greatly appreciates the technical committee members concern for the safety of all electrical workers. I have reviewed the impact on worker safety in each of these proposals. As the safety coordinator for IBEW Local 98 in Philadelphia, I could not support raising the voltage threshold if I felt there was a safety concern that we could not address. If there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

The work of the high voltage task group was very broad in nature. It is widely recognized and understood that emerging technologies such as small wind and PV are breaking the 600-volt threshold making these alternative energy sources more efficient. The HVTG was directed to review this issue and to submit proposals to generate a shift in NEC requirements to specifically address these new system voltages. The HVTG submitted proposals to the technical committees with specific expertise to let each individual CMP make the decision on raising the voltage threshold. We needed a placeholder in all locations. Any CMP that felt there was a safety issue rejected the proposal. The HVTG supported those rejections in each case. The final decision lies with the technical committee.

It is important to note that if this technical committee raises the voltage threshold from 600 to 1000-volts in the NEC, the only change is the " voltage threshold level" of the installation requirement. This change in the voltage threshold level does not permit conductors and equipment rated at 600-volts to be used at 1000-volts. That would require the conductors and equipment to be tested and listed for such use. See NFPA 70 110.3(B). There are many products that are already listed and marked for this use.

NFPA 70E requires that all employees who face a risk of electrical hazard that is not reduced to a safe level by the applicable electrical installation requirements be trained to understand the specific hazards they face. See 70E 110.2. Qualified persons are required. Energized work is only permitted where justified. See 130.2. Personal Protective equipment, including but not limited to voltage rated gloves and arc rated clothing are readily available. Training programs for electrical safe work practices for voltages over 600-volts are readily available.

There are meters and other test instruments readily available for use to day at 1000-volts. It should be noted that NFPA 70E 110.4 requires all test instruments to be properly rated and used only by qualified persons. NFPA 70E 110.2(D)(1)(4)(e) requires the qualified person be trained on the proper use and limitations of the test instrument. A quick Google search revealed the following, there are more:

Fluke 77IV, general purpose digital meter, 1000-vac, 1000-vdc

Ideal 490, general-purpose digital meter, 1000-vac, 1000-vdc

In closing, I would like to repeat that if there is any concern that the safety of electrical workers is impacted, CMP-4 should reject all proposals seeking to raise the voltage threshold.

Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 11 Negative: 2
Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative vote on Comment 4-2.

4-189 Log #685 NEC-P04 **Final Action: Accept**
(694.80)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-373
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 11 Negative: 2
Explanation of Negative:

STAFFORD, T.: See comment on 4-3.

ZINNANTE, V.: See my Explanation of Negative vote on Comment 4-2.

4-190 Log #686 NEC-P04 **Final Action: Accept**
(694, Part IX)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 4-374
Recommendation: Continue to Accept in Principle.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept

Number Eligible to Vote: 13
Ballot Results: Affirmative: 12 Negative: 1
Explanation of Negative:
ZINNANTE, V.: See my Explanation of Negative vote on Comment 4-2.

ARTICLE 695 — FIRE PUMPS

13-32 Log #795 NEC-P13 **Final Action: Accept**
(695.1(B)(3))

TCC Action: The Correlating Committee advises that article scope statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the panel action.
Submitter: John R. Kovacik, UL LLC
Comment on Proposal No: 13-48a
Recommendation: Revise text to read as follows:
(3) Transfer equipment upstream of the fire pump transfer switch<u>(es)</u>
Substantiation: The revision of "switch" from singular to plural will correlate with Section 10.8.2.3 of NFPA 20-2013 which permits a fire pump to have one or more dedicated transfer switches where a transfer switch or switches are required. A transfer switch dedicated to a fire pump is a fire pump transfer switch.
NFPA 20 - 10.8.2.3 Transfer Switch. Each fire pump shall have its own dedicated transfer switch(es) where a transfer switch(es) is required.
Panel Meeting Action: Accept
Number Eligible to Vote: 21
Ballot Results: Affirmative: 20 Negative: 1
Explanation of Negative:
CARON, D.: 695.1(B)(3) was added to eliminate confusion with switching between 2 sources that takes place upstream in main electric rooms in multi-building Campus-style Complexes. Distribution systems that utilize 2 main switchboards with a tie circuit breaker, that have a feeder from each side of the tie breaker serving a transfer switch upstream of the fire pump controller/transfer switch combination, that also serve only fire pump loads, are not required to be in the pump room or listed for fire pump use. There is almost no instance where a fire pump motor would have two transfer switches listed for fire pump use. CMP-13 needs to eliminate the conflicting text between NFPA 20 9.2.2(4) and NFPA 70 695.3(C). NFPA 20 has it right.

13-33 Log #290 NEC-P13 **Final Action: Hold**
(695.3 and 695.4(A))

TCC Action: The Correlating Committee directs that the items referenced in panel action be reported as "Hold."
Submitter: Richard Schneider, Lancaster, SC
Comment on Proposal No: 13-55a
Recommendation: Retain text as per ROP which is:
Change existing 695.3(F) to 695.3(G). NEW 695.3(F) to read:
695.3(F) Transfer of Power. Transfer of power to the fire pump controller between the individual source and one alternate supply shall take place within the pump room. (20:9.6.4)
695.3(G) Phase Converters. Phase converters shall not be permitted to be used for fire pump service. (20:9.1.7)
Reject Comment on Affirmative for 695.3(F):
Overcurrent Device Selection
Delete/reject the entire proposed 695.3(F) text pertaining to Overcurrent Device Protection proposed by Mr. Neil Czarnecki. There was no Panel action on this proposed text - it was merely a comment on the affirmative.
Add new New 695.3(H)
<u>Individually, Listed Fire Pump Controller and Power Transfer Switch Assembly (20:10.8.2.2 & 10.8.2.3).</u>
<u>a) Each fire pump shall have its own dedicated transfer switch, listed for fire service, where a transfer switch is required (20:10.8.2.3)</u>
<u>b) A transfer switch separate from the fire pump controller is to be enclosed and contain its own overcurrent device in the same enclosure. The overcurrent device shall be selectively coordinated as required in 695.3(C)(3)</u>
<u>c) This transfer switch assembly shall be SUSE (Suitable for Use as Service Equipment) rated when so used</u>
<u>d) The disconnect contained therein shall not count against the quota established in 695.4(B)(1)</u>
Revising 695.4(A) as follows:
695.4(A) Direct Connection. The supply conductors shall directly connect the power source to either a listed fire pump controller or listed combination fire pump controller and power transfer switch <u>or the listed transfer switch assembly described in 695.3(H).</u>
Substantiation: NEMA Proposal 13-55a was to commensurate changes in NEC 695 as extracted from revised NFPA 20 (2013), 10.8.2.2 (aka Fig. A.10.8 ARRANGEMENT II). One of the changes was that the CB contained in the upstream ATS Assembly (being an upstream disconnect) was NOT to count against the quota (of 1 max) established in NFPA 20, 9.2.3. That statement did not get included in 13-55a as proposed, but should have.
The intent is to have the Upstream ATS Assembly comply with Article 230, using a THERMAL-MAGNETIC CB, since it needs most often to be SUSE rated. Proposal 13-55a purports to permit the use of an INSTANTANEOUS CB which has RESTRICTED APPLICATION per NEC 430.52(C)(3) thus making the upstream ATS assembly noncompliant with the requirements of Article 230. Additionally, there is a safety concern since the load wiring to the fire pump controller is FIELD WIRING which would remain unprotected up to >20 times the FLC of the motor (NEC 700.27).
The correct Proposal should not permit the use of an Instantaneous CB and leave it as a Thermal Mag thus making this upstream transfer switch assembly compliant with the remainder of the NEC.
(UL 1008 will be updated accordingly at a future time.)
Panel Meeting Action: Accept in Principle in Part
CMP-13 holds the proposed new 695.3(H) and the reference in 695.4(A). Reject the recommendation in reference to the affirmative comment. The remainder is accepted in principle.
Panel Statement: The proposed new 695.3(H) has not had public review and is new material. A technical committee cannot reject an affirmative comment. See the action and statement on Comment 13-37.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-34 Log #158 NEC-P13 **Final Action: Accept**
(695.3(A)(1))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-181d
Recommendation: It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 13 for action in Article 695.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-13 accepts the direction of the Correlating Committee to take action on proposal 9-181d. CMP-13 Accepts in Principle Proposal 9-181d. See the action taken on Proposal 13-53, which meets the intent of the submitter.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-35 Log #413 NEC-P13 **Final Action: Reject**
(695.3(D))

Submitter: Daniel J. Caron, Bard, Rao + Athanas Consulting Engineers, LLC
Comment on Proposal No: 13-91
Recommendation: Following 695.3(D) add the following:
<u>Informational Note: See Informational Note Figure 695.3(D)</u>

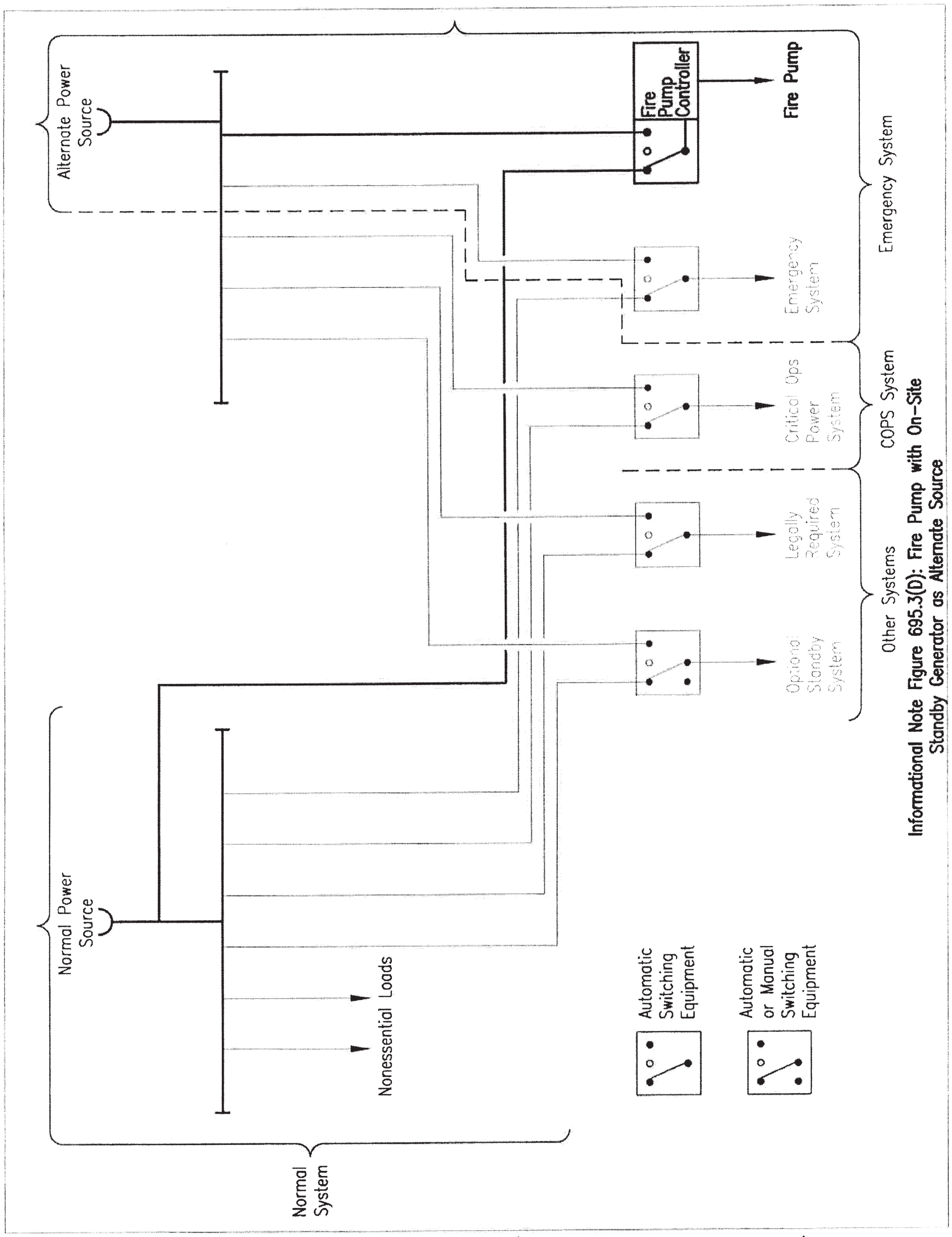
See Figure 695.3(D) on Page 379

Substantiation: Comment submitted to add a figure, similar to 700.2, 701.2, 702.2 and 708.2 as shown on the attached for consistency.
Panel Meeting Action: Reject
Panel Statement: CMP 13 rejects the proposed revisions as they are better suited as handbook material. See 13-65a (Log #CC1301).
Number Eligible to Vote: 21
Ballot Results: Affirmative: 20 Negative: 1
Explanation of Negative:
CARON, D.: See my Explanation of Negative vote on Comment 13-65a.

13-36 Log #365 NEC-P13 **Final Action: Accept in Principle**
(695.3(F))

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 13-55a
Recommendation: Add as new 695.3(F)(2) as recommended in Mr. Czarnecki's ballot comment on Proposal 13-55a. Mr. Czarnecki's recommended addition is pasted below for reference.
<u>(2) Overcurrent Device Selection. An instantaneous trip circuit breaker shall be permitted in lieu of the overcurrent devices specified in 695.4(B)(2) provided it is part of a transfer switch assembly listed for fire pump service.</u>
Substantiation: Mr. Czarnecki's substantiation for the added text is correct. The new 695.3(F)(2) will complete the requirements needed in 695.3(F) to address the use of a dedicated transfer switch to provide an alternate source of power for a fire pump motor.
Panel Meeting Action: Accept in Principle
Panel Statement: See the action on Comment 13-37.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-35 (Log #413) Figure 695(D)



Informational Note Figure 695.3(D): Fire Pump with On-Site Standby Generator as Alternate Source

13-37 Log #434 NEC-P13 **Final Action: Accept in Principle**
(695.3(F))

Submitter: William F. Stelter, Master Control Systems, Inc.
Comment on Proposal No: 13-55a
Recommendation: Revise text to read as follows:
(F) Transfer of Power. Transfer of power to the fire pump controller between the individual source and one alternate source shall take place within the pump room. ~~The transfer switch shall be listed for fire pump service.~~ [20:9.6.4] ~~[20:10.8.1.1]~~
(1) Power Source Selection. Selection of power source shall be performed by a transfer switch listed for fire pump service. [20:10.8.1.1]
(2) Overcurrent Device Selection. An instantaneous trip circuit breaker shall be permitted in lieu of the overcurrent devices specified in 695.4(B)(2)(a)(1) provided it is part of a transfer switch assembly listed for fire pump service which complies with 695.4(B)(2)(a)(2). [20:10.8.2.2(2)]
Substantiation: The overcurrent protection for the fire pump circuit must be coordinated with the fire pump controller circuit breaker such that the fire pump controller circuit breaker is the only device to trip. This is to assure that emergency personnel entering a building during a fire only have to evaluate the fire pump controller for a locked rotor trip. It also allows the circuit to operate at 300 percent current continuously, to allow for single phase running, until failure occurs. Further, it assures that an immediate restart won't trip the circuit breaker. 695.4(B)(2)(a)(2) identifies that minimum overcurrent characteristics for any overcurrent device in this circuit to assure this coordination.
Panel Meeting Action: Accept in Principle
Revise text to read as follows:
(F) Transfer of Power. Transfer of power to the fire pump controller between the individual source and one alternate source shall take place within the pump room. ~~The transfer switch shall be listed for fire pump service.~~ [20:9.6.4] ~~[20:10.8.1.1]~~
(1) Power Source Selection. Selection of power source shall be performed by a transfer switch listed for fire pump service. [20:10.8.~~1~~.3.1]
(2) Overcurrent Device Selection. An instantaneous trip circuit breaker shall be permitted in lieu of the overcurrent devices specified in 695.4(B)(2)(a)(1) provided it is part of a transfer switch assembly listed for fire pump service which complies with 695.4(B)(2)(a)(2). ~~[20:10.8.2.2(2)]~~
Panel Statement: CMP 13 has corrected extract reference numbers by revising and deleting the extract reference number where necessary for consistency.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-38 Log #1360 NEC-P13 **Final Action: Accept in Principle**
(695.3(F))

Submitter: Douglas Stephens, ASCO Power Technologies (Firetrol)
Comment on Proposal No: 13-55a
Recommendation: Add text to read as follows:
(2) Overcurrent Device Selection. An instantaneous trip circuit breaker shall be permitted in lieu of the overcurrent devices specified in 695.4(B)(2) provided it is part of a transfer switch assembly listed for fire pump service.
Substantiation: This comment is submitted in support of the addition to 695.3(F) made by Mr. Czarnecki. A listed power transfer switch assembly with factory installed instantaneous trip circuit breakers for overcurrent protection in accordance with Arrangement II of NFPA20-2013 [10.8.2.2 and 9.2.3.4.1] is suitable for providing factory set, selective coordination of the overcurrent devices for both the normal and alternate sources with the downstream fire pump controller. These instantaneous trip breakers need only provide short-circuit protection since motor overload protection is provided by the circuit breaker locked rotor protector in the fire pump controller where the overload needs to be cleared.
A listed assembly provides certain protections to the owner and his property. It thwarts the wide-spread, improper use of instantaneous trip circuit breakers as standalone, overcurrent protection devices installed upstream of the traditional power transfer switch outside of a listed assembly. Including these devices in a listed assembly means that components, ratings, markings, testing, coordination, safety, instructions, etc. must all be investigated and approved by the agency. Further, it would mean that the isolating switch (optional) and circuit breaker are properly "supervised" as required by existing code. The bottom line is that the listed assembly takes all of the guess work out of coordination and supervision of the transfer switch with the fire pump controller and provides reliable power with proper protection for the owner and his property. The industry can install these listed assemblies ahead of the fire pump controller and use them with confidence.
Panel Meeting Action: Accept in Principle
Panel Statement: See the action on Comment 13-37.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-39 Log #1510 NEC-P13 **Final Action: Accept in Part**
(695.3(F) and (G))

Submitter: James S. Nasby, Skokie, IL
Comment on Proposal No: 13-55a
Recommendation: Continue to accept the Committee Action of this proposal as published in the CDRom version of the Report on Proposals. E.g.: Do NOT add the verbiage suggested by N. Czarnecki.
Substantiation: This is extract text. The suggested added verbiage by N. Czarnecki is new business. It raises very significant issues regarding:
1) protecting of field wiring upstream and downstream of the transfer switch., 2) transfer switch WIC and U.L. Listing coordination of upstream OCP., and 3) protection of service conductors. this applies to the normal source side and often to the emergency source side as well.
Panel Meeting Action: Accept in Part
Panel Statement: The submitter has not provided adequate technical substantiation. The inclusion of any text printed in the ROP does not constitute new material. See committee action on Comment 13-37.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-40 Log #292 NEC-P13 **Final Action: Accept in Principle**
(695.3(F)(2))

Submitter: John R. Kovacik, UL LLC
Comment on Proposal No: 13-55a
Recommendation: Add as new 695.3(F)(2) as recommended in Mr. Czarnecki's ballot comment on Proposal 13-55a:
(2) Overcurrent Device Selection. An instantaneous trip circuit breaker shall be permitted in lieu of the overcurrent devices specified in 695.4(B)(2) provided it is part of a transfer switch assembly listed for fire pump service.
Substantiation: Mr. Czarnecki's substantiation for the added text is correct. The new 695.3(F)(2) will complete the requirements needed in 695.3(F) to address the use of a dedicated transfer switch to provide an alternate source of power for a fire pump motor.
Panel Meeting Action: Accept in Principle
Panel Statement: See the action on Comment 13-37.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-41 Log #1468 NEC-P13 **Final Action: Accept**
(695.4(A))

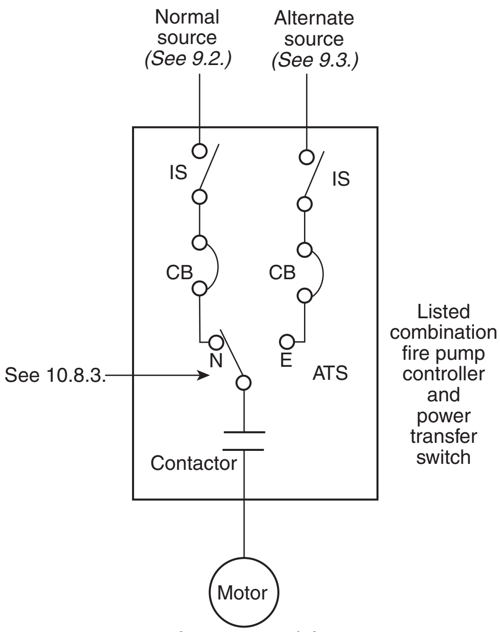
Submitter: John R. Kovacik, UL LLC
Comment on Proposal No: 13-55a
Recommendation: Add new text to read as follows:
695.4 Continuity of Power
Circuits that supply electric motor-driven fire pumps shall be supervised from inadvertent disconnection as covered in 695.4(A) or (B).
(A) Direct Connection. The supply conductors shall directly connect the power source to ~~either~~ a listed fire pump controller, or listed combination fire pump controller and power transfer switch, or a listed fire pump power transfer switch.
Substantiation: Proposal 13-55a clarified that the fire pump transfer switch shall be located in the pump room. Fire pump transfer switches are provided in two types, a combination fire pump controller and transfer switch, or a stand-alone fire pump transfer switch. The latter is omitted from 695.4 which define the permissible connection means from the power source to the fire pump equipment. The added text corrects this omission and correlates with the requirements of NFPA 20-2013.

See Figure A.10.8 of NFPA 20-2013 on Page 381.

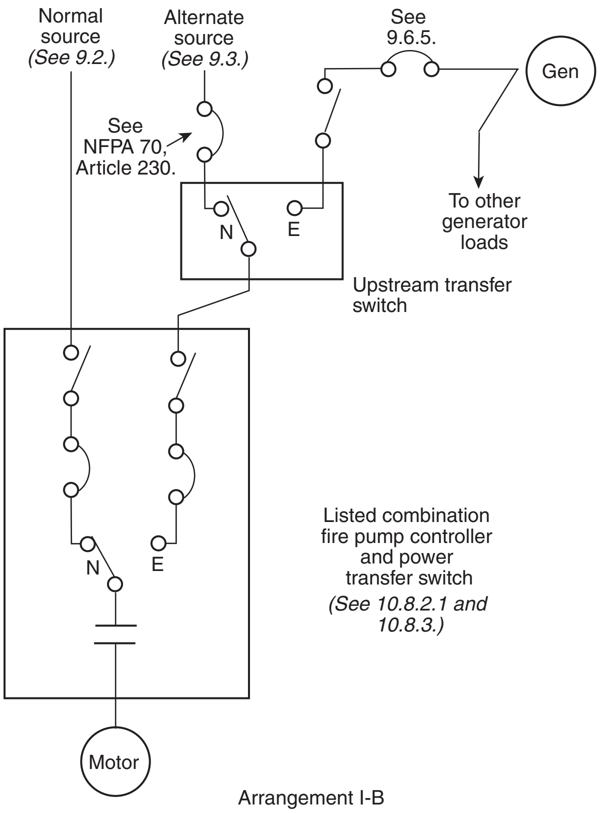
Panel Meeting Action: Accept
Panel Statement:
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-42 Log #771 NEC-P13 **Final Action: Reject**
(695.4(B)(2)(a))

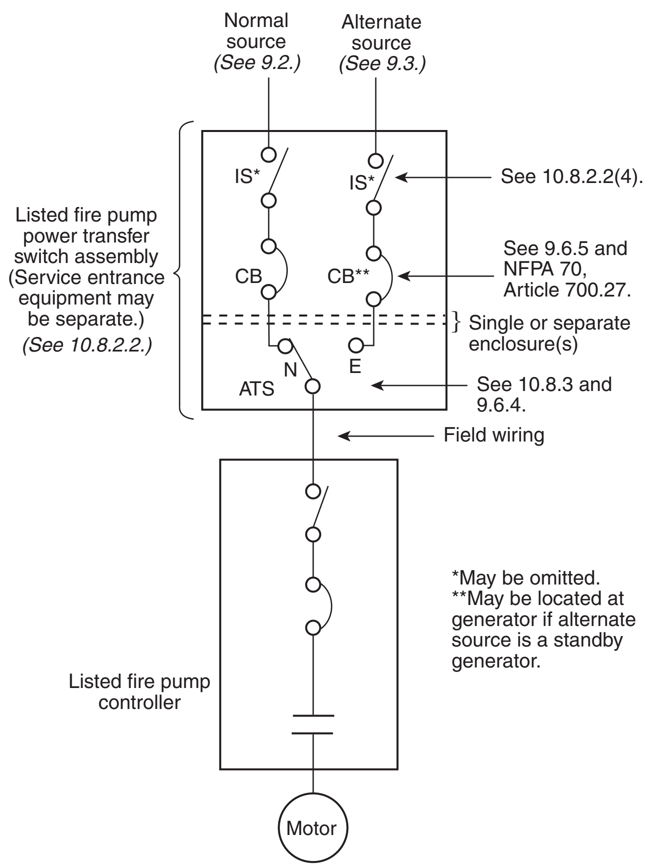
Submitter: Richard Schneider, Lancaster, SC
Comment on Proposal No: 13-59
Recommendation: Proposal 13-58 sufficiently covers the same subject in a format compliant with the NEC Style Manual. It is therefore suggested that, via this Comment, Proposal 13-59 merely refer to Proposal 13-58.
Substantiation: Proposal 13-58 correctly extracts 9.2.3.4 and 9.2.3.4.1 of NFPA 20 (2013).
Panel Meeting Action: Reject
Panel Statement: This comment does not contain a recommendation as required by 4.4.5(d) in the NFPA regulations Governing Committee Projects.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21



Arrangement I-A
(See 10.8.2.1.)



Arrangement I-B



Arrangement II
(See 10.8.2.2.)

13-43 Log #618 NEC-P13 **Final Action: Reject**
(695.4(B)(3)(a)(2))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 13-60
Recommendation: Revise text to read as follows:
695.4 Continuity of Power.
(B) Connection Through Disconnecting Means and Overcurrent Device.
3. Disconnecting Means.
(a) *Features and Location — Normal Power Source.*
(2) Be lockable in the closed and open position. The provision for locking or adding a lock to the disconnecting means shall be installed on or at the switch or circuit breaker used as the disconnecting means and shall remain in place with or without the lock installed. **[ROP 13–60]**
Substantiation: Allow the disconnecting means to be locked in the open position for servicing the motor.
Panel Meeting Action: Reject
Panel Statement: The present extract material only deals with the additional requirement of locking in the closed position.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-44 Log #619 NEC-P13 **Final Action: Reject**
(695.4(B)(3)(b)(5))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 13-61
Recommendation: Revise text to read as follows:
695.4 Continuity of Power.
(B) Connection Through Disconnecting Means and Overcurrent Device.
3. Disconnecting Means.
(b) *Features and Location — On-Site Standby Generator.* The disconnecting means for an on-site standby generator(s) used as the alternate power source shall be installed in accordance with 700.10(B)(5) for emergency circuits and shall be lockable in the closed or open position. The provision for locking or adding a lock to the disconnecting means shall be installed on or at the switch or circuit breaker used as the disconnecting means and shall remain in place with or without the lock installed. **[ROP 13–61]**
Substantiation: Allow the disconnecting means to be locked in the open position as required below:
445.18 Disconnecting means Required for Generators.
Generators shall be equipped with a disconnect(s), *lockable in the open position* in accordance with 110.25, by means of which the generator and all protective devices and control apparatus are able to be disconnected entirely from the circuits supplied by the generator except where both of the following conditions apply:
(1) The driving means for the generator can be readily shut down.
(2) The generator is not arranged to operate in parallel with another generator or other source of voltage.
Panel Meeting Action: Reject
Panel Statement: See Comment 13-43.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-45 Log #1033 NEC-P13 **Final Action: Reject**
(695.4(B)(3)(a))

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 13-60
Recommendation: Revise the proposal by referring to the new section 110.25.
(2) Be lockable in accordance with 110.25 ~~in the closed position.~~ Delete the remainder of (2).
Substantiation: This proposal satisfies the intent of the submitter while maintaining consistency with other sections of the Code that refer to the new section 110.25.
Panel Meeting Action: Reject
Panel Statement: The requirements of 110.25 are only for disconnects locked in the open position.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-46 Log #558 NEC-P13 **Final Action: Accept in Principle**
(695.6(A)(2)(d)(1))

Submitter: Richard E. Loyd, Sun Lakes, AZ
Comment on Proposal No: 13-68
Recommendation: Reconsider and retain (1) be encased in 50mm (2 inches) of concrete.
Substantiation: I agree with Degnan and Ode's comments on their negative voting.
This requirement has been in the code continuously since Article 695 first appeared in the NEC. The submitter is in error as the 2 hour fire rating being discussed was never a condition for using 695.6(A)(2)(d)(1). The committee's substantiation is also in error in comparing the 2 inches of concrete with a 2 hr fire rating.
There has been no substantiation to remove this useful condition of use, nor has there been any substantiation submitted that it compromises the safety of the building or that it has ever failed to provide protection during an actual fire.
Panel Meeting Action: Accept in Principle
Revise text to read as follows:
(d) Inside of a Building. Where routed through a building, the conductors shall be installed using one of the following methods:
(1) Be encased in a minimum ~~50~~ 100 mm (~~2~~ 4 in.) of concrete~~-~~
(2) Be installed under not less than 50 mm (2 in.) of concrete on grade
(~~2~~3) Be protected by a fire-rated assembly listed to achieve a minimum fire rating of 2 hours and dedicated to the fire pump circuit(s)
(~~3~~4) Be a listed electrical circuit protective system with a minimum 2-hour fire rating
Informational Note: UL guide information for electrical circuit protective systems (FHIT) contains information on proper installation requirements to maintain the fire rating.
Exception to (A)(2)(d): The supply conductors located in the electrical equipment room where they originate and in the fire pump room shall not be required to have the minimum 2-hour fire separation or fire resistance rating, unless otherwise required by 700.10(D) of this Code.
Panel Statement: The committee acknowledges that 2 in. of concrete is not sufficient to provide 2 hours of fire rating for areas other than a slab on grade. The committee continues to accept the 4 in. of concrete concept that was submitted during the 2011 cycle.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 18 Negative: 3
Explanation of Negative:
DEGNAN, J.: The submitter commented in support of retaining the 2" of concrete that is in the 2011 code, the panel's action to double the distance is not accepting the principle of the submitter's proposal, it is completely changing the submitter's intent.
While temperature performance issues have been identified with 2" of concrete, it is not clear that they will be resolved with 4" concrete. If the panel changes the code they should be able to cite field performance data that substantiates that 2" of concrete has resulted in loss of life in a statistically significant number of building fires, and that this will be corrected by extension to 4" of concrete.
ODE, M.: I agree with negative votes of Mr. Degnan and Mr. Spina. The Comment did not provide any technical substantiation for the change from 2 inches of concrete in the existing NEC text to 4 inches of concrete. There are many different factors that can affect heat transfer, other than the thickness of concrete. Pre-stressed concrete has a different heat transfer ratio than lightweight concrete, steel reinforcement within concrete will affect heat transfer, and the type of aggregate used within the concrete will also affect heat transfer. The NFPA Fire Protection Handbook states the following: "Reinforcing steel can also affect the amount of heat transfer that can occur within the concrete floor or wall." Concrete has a low thermal conductivity and a low thermal capacity. One of the more significant factors in determining the thermal characteristics of reinforced concrete is the type of aggregate used in the concrete and can vary throughout the United States. Concrete in direct contact with earth will have a different heat transfer than concrete installed as a wall or floor ceiling installation for multiple floor locations. Moisture content of the concrete will affect heat transfer. Furthermore, lightweight concrete has much different heat transfer rates than regular, reinforced, or pre-stressed concrete. The submitter could have provided a Fact Finding Study on the different types of concrete that could be used, the recommended thickness, and addressed the variables with the amount of heat transfer for each application so the Panel could act on the technical merits for this change, rather than just guessing at a depth of concrete. The 2-inch concrete thickness has been used for many NEC cycles to provide physical protection with some limited protection from heat transfer and should not be changed without proper technical substantiation for this change.
SPINA, M.: No technical substantiation of any safety concerns or evidence of failures has been provided to change the 2-inch requirement which has been part of the NEC for many cycles. Many factors play into the ability of concrete to transfer heat therefore any simple prescriptive requirement for a thickness does not guarantee any fire rating and is somewhat arbitrary. Furthermore, absolutely no technical substantiation was provided which supports the panel's assertion that conductors installed in conduits under a concrete slab on grade can be considered to have a 2-hour fire rating. The 2-inch requirement should remain intact until such time that a thorough study on the topic be performed and sound technical substantiation can accompany a proposal to change this time honored requirement.

13-47 Log #956 NEC-P13 **Final Action: Reject**
(695.6(A)(2)(d)(1))

Submitter: William A. Wolfe, Steel Tube Institute
Comment on Proposal No: 13-67
Recommendation: Reject the proposal and retain the text in the 2011 NEC.
Substantiation: This proposal removes the allowance for 2" of concrete which has for years been a recognized method of providing fire and mechanical protection for conductors. Sufficient substantiation for removing this long-held

option was not provided. The submitter states that it is documented in the International Building Code (IBC) that 2 inches of concrete is not eqllivalelll to 2-hr. fire protection. In fact, the 2012 mc Section 909.20.6.1 (provided) allows control and power wiring to be encased in 2" of concrete as an alternative to the use of 2 hour rated cable. fire barriers, etc. The IBC does not require a "listed" concrete assembly.

The permission for concrete encasement should also be retained in the NEC as a viable alternative to the other methods listed. The NEC 20 II Handbook describes the difference between - not eqllivalency of - the other 2 methods allowed in 695.6(A)(2)(d): a 2-hour fire rating of an electrical circuit and a 2-hour fire-resistance rating of a structural member, such as a wall. In September 2012, UL removed several Electrical Circuit Protective Systems as allowed in 695.6(A)(2)(d)(3) from the UL Fire Resistive Directory.

Note: Supporting material is available for review at NFPA Headquarters.

Panel Meeting Action: Reject

Panel Statement: See the panel action and statement on comment 13-46.

Number Eligible to Vote: 21

Ballot Results: Affirmative: 18 Negative: 3

Explanation of Negative:

DEGNAN, J.: See my statement on comment 13-46.

ODE, M.: See my statement on Comment 13-46.

SPINA, M.: See my statement on comment 13-46.

13-48 Log #957 NEC-P13 **Final Action: Reject**
(695.6(A)(2)(d)(1))

Submitter: William A. Wolfe, Steel Tube Institute

Comment on Proposal No: 13-68

Recommendation: Reject this proposal and retain the 2011 text in 695.6(A)(2)(d).

Substantiation: This proposal removes the allowance for 2" of concrete which has for years been a recognized method of providing fire and mechanical protection for conductors. Sufficient substantiation for removing this long-held option was not provided. The submitter states that it is documented in the International Building Code (IBC) that 2 inches of concrete is not equivalent to 2-hr. fire protection. In fact, the 2012 mc Section 909.20.6.1 (provided) allows control and power wiring to be encased in 2" of concrete as an alternative to the use of 2 hour rated cable, fire barriers, etc. The IBC does not require a "listed" concrete assembly.

The permission for concrete encasement should also be retained in the NEC as a viable alternative to the other methods listed. The NEC 2011 Handbook describes the difference between - not equivalency of - the other 2 methods allowed in 695.6(A)(2)(d): a 2-hour fire rating of an electrical circuit and a 2-hour fire -resistance rating of a structural member, such as a wall. In September 2012, UL removed several Electrical Circuit Protective Systems as allowed in 695.6(A)(2)(d)(3) from the UL Fire Resistive Directory.

Note: Supporting material is available for review at NFPA Headquarters.

Panel Meeting Action: Reject

Panel Statement: See the panel action and statement on Comment 13-46.

Number Eligible to Vote: 21

Ballot Results: Affirmative: 18 Negative: 3

Explanation of Negative:

DEGNAN, J.: See my statement on comment 13-46.

ODE, M.: See my statement on Comment 13-46.

SPINA, M.: See my statement on comment 13-46.

13-49 Log #1211 NEC-P13 **Final Action: Reject**
(695.6(A)(2)(d)(1))

Submitter: James S. Nasby, Skokie, IL

Comment on Proposal No: 13-67

Recommendation: Reject this proposal.

Substantiation: I agree with the negative vote comments by M. Ode. Also, the 2" concrete requirement appears over a dozen times in NFPA-70 and has been as such for many editions. No problem or difficulty was offered for changing this requirement. No cost-benefit data was given. This is a very ornerous requirement. This would require 280% more concrete for a 3-1/2" conduit installation; plus twice the floor area. This would be even more horrendous on retrofit installations. While I did agree with increasing the requirement for wire protective systems from one hour to two hours, this requirement does not correlate with how much concrete is equivalent. This also invalidates almost all UL Listed wiring systems.

Panel Meeting Action: Reject

Panel Statement: See the panel action and statement on Comment 13-46.

Number Eligible to Vote: 21

Ballot Results: Affirmative: 18 Negative: 3

Explanation of Negative:

DEGNAN, J.: See my statement on comment 13-46.

ODE, M.: See my statement on Comment 13-46.

SPINA, M.: See my statement on comment 13-46.

13-50 Log #1469 NEC-P13 **Final Action: Reject**
(695.6(A)(2)(d)(1))

Submitter: John R. Kovacik, UL LLC

Comment on Proposal No: 13-67

Recommendation: Reject Proposal 13-67.

Substantiation: I have discussed the content of this proposal with the NFPA 20 Fire Pump Committee and there is general agreement among the Committee members that there is no justification for removing the allowance for 2 in. of concrete. There were no incidents cited or problems identified that justify the removal of this requirement. The 2 in of concrete is a long-standing requirement that has a history and proven track record of providing adequate fire protection for conductors.

The added requirement that concrete or other material be listed to achieve a minimum fire rating is impractical for concrete. UL does not test concrete alone for a fire rating and such a program would be difficult if not impossible to develop based on the variables involved in preparation, finishing, curing, treating, etc.

The proponents of this proposal have argued that 2 in. of concrete does not equate to 2 hours of fire protection on the basis that the 2 in. concrete requirement was in NFPA 20 when the required fire rating for conductors was 1 hour, and the 2 in. concrete requirement was left unchanged when the fire rating for conductors was increased to 2 hours. The 2 in. of concrete has never been claimed to provide a specific time-sensitive fire rating or been considered to equate to a specific fire rating. It is an alternative method of protection for conductors and its removal from the NEC will cause a hardship in that it will force installers to use protection methods that may not be superior to 2 in. of concrete.

Panel Meeting Action: Reject

Panel Statement: See the panel action and statement on Comment 13-46.

Number Eligible to Vote: 21

Ballot Results: Affirmative: 18 Negative: 3

Explanation of Negative:

DEGNAN, J.: See my statement on comment 13-46.

ODE, M.: See my statement on Comment 13-46.

SPINA, M.: See my statement on comment 13-46.

13-51 Log #1470 NEC-P13 **Final Action: Reject**
(695.6(A)(2)(d))

Submitter: John R. Kovacik, UL LLC

Comment on Proposal No: 13-68

Recommendation: Reject Proposal 13-68.

Substantiation: I have discussed the content of this proposal with the NFPA 20 Fire Pump Committee and there is general agreement among the Committee members that there is no justification for removing the allowance for 2 in. of concrete. There were no incidents cited or problems identified that justify the removal of this requirement. The 2 in of concrete is a long-standing requirement that has a history and proven track record of providing adequate fire protection for conductors.

The added requirement that concrete or other material be listed to achieve a minimum fire rating is impractical for concrete. UL does not test concrete alone for a fire rating and such a program would be difficult if not impossible to develop based on the variables involved in preparation, finishing, curing, treating, etc.

The proponents of this proposal have argued that 2 in. of concrete does not equate to 2 hours of fire protection on the basis that the 2 in. concrete requirement was in NFPA 20 when the required fire rating for conductors was 1 hour, and the 2 in. concrete requirement was left unchanged when the fire rating for conductors was increased to 2 hours. The 2 in. of concrete has never been claimed to provide a specific time-sensitive fire rating or been considered to equate to a specific fire rating. It is an alternative method of protection for conductors and its removal from the NEC will cause a hardship in that it will force installers to use protection methods that may not be superior to 2 in. of concrete.

Panel Meeting Action: Reject

Panel Statement: See the panel action and statement on Comment 13-46.

Number Eligible to Vote: 21

Ballot Results: Affirmative: 18 Negative: 3

Explanation of Negative:

DEGNAN, J.: See my statement on comment 13-46.

ODE, M.: See my statement on Comment 13-46.

SPINA, M.: See my statement on comment 13-46.

13-52 Log #787 NEC-P13 **Final Action: Reject**
(695.6(B))

Submitter: Thomas Guida, TJG Services Inc.

Comment on Proposal No: 13-68

Recommendation: I support the Panel Action on this proposal.

Substantiation: None given.

Panel Meeting Action: Reject

Panel Statement: CMP 13 rejects this comment since it does not comply with the Regulations Governing Committee Projects 4.4.5(d). No substantiation was provided.

Number Eligible to Vote: 21

Ballot Results: Affirmative: 21

13-53 Log #1034 NEC-P13 **Final Action: Reject**
(695.6(B))

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 13-68
Recommendation: Reject the proposal.
Substantiation: I agree with Mr. Ode. Concrete encasement is a time-proven effect method for protecting conductors and wiring methods, not only in this article but in article 230 as well.
Panel Meeting Action: Reject
Panel Statement: See the panel action and statement on comment 13-46.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 18 Negative: 3
Explanation of Negative:
DEGNAN, J.: See my statement on comment 13-46.
ODE, M.: See my statement on Comment 13-46.
SPINA, M.: See my statement on comment 13-46.

13-54 Log #1213 NEC-P13 **Final Action: Accept in Principle**
(695.6(B))

Submitter: James S. Nasby, Skokie, IL
Comment on Proposal No: 13-68
Recommendation: Do not remove the option of 2 in. of concrete. Do not delete said text.
Substantiation: I agree with the negative vote comment by J. Degnan. Further, also, 2" concrete requirement appears over a dozen times in NFPA 70 and has been as such for many additions. No problem or difficulty was offered for changing this requirement. No cost-benefit data was given. This is a very onerous requirement. This would require 280% more concrete for a 3-1/2 conduit installation: plus twice the floor area. This would be even more horrendous on retrofit installations. While I didn't agree with increasing the requirements for wire protective systems from one hour to two hours, this requirement does not correlate with how much concrete is equivalent. This also invalidates almost all UL Listed wiring systems.
Panel Meeting Action: Accept in Principle
Panel Statement: See the panel action and statement on comment 13-46. CMP 13 does not agree with the submitter's substantiation.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 19 Negative: 2
Explanation of Negative:
DEGNAN, J.: See my statement on comment 13-46.
ODE, M.: See my statement on Comment 13-46.

13-55 Log #179 NEC-P13 **Final Action: Accept**
(695.6(D))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 13-70
Recommendation: It was the action of the Correlating Committee that the panel clarify the panel action on this proposal with respect to the panel actions taken on Proposals 13-71 and 13-75 relative to the order of the appearance of the accepted text in 695.6(D).
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-13 accepts the direction of the Correlating Committee to provide clarity. CMP-13 has accepted comments 13-57 and 13-58 to reject proposal 13-75.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-56 Log #1212 NEC-P13 **Final Action: Reject**
(695.6(D))

Submitter: James S. Nasby, Skokie, IL
Comment on Proposal No: 13-69
Recommendation: Accept this proposal. Specifically, remove the option of using "electrical metallic tubing," which was added during the last cycle.
Substantiation: EMT is not suitable for carrying conductors not protected at their rated ampacity. Fire pump circuits are protected at not less than 300% of the conductor rated ampacity. This is serifical on purpose, as required by NFPA 20. Further FMT has only 57% of the conductance of IMC and only 40% that of RC. Worse yet, is that the fault current will likely have to flow thru set-screw connections rather than threaded fittings (couplers). The result can be a hot motor, especially since many, if not most, fire pump circuit faults occur in the motor or its junction box. This is both a safety hazard as well as a fire hazard. For example, 3" EMT cross section is around 0.717in^2 but can house at least three 600 MCM wire at 0.471 in^2 each; but, steel is 10 to 12 times higher in resistivity. Hence the conduit will be at least five time higher in resistance and heating.
Panel Meeting Action: Reject
Panel Statement: The submitter has not provided adequate technical substantiation. A substantial amount of testing has been performed, including but not limited to the modeling and testing performed by the Georgia Institute of Technology proving that EMT is suitable for this application.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-57 Log #1377 NEC-P13 **Final Action: Accept**
(695.6(D))

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 13-75
Recommendation: This proposal should be rejected.
Substantiation: This revision to 695.6(D) was based on a comment on a proposal to NFPA 20 that had been rejected. The actual text from NFPA 20 now reads: "Where the raceway (conduit) between the controller and motor is not capable of conducting ground fault current sufficient to trip the circuit breaker when a ground fault occurs, a separate equipment grounding conductor shall be installed between the controller and motor." The substantiation for the NFPA 20 comment was incorrect since it stated: "EMT is suitable for normal branch circuits; but, not for fire pump circuits since these circuits must hold 300% forever downstream of the controller, 600% upstream, are often service entrance and are almost always high fault sources." This comment shows a misunderstanding of the use and sizing of conduit. A NEMA/Georgia Tech research report on grounding (attached) states the following:
- Comparably sized steel EMT, IMC and RIGID conduit will allow the flow of higher fault current than an equipment grounding conductor as listed in NEC Table 250-95
- Steel EMT, IMC and RIGID conduit are of sufficiently low impedance to limit the voltage to ground and facilitate the operation of the circuit protective devices in runs not exceeding the maximum allowable lengths detailed in this report. In most cases, the maximum allowable lengths exceed those permitted by the IAEI Soares Book on Grounding [1] using the same arc voltage and ground fault current.
- Where lengths do not exceed the maximum allowable computed by the method, supplemental grounding conductors in secondary power systems enclosed in steel EMT, IMC or RIGID conduit are not necessary.

In addition, the substantiation submitted with Proposal 13-75 is incorrect. It includes a reference to EMT and set-screw fittings as an example of a raceway that is not capable of conducting sufficient ground-fault to open the overcurrent protective device. Effective February 1996, UL 514B, the Standard for Safety for Conduit, Tubing and Cable Fittings required that all EMT fittings be subjected to a current test to determine if the EMT and the interface between the EMT and the fitting can effectively carry fault current, in order to permit operation of the overcurrent device and terminate fault current flow. In order to carry a UL listing, EMT fittings must pass this test. Article 358 (Electrical Metallic Tubing) requires the use of listed fittings.
NFPA 20 has jurisdiction over fire pumps. The NFPA 20 text has not been extracted - CMP 13 changed the wording and now has surpassed the requirements in NFPA 20 by requiring an equipment grounding conductor in all raceways without substantiation.
Panel Meeting Action: Accept
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-58 Log #1471 NEC-P13 **Final Action: Accept**
(695.6(D))

Submitter: John R. Kovacik, UL LLC
Comment on Proposal No: 13-75
Recommendation: Reject Proposal 13-75 and return the text of 695.6(D) to the 2011 Edition of the NEC.
Substantiation: Proposal 13-75 was the result of action taken by the NFPA 20 Committee on Stationary Fire Pumps in the 2013 Edition of their document to address reports of shorting of motor conductors and their connectors to the grounded metal of the motor termination box. After further consideration of this issue it is not clear that the problem cited is the result of inadequate equipment grounding provided by the raceway and its associated fittings. As such, there is no need to call into question the suitability of the allowable metallic raceways and fittings to serve as an equipment grounding conductor in this application. These raceways and their associated fittings perform adequately as an equipment grounding conductor when installed in accordance with the NEC. This includes electrical metallic tubing with set-screw fittings. In the absence of any clearly identified problem, the use of an additional grounding conductor would be redundant. It is also noted that the Panel Meeting Action does not align with the text of NFPA 20 that is identified as extract material. [20:9.9.5] The NFPA 20 text does not mandate the use of an additional grounding conductor. It is recommended that no action be taken on 695.6(D) until the Fire Pump Committee conducts an in-depth analysis of the problem to determine the proper corrective action.
Panel Meeting Action: Accept
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-58a Log #CC1302 NEC-P13 **Final Action: Accept**
(695.14(F))

Submitter: Code-Making Panel 13,
Comment on Proposal No: 13-85
Recommendation: Revise the action on Proposal 13-85 as follows:
(F) Generator Control Wiring Methods. Control conductors installed between the fire pump power transfer switch and the standby generator supplying the fire pump during normal power loss shall be kept entirely independent of all other wiring. They shall be protected to resist potential damage by fire or structural failure. They shall be permitted to be routed through a building(s) using one of the following methods:
(1) Be encased in a minimum ~~50~~ 100 mm (~~2~~ 4 in.) of concrete~~.~~
(2) Be installed under not less than 50 mm (2 in.) of concrete on grade
(~~2~~3) Be protected by a fire-rated assembly listed to achieve a minimum fire rating of 2 hours and dedicated to the fire pump circuits.
(~~3~~4) Be a listed electrical circuit protective system with a minimum 2-hour fire rating. The installation shall comply with any restrictions provided in the listing of the electrical circuit protective system used.
Informational Note: UL guide information for electrical circuit protective systems (FHIT) contains information on proper installation requirements to maintain the fire rating.
Substantiation: The committee acknowledges that 2 inches of concrete is not sufficient to provide 2 hours of fire rating for areas other than a slab on grade. The committee continues to accept the 4 inches of concrete concept that was submitted during the 2011 cycle. The committee considers the 4 inch concept to be enforceable.
Panel Meeting Action: Accept
Number Eligible to Vote: 21
Ballot Results: Affirmative: 17 Negative: 4
Explanation of Negative:
CZARNECKI, N.: The allowance for 2" concrete encasement has been an acceptable method for providing protection for years in this section of the Code and no substantiation has been provided to show there is a problem with its use. Contrary to the substantiation in Proposal 13-68, Section 909.20.6.1 of the International Building code does allow control and power wiring to be encased in 2" of concrete as an alternative to the use of 2 hour rated cable, fire barriers, etc. The NEC has long allowed the use of 2" concrete as a viable alternative to other methods allowed and the 2011 NFPA Handbook describes the difference between the allowable methods in 695.6(A)(2)d), not necessarily their equivalency.
DEGNAN, J.: See my statement on comment 13-46.
ODE, M.: I agree with the negative votes of Mr. Degnan, Mr. spina, and Mr. Czarnecki. See my statement on Comment 13-46.
SPINA, M.: See my statement on comment 13-46.

13-59 Log #958 NEC-P13 **Final Action: Reject**
(695.14(F))

Submitter: William A. Wolfe, Steel Tube Institute
Comment on Proposal No: 13-85
Recommendation: Reject the proposal and retain 2011 NEC text.
Substantiation: This proposal removes the allowance for 2" of concrete which has for years been a recognized method of providing fire and mechanical protection for conductors. Sufficient substantiation for removing this long-held option was not provided. The submitter states in his similar proposal to 13-67 that it is documented in the International Building Code (IBC) that 2 inches of concrete is not equivalelll to 2-hr. fire protection. In fact, the 2012 IBC Section 909.20.6.1 (provided) allows control and power wiring to be encased in 2" of concrete as an alternative to the use of 2 hour rated cable, fire barriers, etc. The IBC does not require a "listed" concrete assembly.
The permission for concrete encasement should also be retained in the NEC as a viable alternative to the other methods listed. The NEC 201 I Handbook describes the difference between - not equivalency of - the other 2 methods allowed in 695.6(A)(2)(d): a 2-hour fire rating of an electrical circuit and a 2-hour fire-resistance rating of a structural member, such as a wall. In September 2012, UL removed several Electrical Circuit Protective Systems as allowed in 695.6(A)(2)(d)(3) from the UL fire Resistive Directory.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: See 13-58a (Log #CC1302).
Number Eligible to Vote: 21
Ballot Results: Affirmative: 18 Negative: 3
Explanation of Negative:
DEGNAN, J.: See my statement on comment 13-46.
ODE, M.: See my statement on Comment 13-46.
SPINA, M.: See my statement on comment 13-46.

13-60 Log #1472 NEC-P13 **Final Action: Reject**
(695.14(F))

Submitter: John R. Kovacik, UL LLC
Comment on Proposal No: 13-85
Recommendation: Reject Proposal 13-85.
Substantiation: I have discussed the content of this proposal with the NFPA 20 Fire Pump Committee and there is general agreement among the Committee members that there is no justification for removing the allowance for 2 in. of concrete. There were no incidents cited or problems identified that justify the removal of this requirement. The 2 in of concrete is a long-standing requirement that has a history and proven track record of providing adequate fire protection for conductors.
The added requirement that concrete or other material be listed to achieve a minimum fire rating is impractical for concrete. UL does not test concrete alone for a fire rating and such a program would be difficult if not impossible to develop based on the variables involved in preparation, finishing, curing, treating, etc.
The proponents of this proposal have argued that 2 in. of concrete does not equate to 2 hours of fire protection on the basis that the 2 in. concrete requirement was in NFPA 20 when the required fire rating for conductors was 1 hour, and the 2 in. concrete requirement was left unchanged when the fire rating for conductors was increased to 2 hours. The 2 in. of concrete has never been claimed to provide a specific time-sensitive fire rating or been considered to equate to a specific fire rating. It is an alternative method of protection for conductors and its removal from the NEC will cause a hardship in that it will force installers to use protection methods that may not be superior to 2 in. of concrete.
Panel Meeting Action: Reject
Panel Statement: See 13-58a (Log #CC1302).
Number Eligible to Vote: 21
Ballot Results: Affirmative: 18 Negative: 3
Explanation of Negative:
DEGNAN, J.: See my statement on comment 13-46.
ODE, M.: See my statement on Comment 13-46.
SPINA, M.: See my statement on comment 13-46.

13-61 Log #788 NEC-P13 **Final Action: Reject**
(695.14(F)(1))

Submitter: Thomas Guida, TJG Services Inc.
Comment on Proposal No: 13-86
Recommendation: I support the Panel Action on this proposal.
Substantiation: None given.
Panel Meeting Action: Reject
Panel Statement: CMP 13 rejects this comment since it does not comply with the Regulations Governing Committee Projects 4.4.5(d). No substantiation was provided.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-62 Log #959 NEC-P13 **Final Action: Reject**
(695.14(F)(1))

Submitter: William A. Wolfe, Steel Tube Institute
Comment on Proposal No: 13-86
Recommendation: Reject this proposal and retain the text in 2011 NEC.
Substantiation: This proposal removes the allowance for 2" of concrete which has for years been a recognized method of providing fire and mechanical protection for conductors. Sufficient substantiation for removing this long-held option was not provided. The submitter states that it is documented in the International Building Code (IBC) that 2 inches of concrete is not eqllivalelll to 2·hr. fire protection. In fact, the 2012 mc Section 909.20.6.1 (provided) allows control and power wiring to be encased in 2" of concrete as an alternative to the use of 2 hour rated cable, fire barriers, etc. The IBC does not require a "listed" concrete assembly.
The permission for concrete encasement should also be retained in the NEC as a viable alternative to the other methods listed. The NEC 2011 Handbook describes the difference between - not equivalency of - the other 2 methods allowed in 695.6(A)(2)(d): a 2-hour fire rating of an electrical circuit and a 2-hour fire ·resistance rating of a structural member, such as a wall. In September 2012, UL removed several Electrical Circuit Protective Systems as allowed in 695.6(A)(2)(d)(3) from the UL Fire Resistive Directory.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: See 13-58a (Log #CC1302).
Number Eligible to Vote: 21
Ballot Results: Affirmative: 19 Negative: 2
Explanation of Negative:
DEGNAN, J.: See my statement on comment 13-46.
SPINA, M.: See my statement on comment 13-46.

ARTICLE 696 —ENERGY STORAGE SYSTEM (PROPOSED)

13-63 Log #86a NEC-P13 **Final Action: Accept**
(696 (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-375
Recommendation: The Correlating Committee advises that the location and assignment of new Articles is the responsibility of the Correlating Committee and the Correlating Committee Rejects the panel action.
The Correlating Committee directs that the Chairs of Code-Making Panels 4, 13, the Chair of the Correlating Committee DC Task Group, and the Chair of the NEC Smart Grid Task Group form a Task Group to reconsider this proposal, as the proposed text may be more suitable in this and other Articles. The Correlating Committee further directs that this proposal be forwarded to Code-Making Panels 4 and 13 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP 13 holds Proposal 4-375 in accordance with 4.4.6.2.2(c) of the Regulations Governing Committee Projects because it could not be properly handled within the timeframe for the report. CMP 13 will participate in the task group as directed by the correlating committee.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-64 Log #1079a NEC-P13 **Final Action: Hold**
(696 (New))

Submitter: John C. Wiles, Southwest Technology Development Institute, New Mexico State University
Comment on Proposal No: 4-375
Recommendation: Restore all of Part VII of Article 690, Storage Batteries to the text in the 2011 NEC Edition.
[Staff Note: This comment has also been submitted to Panel 4 for action.]
Substantiation: While this section was stricken in the Draft 2014 NEC, none of the requirements appear elsewhere in the Draft Code and the proposed new Article 696 addressing energy storage systems was NOT ADDED. Many of these requirements are critical to the safe installation and use of storage batteries and must remain in the NEC.
We suggest that these requirements remain in Article 690 Part VII for at least one edition of the Code after they have been firmly, correctly and completely established elsewhere in an appropriate section of the NEC.
Panel Meeting Action: Hold
Panel Statement: See the panel action and statement on Comment 13-63.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-65 Log #1383a NEC-P13 **Final Action: Hold**
(696 (New))

Submitter: Chad Kennedy, Schneider Electric
Comment on Proposal No: 4-375
Recommendation: Delete all proposed text.
Substantiation: Schneider Electric recognizes that energy storage solutions can have unique requirements and warrant specific requirements for a safe installation. However, there are concerns that the proposed requirements need more industry review and input prior to being included in the code. For example the requirements in the proposed 69X.11(C) seem to conflict with the committee action on 690.71(H) in ROP 4-325. The proposed text also contains a number of requirements for battery systems which may be better located in Article 480. In addition, some of the requirements seem to be directed at a particular installation type or size. The proposed 69X.11(F) would require a battery system disconnect to be accessible only to qualified personnel even in a dwelling installation. A better solution would be obtained through a task group working on this subject with new requirements proposed next cycle.
Panel Meeting Action: Hold
Panel Statement: See the panel action and statement on Comment 13-63.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

4-191 Log #86 NEC-P04 **Final Action: Accept**
(696 (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-375
Recommendation: The Correlating Committee advises that the location and assignment of new Articles is the responsibility of the Correlating Committee and the Correlating Committee Rejects the panel action.
The Correlating Committee directed that the Chairs of Code-Making Panels 4, 13, the Chair of the Correlating Committee DC Task Group, and the Chair of the NEC Smart Grid Task Group form a Task Group to reconsider this proposal, as the proposed text may be more suitable in this and other Articles. The Correlating Committee further directs that this proposal be forwarded to Code-Making Panels 4 and 13 for action.
This action will be considered as a public comment by Code-Making Panels 4 and 13.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the recommendation of the Correlating Committee. The panel will work with members of CMP 4, CMP 13, DC task group and smart grid task group to form a task group to address this matter.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

4-192 Log #1079 NEC-P04 **Final Action: Accept**
(696 (New))

Submitter: John C. Wiles, Southwest Technology Development Institute, New Mexico State University
Comment on Proposal No: 4-375
Recommendation: Restore all of Part VII of Article 690, Storage Batteries to the text in the 2011 NEC Edition.
[Staff Note: This comment has also been submitted to Panel 13 for action.]
Substantiation: While this section was stricken in the Draft 2014 NEC, none of the requirements appear elsewhere in the Draft Code and the proposed new Article 696 addressing energy storage systems was NOT ADDED. Many of these requirements are critical to the safe installation and use of storage batteries and must remain in the NEC.
We suggest that these requirements remain in Article 690 Part VII for at least one edition of the Code after they have been firmly, correctly and completely established elsewhere in an appropriate section of the NEC.
Panel Meeting Action: Accept
Panel Statement: The panel notes the correct reference is Part VIII Storage Batteries in 2011 NEC not Part VII.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

4-193 Log #1383 NEC-P04 **Final Action: Accept**
(696 (New))

Submitter: Chad Kennedy, Schneider Electric
Comment on Proposal No: 4-375
Recommendation: Delete all proposed text.
Substantiation: Schneider Electric recognizes that energy storage solutions can have unique requirements and warrant specific requirements for a safe installation. However, there are concerns that the proposed requirements need more industry review and input prior to being included in the code. For example the requirements in the proposed 69X.11(C) seem to conflict with the committee action on 690.71(H) in ROP 4-325. The proposed text also contains a number of requirements for battery systems which may be better located in Article 480. In addition, some of the requirements seem to be directed at a particular installation type or size. The proposed 69X.11(F) would require a battery system disconnect to be accessible only to qualified personnel even in a dwelling installation. A better solution would be obtained through a task group working on this subject with new requirements proposed next cycle.
Panel Meeting Action: Accept
Panel Statement: See panel action on Comment 4-192.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ARTICLE 700 — EMERGENCY SYSTEMS

13-65a Log #CC1301 NEC-P13 **Final Action: Accept**
(700.2, 700.27, 701.12(D), and 702.13)

Submitter: Code-Making Panel 13,
Comment on Proposal No: 13-91
Recommendation: By this committee comment CMP 13 rejects proposal 13-91, 13-130, 13-141, and 13-156.
Substantiation: CMP 13 rejects these proposals as they are better suited as Handbook material.
Panel Meeting Action: Accept
Number Eligible to Vote: 21
Ballot Results: Affirmative: 19 Negative: 2
Explanation of Negative:
CARON, D.: The figures presented were intentionally designed to be in the same format as the figures in Article 517.30, and convey similar information. They seek to clarify the many components making up the fire pump, emergency, legally required, optional standby, and COPS distribution systems that have a common connection to the stand-by source (the generator), but follow differing requirements. To coin a phrase; “a picture tells a thousand words”.
CZARNECKI, N.: The figures, as originally proposed in Proposals 13-91, 13-130, 13-141, and 13-156 provide guidance and clarity to the specifications

and divisions between emergency, legally-required, optional standby, and critical operations devices and wiring. The proposal to move them to the Code Handbook denies the readers of the Code the benefit of this clarification. Further, the action of CC1301 seeks only to request that NFPA Staff consider including the figures in the Code Handbook, as the Committee cannot direct Staff to make this addition. Finally, the action of CC1301 has the effect of removing the figures from the Code, an action in direct conflict with the Committee's original vote on the proposals, and in direct conflict with the received comments, and does so with no technical substantiation.

13-66 Log #414 NEC-P13 **Final Action: Reject**
(700.2)

Submitter: Daniel J. Caron, Bard, Rao + Athanas Consulting Engineers, LLC
Comment on Proposal No: 13-91
Recommendation: Revise figure as shown:

See Figure 700.2 on Page 388

Substantiation: Figure should be revised to show the various systems that could be connected to the alternate power source and should be consistent between Articles 695, 700, 701, 702 and 708.
Panel Meeting Action: Reject
Panel Statement: CMP 13 rejects the proposed revisions as they are better suited as handbook material. See 13-65a (Log #CC1301).
Number Eligible to Vote: 21
Ballot Results: Affirmative: 20 Negative: 1
Explanation of Negative:
CARON, D.: See my Explanation of Negative vote on Comment 13-65a.

13-67 Log #754 NEC-P13 **Final Action: Accept**
(700.5(C))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 13-95
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Panel Statement:
Number Eligible to Vote: 21
Ballot Results: Affirmative: 20 Negative: 1
Explanation of Negative:
BROWN, J.: It is recognized that increasing voltage from 600 volts to 1000 volts may be applicable to specific installations. However, adequate technical substantiation has not been provided to support the change in this Article.

13-68 Log #366 NEC-P13 **Final Action: Accept in Principle**
(700.8 (New))

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 13-98
Recommendation: Add text to read as follows:
<u>700.8 Surge Protection. A listed SPD of at least 10 kA Nominal Discharge Current I(n) shall be installed in or on all emergency system switchboards and panelboards.</u>
Substantiation: NEMA respectfully requests the code panel to reconsider its action. The revised text proposed as well as the additional substantiation below attempt to respond to the code panel's statement.
1) Why should surge protection be recommended for emergency systems?
Electronics are embedded within the infrastructure of facilities. These electronics monitor and control all aspects of the building with fire alarm systems, emergency lighting and exit lighting, generator and transfer equipment, and automatic load control relays. We are a reliant society on electronic control and communication, surge protection has the opportunity to ensure critical safety systems are not compromised and property damage within businesses are mitigated.
2) Levels of surge protection
a) The consulting and specifying engineering community through the American Institute of Architects (AIA) has a MasterSpec document referencing a level of 250 kA be used at service entrance location. While this document is not an absolute standard it is a common guideline and further work is being done to establish a recommendation. Additional consideration for support is found in NFPA 780 and their use of per phase surge protection of 20 kA nominal discharge current. All listed SPDs are qualified with surge rating per mode and this level supports the NFPA 780 recommendation.
b) Field Investigation from a utility distribution perspective. The use of surge protection in their distribution systems recognizes the need. Where the distribution system extends beyond the scope of NFPA 70, a recommended practice should be established from the NFPA standpoint.
Panel Meeting Action: Accept in Principle
Panel Statement: See the action on Comment 13-69. CMP 13 recognizes that UL 1449 3rd edition covers the required level of discharge current.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 20 Negative: 1
Explanation of Negative:
CARON, D.: See my explanation of Negative vote on Comment 13-69.

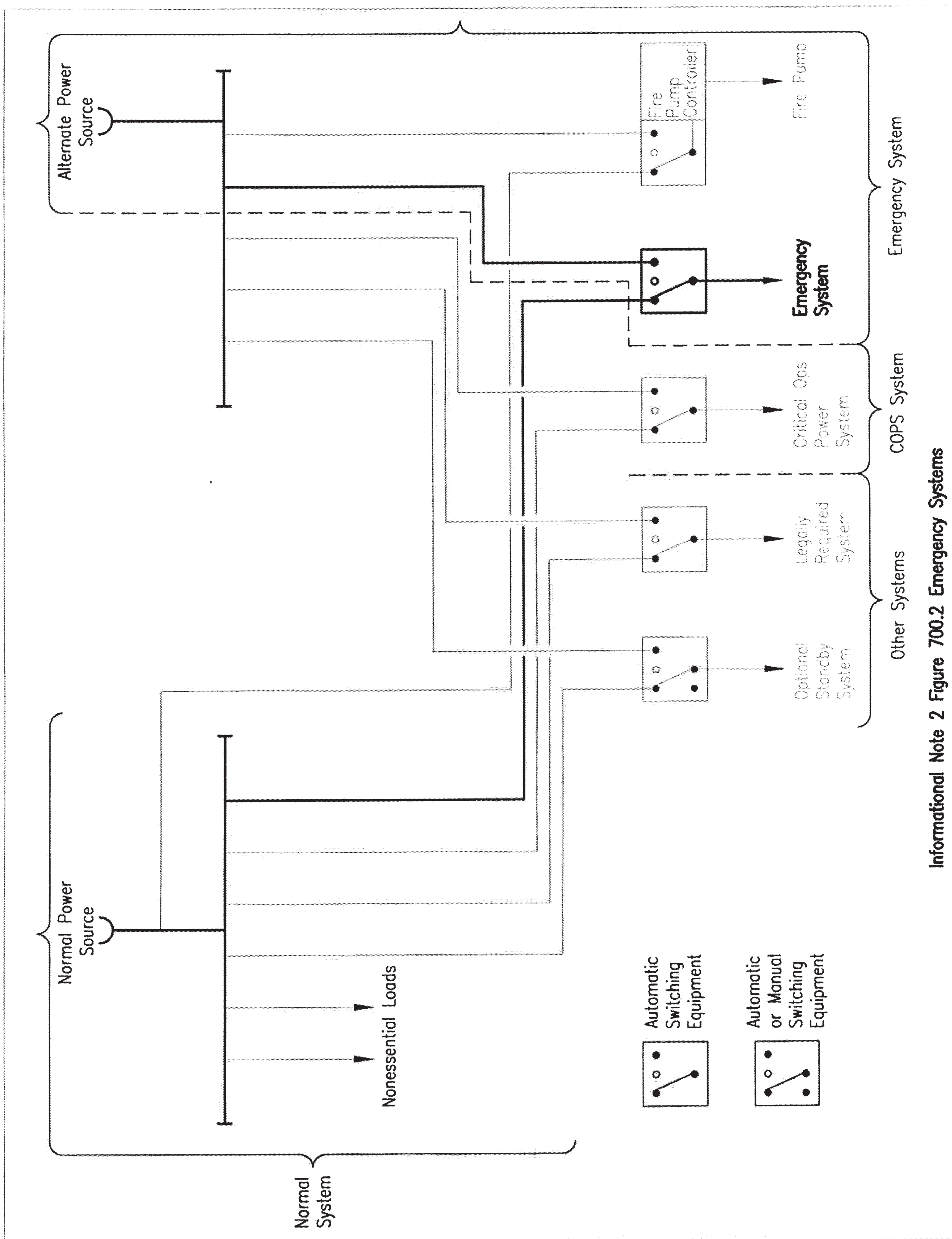
13-69 Log #766 NEC-P13 **Final Action: Accept**
(700.8 (New))

Submitter: Rob Redfoot, Eaton Corp.
Comment on Proposal No: 13-98
Recommendation: Add new text to read as follows:
<u>700.8 Surge Protection. A listed SPD shall be installed in or on all emergency systems switchboards and panelboards.</u>
Substantiation: The panel statement acknowledged that surges may result in failures but further substantiation of the type of SPD and level of protection was needed. UL 1449 3rd edition is the latest UL standard for SPD's and it defines four different types of surge protective devices and where each can be applied.

Type 1 - Before service disconnect
Type 2 - After service disconnect
Type 3 - At least 10 feet of conductor between service disconnect overcurrent device and and SPD
Type 4 - Component SPD (must be tested to the appropriate installation location where it will be installed.

The standard defined performance requirements for each of these different types of SPD's. Furthermore, IEEE C62.41 makes recommendations of size based on geographic location and incidents of lightning strikes. These are good guides and represent a significant amount of formal research that has been to define levels of protection.
Panel Meeting Action: Accept
Number Eligible to Vote: 21
Ballot Results: Affirmative: 20 Negative: 1

13-66 (Log #414) Figure 700.2



Informational Note 2 Figure 700.2 Emergency Systems

Explanation of Negative:

CARON, D.: The submitters substantiation does not cite any actual safety issues in the field due to a lack of SPD's, just anecdotal evidence that systems may be better if they are installed.

13-70 Log #1214 NEC-P13 **Final Action: Reject**
(700.9(B)(5))

Submitter: James S. Nasby, Skokie, IL
Comment on Proposal No: 13-99
Recommendation: Do NOT remove the option of using 2 in. of concrete. Eg., Do not delete said text.
Substantiation: 2" concrete requirement appears over a dozen times in NFPA 70 and has been as such for many editions. No problem or difficulty was offered for changing this requirement. No cost-benefit data was given. This is a very ornerous requirement. This would require 280% more concrete for a 3-1/2" conduit installation; plus twice the floor area. This would be even more horrendous on retrofit installations. While I did agree with increasing the requirement for wire protective systems from one hour to two hours, this requirement does not correlate with how much concrete is equivalent. This also invalidates almost all UL Listed wiring systems.
Panel Meeting Action: Reject
Panel Statement: Proposal 13-99 does not modify 700.10(D)(1)(5). See 13-75a (Log #CC1303).
Number Eligible to Vote: 21
Ballot Results: Affirmative: 19 Negative: 2
Explanation of Negative:

ODE, M.: See my statement on Comment 13-46.

SPINA, M.: See my statement on comment 13-46.

13-71 Log #789 NEC-P13 **Final Action: Reject**
(700.9(D)(1))

Submitter: Thomas Guida, TJG Services Inc.
Comment on Proposal No: 13-101
Recommendation: I support the Panel Action on this proposal.
Substantiation: None given.
Panel Meeting Action: Reject
Panel Statement: CMP 13 rejects this comment since it does not comply with the Regulations Governing Committee Projects 4.4.5(d). No substantiation was provided.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-72 Log #1473 NEC-P13 **Final Action: Reject**
(700.9(D)(1))

Submitter: John R. Kovacik, UL LLC
Comment on Proposal No: 13-101
Recommendation: Reject Proposal 13-101.
Substantiation: There were no incidents cited or problems identified that justify the removal of this requirement. The 2 in of concrete is a long-standing requirement that has a history and proven track record of providing adequate fire protection for conductors.

The added requirement that concrete or other material be listed to achieve a minimum fire rating is impractical for concrete. UL does not test concrete alone for a fire rating and such a program would be difficult if not impossible to develop based on the variables involved in preparation, finishing, curing, treating, etc.

The proponents of this proposal have argued that 2 in. of concrete does not equate to 2 hours of fire protection on the basis that the 2 in. concrete requirement was in the NFPA 20 Fire Pump Standard when the required fire rating for conductors was 1 hour, and the 2 in. concrete requirement was left unchanged when the fire rating for conductors was increased to 2 hours. The 2 in. of concrete has never been claimed to provide a specific time-sensitive fire rating or been considered to equate to a specific fire rating. It is an alternative method of protection for conductors and its removal from the NEC will cause a hardship in that it will force installers to use protection methods that may not be superior to 2 in. of concrete.
Panel Meeting Action: Reject
Panel Statement: See 13-75a (Log #CC1303).
Number Eligible to Vote: 21
Ballot Results: Affirmative: 18 Negative: 3
Explanation of Negative:

DEGNAN, J.: While temperature performance issues have been identified with 2" of concrete, it is not clear that they will be resolved with 4" concrete. If the panel changes the code they should be able to cite field performance data that substantiates that 2" of concrete has resulted in loss of life in a statistically significant number of building fires, and that this will be corrected by extension to 4" of concrete.

ODE, M.: See my statement on Comment 13-46.

SPINA, M.: See my statement on comment 13-46.

13-73 Log #159 NEC-P13 **Final Action: Accept**
(700.10(B)(5))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-181e
Recommendation: It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 13 for action in Article 700.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-13 accepts the direction of the Correlating Committee to take action on Proposal 9-181e. CMP-13 accepts in principle Proposal 9-181e. See the action taken on Proposal 13-103, which meets the intent of the submitter.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-74 Log #180 NEC-P13 **Final Action: Accept**
(700.10(B)(5))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 13-104
Recommendation: The Correlating Committee directs that the panel clarify the panel action on this proposal with respect to the text accepted by the panel action on Proposal 13-103.

The Correlating Committee also directs that these proposals be correlated with the action on Proposal 9-181e.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
The resulting text from the actions on Proposals 9-181e, 13-103 & 13-104 is provided for clarity:
700.10(B)(5) Wiring from an emergency source to supply ~~any combination of~~ emergency and other loads~~, legally required, or optional loads~~ in accordance with (a), (b), (c), and (d):

a. ~~From~~ sSeparate vertical switchgear sections or separate vertical switchboard sections, with or without a common bus, or ~~from~~ individual disconnects mounted in separate enclosures shall be used to separate emergency loads from all other loads.

b. The common bus of ~~or~~ separate sections of the switchgear, separate sections of the switchboard or the individual enclosures shall be permitted to be supplied by single or multiple feeders without overcurrent protection at the source.

Exception to (5)(b): Overcurrent protection shall be permitted at the source or for the equipment, provided the overcurrent protection complies with the requirements of 700.27.

c. ~~Legally required and optional standby~~ Emergency circuits shall not originate from the same vertical switchgear section, vertical switchboard section, panelboard enclosure, or individual disconnect enclosure as ~~emergency~~ other circuits.

d. It shall be permissible to utilize single or multiple feeders to supply distribution equipment between an emergency source and the point where the ~~combination of emergency, legally required, or optional~~ emergency loads are separated from all other loads.
Panel Statement: CMP-13 accepts the direction of the Correlating Committee to clarify and correlate the panel actions on Proposals 9-181e, 13-103 & 13-104.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-75 Log #415 NEC-P13 **Final Action: Reject**
(700.10(D))

Submitter: Daniel J. Caron, Bard, Rao + Athanas Consulting Engineers, LLC
Comment on Proposal No: 13-105
Recommendation: Revise text to read as follows:
(D) Fire Protection. Emergency systems shall meet the additional requirements in (D)(1) through (D)(3) ~~in assembly occupancies for not less than 1000 persons or in buildings above 23 m (75 ft) in height~~.
Substantiation: All emergency systems should be required to meet the requirements of (D)(1) through (D)(3). In the original substantiation provided by Mr. Guida, he states that "The need for fire protection of emergency system s is the same regardless of the occupancy classification." However, even after acceptance of his proposed revised text, the requirement only applies only to large places of assembly and high rise buildings. For instance, a large hospital that is only 4 floors (less than 75') would not be required to meet the requirements of (D)(l) through (D)(3).
Panel Meeting Action: Reject
Panel Statement: The existing text applies to assembly occupancies of not less than 1000 persons or buildings of greater than 75 ft in height. There wasn't any technical substantiation provided with the comment to justify applying these very specific fire protection techniques to all emergency feeder circuits and

equipment for all buildings. The removal of the quantity of persons and height thresholds should be given the opportunity for additional public review.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 16 Negative: 5
Explanation of Negative:
CARON, D.: CMP 13 missed an opportunity to expand upon accepted proposal 13-105, and include the requirements of 700.10(D) to all occupancies requiring emergency systems. Much discussion was had regarding the importance of 2 hour fire rated feeders, however, with 700.10(D) as written, 2 hour fire rated feeders are required on very few projects (high rise buildings and large places of assembly only)
I take exception to the Panel statement that this is new material. Please review my comment on Proposal 13-105 in the 2014 ROP. This is not new material.
LITTLE, L.: We are voting negative on the panel action to "Reject" comment 13-75. The submitter is correct, there is no practical reason to limit the fire protection requirements in 700.10(D) to assembly occupancies for not less than 1000 persons or in buildings above 75-feet in height. The submitter clearly provided adequate technical substantiation for this revision. Hospitals, schools, nursing homes, commercial structures and other occupancies may not contain areas for the assembly of 1000 persons. However, these occupancies may be extremely large without being taller than four of five stories in height. These occupancies should not be excluded from the fire protection requirements in 700.10(D).
NEESER, D.: This comment should have been accepted in addition to the deletion of occupancy types that was accepted at the ROP stage. The requirements for fire protection in emergency systems should not be based on the number of occupants or height of a building. The selection of 1000 persons or 75 ft in height should not determine when fire protection is required for emergency systems.
SPINA, M.: The requirements for fire protection in emergency systems should not be based on the occupancy capabilities or height of a building. A building with occupancy of less than 1000 persons or less than 75 ft in height should be provided with the same fire protection capabilities for emergency systems. The arbitrary selection of occupancy of 1000 persons or 75 ft in height has no bearing on when fire protection should be required for emergency systems.
WHITE, J.: We are voting "negative" on the committee action taken on 13-75. After consideration, we believe the submitter is correct in making the requirements of 700.10(D) mandatory for other types of facilities that may have assembly areas that will hold greater than 1,000 people or that may be less than 75 feet in height. As the submitter stated in his substantiation, many types of facilities, such as schools, hospitals and nursing homes may house hundreds of people, but not have an assembly area that holds 1,000 people.

13-75a Log #CC1303 NEC-P13 **Final Action: Accept**
(700.10(D)(1))

Submitter: Code-Making Panel 13,
Comment on Proposal No: 13-101
Recommendation: Revise the action on Proposal 13-101 as follows:
(1) Feeder-Circuit Wiring. Feeder-circuit wiring shall meet one of the following conditions:
(1) Be installed in spaces or areas that are fully protected by an approved automatic fire suppression system
(2) Be a listed electrical circuit protective system with a minimum 2-hour fire rating
Informational Note: UL guide information for electrical circuit protective systems (FHIT) contains information on proper installation requirements to maintain the fire rating.
~~(3) Be protected by a listed thermal barrier system for electrical system components with a minimum 2-hour fire rating~~
(~~4~~3) Be protected by a listed fire-rated assembly that has a minimum fire rating of 2 hours and contains only emergency
wiring circuits.
(4~~5~~) Be encased in a minimum ~~50~~ 100 mm (~~2~~ 4 in.) of concrete
(65) Be installed under not less than 50 mm (2 in.) of concrete on grade
Substantiation: The committee acknowledges that 2 inches of concrete is not sufficient to provide 2 hours of fire rating for areas other than a slab on grade. The committee continues to accept the 4 inches of concrete concept that was submitted during the 2011 cycle. The committee considers the 4 inch concept to be enforceable. The recommendation includes the action taken on Proposal 13-109 for clarity.
Panel Meeting Action: Accept
Number Eligible to Vote: 21
Ballot Results: Affirmative: 17 Negative: 4
Explanation of Negative:
CZARNECKI, N.: The allowance for 2" concrete encasement has been an acceptable method for providing protection for years in this section of the Code and no substantiation has been provided to show there is a problem with its use. Contrary to the substantiation in Proposal 13-68, Section 909.20.6.1 of the International Building code does allow control and power wiring to be encased in 2" of concrete as an alternative to the use of 2 hour rated cable, fire barriers, etc. The NEC has long allowed the use of 2" concrete as a viable alternative to other methods allowed and the 2011 NFPA Handbook describes the difference between the allowable methods in 695.6(A)(2)d), not necessarily their equivalency.
DEGNAN, J.: See my statement on comment 13-72.
ODE, M.: See my statement on Comment 13-46.
SPINA, M.: See my statement on comment 13-46.

13-76 Log #960 NEC-P13 **Final Action: Reject**
(700.10(D)(1))

Submitter: William A. Wolfe, Steel Tube Institute
Comment on Proposal No: 13-109
Recommendation: Reject this proposal and retain text from 20 II NEC.
Substantiation: This proposal removes the allowance for 2" of concrete which has for years been a recognized method of providing fire and mechanical protection for conductors. Sufficient substantiation for removing this long-held option was not provided. The submitter states that it is documented in the International Building Code (IBC) that 2 inches of concrete is not equivalency to 2-hr. fire protection. In fact, the 2012 IBC Section 909.20.6.1 (provided) allows control and power wiring to be encased in 2" of concrete as an alternative to the use of 2 hour rated cable fire barriers, etc. The BC does not require a "listed" concrete assembly.
The permission for concrete encasement should also be retained in the NEC as a viable alternative to the other methods listed. The NEC 2011 Handbook describes the difference between -not equivalency of - the other 2 methods allowed in 695.6(A)(2)(d): a 2·hour fire rating of an electrical circuit and a 2-hour fire-resistance rating of a structural member, such as a wall. In September 2012. UL removed several Electrical Circuit Protective Systems as allowed in 695.6(A)(2)(d)(3) from the UL Fire Resistive Directory.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: Proposal 13-109 does not modify 700.10(D)(1)(5). See 13-75a (Log #CC1303).
Number Eligible to Vote: 21
Ballot Results: Affirmative: 18 Negative: 3
Explanation of Negative:
DEGNAN, J.: See my statement on comment 13-72.
ODE, M.: See my statement on Comment 13-46.
SPINA, M.: See my statement on comment 13-46.

13-77 Log #416 NEC-P13 **Final Action: Reject**
(700.12(B)(6), 701.12(B)(5), and 702.12)

Submitter: Daniel J. Caron, Bard, Rao + Athanas Consulting Engineers, LLC
Comment on Proposal No: 13-111
Recommendation: Add text to read as follows:
(6) Outdoor Generator Sets. Outdoor housed generator sets) shall be equipped with a disconnecting means in accordance with (6)(a) or (6)(b):
(a) A disconnecting means. in accordance with 445. 18, mounted on or within the generator enclosure and located within sight of the building or structure supplied.
(b) A disconnecting means, in accordance with 445.18. mounted on or within the generator enclosure and an additional disconnecting means. in accordance with 225.36 located where ungrounded conductors serve or pass through the building or structure supplied.
Exception: For installations under single management. where conditions of maintenance and super vision ensure that only qualified persons will monitor and service the installation and where documented safe switching procedures are established and maintained for disconnection. the generator set disconnecting means shall not be required to be located within sight of the building or structure served and an additional disconnecting means, in accordance with 225.36 located where ungrounded conductors serve or pass through the building or structure supplied shall not be required.
Substantiation: The Article should be rewritten for clarity.
Panel Meeting Action: Reject
Panel Statement: The proposed revision would significantly revise the requirement and is not editorial. No technical substantiation was provided.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 19 Negative: 2
Explanation of Negative:
BOX, K.: The committee rejects the proposal based upon the fact that "the revision would significantly revise the requirement." If the requirement as it is written is confusing, unclear and presents a potential safety hazard, the committee's basis for rejection is unwarranted. The recommendation does in fact add clarity to to article and should be revised.
CARON, D.: The proposed re-write of Proposal 13-111 does not change the requirement at all, but makes the requirement easier to understand.

13-78 Log #620 NEC-P13 **Final Action: Reject**
(700.12(F)(2)(3) Exception)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 13-116
Recommendation: Revise text to read as follows:
700.12 General Requirements.
(F) Unit Equipment.
(2) Installation of Unit Equipment.

(3) The branch circuit feeding the unit equipment shall be the same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches.

Exception: In a separate and uninterrupted area supplied by a minimum of three normal lighting circuits that are not part of a multiwire branch circuit, a separate branch circuit for unit equipment shall be permitted if it originates from the same panelboard as that of the normal lighting circuits that are not part of a multiwire branch circuit and is ~~provided with a lock-on feature.~~ lockable in the closed position. **[ROP 13–116]**

Substantiation: Parallel the dominate "lockable" text:

110.25 Lockable Disconnecting Means. Where a disconnecting means is required to be *lockable open*, elsewhere in this *Code*, it shall be capable of being l*ocked in the open position*. The provisions for locking shall remain in place with or without the lock installed.

Panel Meeting Action: Reject

Panel Statement: The "lock-on feature" referred to in this exception is typically a device that is screwed tight to prevent inadvertent opening of the circuit.

Number Eligible to Vote: 21

Ballot Results: Affirmative: 21

13-79 Log #417 NEC-P13 **Final Action: Reject**
(700.20)

Submitter: Daniel J. Caron, Bard, Rao + Athanas Consulting Engineers, LLC

Comment on Proposal No: 13-119

Recommendation: Revise text to read as follows:

700.20 Switch Requirements.

(A) Arrangement. The switch or switches installed in emergency lighting circuits shall be arranged so that only authorized persons have control of emergency lighting.

Exception No. 1: Where two or more single-throw switches are connected in parallel to control a single circuit, at least one o/these switches shall be accessible only to authorized persons.

Exception No. 2: Additional switches that act only to put emergency lights into operation but not disconnect them shall be permissible.

(B) Series Connected or Three Way and Four Way Switches. Switches connected in series or 3- and 4-way switches shall not be used.

(C) Motion Sensors. Emergency lighting circuits shall be permitted to be switched by motion sensors, where all of the following conditions are met:

(1) Spacing between motion sensors is in accordance with manufacturer's instructions.

(2) Manual activation is not required to reenergize emergency lighting when the area is occupied.

(3) A non-adjustable time delay of 30 ~ minutes shall be required after the area is vacated prior to extinguishing of lighting for the area.

Exception to (C) (3): Motion sensors with lime delays shall be permitted, provided it is used in conjunction with an automatic load control relay that will automatically bypass the motion sensor and energize emergency lighting upon loss of normal power.

(4) Motion sensors shall not have a manual-off position.

Exception to 700.20: Exit signs shall not be permitted to be switched by any means.

Substantiation: Upon further reflection of the proposal, and commentary during the ROP, additional text has been added to alleviate some valid concerns.

Panel Meeting Action: Reject

Panel Statement: CMP-13 has rejected Proposal 13-119. See Comment 13-80.

Number Eligible to Vote: 21

Ballot Results: Affirmative: 20 Negative: 1

Explanation of Negative:

CARON, D.: Automatic load control relays (ALCR) are designed to turn emergency lights on during a normal power failure. There are many other types of "emergency:" situations, where the ALCR does not turn the lights on and motion sensors must operate solely by sensing occupancy, such as a fire alarm event, or other emergency situation where normal power is available. During these events, unoccupied areas are in darkness, and motion sensors alone turn the lights on when emergency or other personnel enter the area. There has been no evidence of motion sensors failing during these other types of emergency events.

13-80 Log #793 NEC-P13 **Final Action: Accept**
(700.20)

TCC Action: The Correlating Committee understands that the committee action is to reject proposal 13-119 in its entirety.

Submitter: Leon Hermans, LVS, Inc.

Comment on Proposal No: 13-119

Recommendation: Suggest rejecting Proposal 13-119 which would permit motion sensors to control emergency lighting circuits.

~~Motion Sensors It shall be permissible to control emergency lighting circuits with motion sensors, provided all of the following conditions are met:~~

~~(1) Spacing between motion sensors and installation is in accordance with manufacturer's instructions.~~

~~(2) Manual intervention is not required to reenergize emergency lighting when occupied.~~

~~(3) Areas must be vacant for 15 minutes continuously prior to extinguishing lighting.~~

Substantiation: The proposal should be rejected for the following reasons (detailed explanations follow summary):

1) Motion sensors are not fail-safe and may fail to illuminate lighting immediately even when a space is occupied. Only a 2 way transmitter/receiver design could be regarded as fail safe. Conditions such as fire and debris further degrade the performance of the motion sensors.

2) NFPA 101 Section 7.9.2.1 requires that "emergency illumination shall be provided for not less than 1-1/2 hours in the event of failure of normal lighting." The proposal would allow emergency lighting to be on for a period of only 15 minutes. NFPA 101 Section 7.9.2.2 details when emergency illumination is required and none of the requirements state that emergency lighting is required only in occupied areas.

3) The proposal does not solve any problem(s). The justification given is energy conservation: "Currently, most buildings with emergency generator backup for emergency lighting leave emergency lighting on 24/7/365."

This is inaccurate: NEC 700.2 defines Automatic Load Control Relays (ALCR's) which switch emergency lighting circuits, including wall switches, motion sensors, time clocks, and more. The ALCR's provide fail-safe ON operation, bypassing switching elements, during a power interruption. The proposed use of motion sensors without an ALCR would diminish the safety and reliability of the system. ALCR's have been widely accepted and used by industry for over 10 years.

sensor, blockage of the sensor, or an empty room, all of which will be interpreted as "LIGHTS OFF". The only fail-safe sensor would be a 2 way transmitter/receiver design such as a beam motion sensor, which is triggered when the received does not receive a signal from the transmitter (be it transmitter failure, or a person interrupting the beam by moving). For the purpose of emergency lighting, the first category of sensor should not be permitted because its operation is not fail-safe and will not guarantee that emergency lighting will illuminate when it is needed. The proposed motion sensor controlled emergency lighting system (in place of existing emergency lighting designs which come on automatically regardless of occupancy during a power interruption) would also degrade the ability of responders to perceive hazards in adjacent rooms and non-moving persons.

2) NFPA 101 Section 7.9.2.1 requires that emergency lighting stay on for a minimum of 90 minutes or until utility power is restored. The proposal would change these definitions to be "or for 15 minutes after a person is last detected." This is a major change to widely accepted life safety requirements (also used in IBC and UBC). This change should be considered in more detail to ensure consistent code requirements.

3) The proposal's justification.

"Currently, most buildings with emergency generator backup for emergency lighting leave emergency lighting on 24/7/365. In buildings that operate during set business hours and/or are vacant for significant periods of time (such as high rise commercial office buildings, out-patient facilities, etc.), this results in a substantial amount of wasted energy."

Does not recognize the wide use of ALCR's as defined in NEC 700.2. The same justification provided by the proposal was used to create ALCR's and led to their acceptance by the NEC. ALCR's can already be used with motion sensors, and other switching devices in compliance with all codes. ALCR's are also required to be tested and listed for use in emergency systems. Since the problem being solved by the proposal has already been addressed by the current edition of the NEC and by industry, this proposal would not offer any improvement from an energy conservation standpoint and would in fact diminish the safety of the emergency lighting system for the reasons discussed in 1) and 2).

Panel Meeting Action: Accept

Number Eligible to Vote: 21

Ballot Results: Affirmative: 20 Negative: 1

Explanation of Negative:

CARON, D.: See my Explanation of Negative vote on Comment 13-79.

13-81 Log #288 NEC-P13 **Final Action: Accept**
(700.24)

Submitter: Curtis Kasefang, Theatre Consultants Collaborative

Comment on Proposal No: 13-121

Recommendation: The following proposal was made by Steven Terry – I have suggested additional modifications (underlined).

700.24 (new), Directly Controlled Luminaires. Where emergency illumination is provided by one or more directly controlled luminaries that respond to an external control input to bypass normal control upon loss of normal power, such luminaires and external bypass controls shall be individually listed for use in emergency systems.

Substantiation: The code was written for externally dimmed and switched fixtures. Historically a listed transfer switch has been used to sense power loss and bypass dimming or switching to bring these devices to full. LED luminaries with onboard dimming capability are used widely at the moment. All have constant power input and are dimmed using serial or analog (0-10v) control schemes. In places of public assembly these are often used as emergency lights. To bring these devices to full in an emergency numerous unlisted schemes have been implemented. In code it is unclear as to the requirements for emergency switching of self dimming fixtures.

Philosophically be believe the intent is to have all intelligent devices in the emergency control signal chain listed for use in emergency systems. The initial proposal requires the fixture and its intelligent controls to have this listing. I am proposing that other devices in the signal chain also have that listing, such as devices that through serial communications or analog control sense power loss and tell the fixture to go to full. The resulting text when taken in combination with the existing text unambiguously requires that all devices that are required to bring a self dimming fixture to full are listed for this purpose, including the fixture itself.

Panel Meeting Action: Accept
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-82 Log #764 NEC-P13 **Final Action: Reject**
(700.26)

Submitter: Rob Redfoot, Eaton Corp.
Comment on Proposal No: 13-123
Recommendation: Revise text to read as follows:

700.26 Ground-Fault Protection of Equipment. The alternative source for emergency systems shall not be required to have ground-fault protection of equipment with automatic disconnecting means <u>and shall be selectively coordinated in accordance with 700.27</u>. Ground-fault indication of the emergency source shall be provided in accordance with 700.6(D).

Substantiation: The panel rejected this proposal based on argument that not having ground fault protection will help maintain power to emergency system. The problem is that most of these systems are solidly grounded systems. The purpose of low impedance ground is to provide a path for current to flow back to source at a level which will trip protective devices. Without ground fault protection there is very real possibility and many documented cases where the arcing fault current will not trip protective devices and could cause burn down of emergency equipment. As an example, with bonding impedance of.1 ohms, the fault current on 277V system would be only 2770 amps as a maximum. This would take a normal 1200A breakers several minutes to clear this fault without ground-fault protection. As mentioned above, there are many documented cases where emergency system has burned down because of low level ground faults. Reliability would be improved with the use of multi-level ground fault protection and zone interlocking to clear faults quickly and isolate them as close to fault point as possible. Attached is white paper on this subject.

Note: Supporting material is available for review at NFPA Headquarters.

Panel Meeting Action: Reject
Panel Statement: The added reference to 700.27 is unnecessary in 700.26 since emergency system overcurrent devices must already comply with selective coordination.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-83 Log #418 NEC-P13 **Final Action: Reject**
(700.27)

Submitter: Daniel J. Caron, Bard, Rao + Athanas Consulting Engineers, LLC
Comment on Proposal No: 13-124
Recommendation: Reconsider Proposal 13-124.
Substantiation: Although Panel 13 continues to support the action take in 2011 ROP Proposal 13-197, as stated in the Panel Statement, it is still clear that requirements on the normal system are outside the scope of Article 700 as stated by the Panel in 2011 and as clearly defined in Article 700.1 <u>"The provisions of this article apply to the electrical safety of the installation, operation, and maintenance of emergency systems</u> consisting of circuits and equipment intended to supply, distribute, and control electricity for illumination, power, or both, to required facilities <u>when the normal electrical supply or system is interrupted.</u>" (emphasis added)

Panel Meeting Action: Reject
Panel Statement: 700.1 clearly states that Article 700 has purview over the "electrical safety of the installation, operation, and maintenance of emergency systems consisting of circuits and equipment intended to supply, distribute, and control electricity for illumination, power, or both, to required facilities when the normal electrical supply or system is interrupted."

It is important to note that this section identifies the "circuits and equipment" covered in Article 700. It is the "circuits and equipment" that will be supplied by the alternate source "when the normal electrical supply or system is interrupted."

700.1 clearly states that Article 700 has purview over the "installation, operation, and maintenance" of these "circuits and equipment" that make up the emergency system. Article 700 has purview over both normal and emergency sources because they both supply "circuits and equipment" identified in 700.1

Number Eligible to Vote: 21
Ballot Results: Affirmative: 18 Negative: 3
Explanation of Negative:

BOX, K.: The "circuits and equipment" noted in the committee's response are shared circuits and equipment between the normal and emergency sources. 700.1 does not infer purview over the normal system. It clearly separates the normal system from the emergency system when the normal source is interrupted. The shared circuits are no longer energized by the normal source and are effectively disconnected from the normal source when the transfer switch is in the alternate source position.

CARON, D.: This Comment should have been accepted. The Panel Statement states, in part "Article 700 has purview over both normal and emergency sources because they both supply "circuits and equipment" identified in 700.1", however during the 2011 code Cycle, this same Panel made a different observation regarding Proposal 13-197, again, in part "The proposal for "(A) Normal System" covers devices in the normal source that are outside the scope of Article 700."

Although this Comment and Proposal 13-197 in the 2011 code cycle are completely different topics, Panel statements should be consistent for all proposal and comments. This Panel has to decide whether normal system circuits, equipment, devices, etc. are, or are not, in the scope of Article 700.

DEGNAN, J.: Anyone reading the chain of correspondence related to this comment, the original proposal, and the 2010 panel statements referenced in the proposal may be confused by what is or is not being stated by the panel and whether this does or does not constitute a change to the NEC.

The scope of Article 700, "Emergency Systems" is as defined in 700.1: the emergency system supplies, distributes and controls electrical power when the normal supply is interrupted. If the normal supply is interrupted the overcurrent devices on the normal side of the transfer switch are no longer in the circuit, are not part of the emergency system, and should not expect to be included with the requirements of 700.27.

The panel statement that Article 700 has purview over the normal source because the normal source supplies emergency circuits ignores the scope qualifier "when the normal electrical supply or system is interrupted" and should therefore be reevaluated.

A selectively coordinated emergency system is always available if the normal supply is interrupted from a utility failure or even if the normal side is interrupted because of a failure to selectively coordinate, hence requiring a selectively coordinated normal system results in a marginal gain in reliability. Those adopting the NEC may want to provide additional clarification statements if they require, or don't require some portion of the normal circuitry to be selectively coordinated. If they do require it, they must be specific as to whether that's one overcurrent protective device upstream from the transfer switch or all the way to the utility meter, which may be way upstream on a medium voltage distribution system. If the serving utility has fault currents in excess of 85000 amps it is also probable that selectively coordinating the normal side of an emergency system will mandate the use of fuses as overcurrent protective devices throughout the emergency system.

13-84 Log #419 NEC-P13 **Final Action: Reject**
(700.27)

Submitter: Daniel J. Caron, Bard, Rao + Athanas Consulting Engineers, LLC
Comment on Proposal No: 13-125
Recommendation: Reconsider Proposal 13 -125.
Substantiation: As stated in my explanation of my negative vote and in Ms. Little's comment on affirmative vote, Panel 13 in encouraged to seek a compromise between the Article 700.27 and NFPA 20 6.4.2.1.2.1. Without some relief to the strict interpretation, other special interests may seek to fine their own way to circumvent this provision. As is characterized by the many Proposals over the past few code cycles, this issue is not going away.

Panel Meeting Action: Reject
Panel Statement: No technical substantiation was provided.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 20 Negative: 1
Explanation of Negative:

CARON, D.: The Panel action should have been "Accept in Principal" and the Panel Statement should have been "See Panel Action and Statement on Comment 13-85"

13-85 Log #1433 NEC-P13 **Final Action: Accept in Part**
(700.27)

Submitter: Randy Hunter, Las Vegas, NV
Comment on Proposal No: 13-126
Recommendation: Revise text to read as follows:

700.27 Coordination.

Emergency system(s) overcurrent devices shall be selectively coordinated with all supply side overcurrent protective devices.

<u>Selective Coordination shall be selected by a licensed professional engineer or other qualified persons that are acceptable to the AHJ engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.</u>

Exception: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.

Substantiation: This proposal should have been accepted. The panel statement implies that the proposed language requires a licensed professional engineer only, but it does not. The original proposal clearly allows "or other qualified persons" to select the coordination. The qualification "acceptable to the AHJ" makes it clear that the AHJ has final say over who is qualified to choose selective coordination.

The last sentence in the panel substantiation stating that "… nor should the NEC get into licensing and stamping issues." is confusing, since other areas of the NEC (like 399.30 and 240.86(A)) require a licensed professional engineer. Certainly, emergency systems are important enough to justify requiring a qualified person, and being a licensed professional engineer is one way to demonstrate qualification.

Note that Panel 12 accepted similar language in Proposal 12-50 for 620.62.

Panel Meeting Action: Accept in Part

Revise the text to read as follows:

700.27 Selective **Coordination.** Emergency system(s) overcurrent devices shall be selectively coordinated with all supply side overcurrent protective devices.

Selective Coordination shall be selected by a licensed professional engineer or other qualified persons ~~that are acceptable to the AHJ~~ engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.

Exception: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.

Panel Statement: CMP-13 agrees with the substantiation that documentation as required in the revised wording will assist with the enforcement of the requirements for selective coordination. "Acceptable to the AHJ" is not necessary. CMP 13 now recognizes the need for this revision to assist the enforcement community with respect to this requirement.

Number Eligible to Vote: 21

Ballot Results: Affirmative: 20 Negative: 1

Explanation of Negative:

DEGNAN, J.: All states have laws that set thresholds for the type of electrical systems that require Professional Engineering, and emergency systems that protect safety and welfare are usually included within those thresholds. States may also adopt the NEC, however NEC statements regarding professional engineering can supplement state law, but not supplant it. If state law requires Professional Engineering the NEC's language of "other qualified persons" will not supplant the state's requirement. If the project has an emergency system that is outside of the state thresholds for professional engineering the language of "other qualified persons" is subjective, and no guidance is given as to what constitutes a "qualified person", which basically leaves the AHJ defenseless in any assessment of a person's qualifications. Accordingly the AHJ is in the same position with the "other qualified persons" language as they were before it was added into the code. For the most part this addition to the code won't accomplish much, and therefore is not worth adding.

Comment on Affirmative:

CARON, D.: The Panel is commended for finding a reasonable compromise to this requirement.

13-86 Log #1215 NEC-P13 **Final Action: Accept in Principle**
(700.100(D)(1)(5))

Submitter: James S. Nasby, Skokie, IL

Comment on Proposal No: 13-128

Recommendation: Do NOT remove the option of using 2 in. of concrete. E.g., Do not delete said text.

Substantiation: 2" concrete requirement appears over a dozen times in NFPA 70 and has been as such for many editions. No problem or difficulty was offered for changing this requirement. No cost-benefit data was given. This is a very ornerous requirement. This would require 280% more concrete for a 3 1/2" conduit installation; plus twice the floor area. This would be even more horrendous no retrofit installations. While I did agree with increasing the requirement for wire protective systems from one hour to tow hours, this requirement does not correlate with how much concrete is equivalent. This also invalidates almost all UL Listed wiring systems.

Panel Meeting Action: Accept in Principle

Panel Statement: See the action on 13-75a (Log #CC1303). CMP 13 does not agree with the submitter's substantiation.

Number Eligible to Vote: 21

Ballot Results: Affirmative: 18 Negative: 3

Explanation of Negative:

DEGNAN, J.: See my statement on comment 13-72.

ODE, M.: See my statement on Comment 13-46.

SPINA, M.: See my statement on comment 13-46.

13-87 Log #1474 NEC-P13 **Final Action: Reject**
(700.100(D)(1)(5))

Submitter: John R. Kovacik, UL LLC

Comment on Proposal No: 13-128

Recommendation: Reject Proposal 13-128.

Substantiation: There were no incidents cited or problems identified that justify the removal of this requirement. The 2 in of concrete is a long-standing requirement that has a history and proven track record of providing adequate fire protection for conductors.

The added requirement that concrete or other material be listed to achieve a minimum fire rating is impractical for concrete. UL does not test concrete alone for a fire rating and such a program would be difficult if not impossible to develop based on the variables involved in preparation, finishing, curing, treating, etc.

The proponents of this proposal have argued that 2 in. of concrete does not equate to 2 hours of fire protection on the basis that the 2 in. concrete requirement was in the NFPA 20 Fire Pump Standard when the required fire rating for conductors was 1 hour, and the 2 in. concrete requirement was left unchanged when the fire rating for conductors was increased to 2 hours. The 2 in. of concrete has never been claimed to provide a specific time-sensitive fire rating or been considered to equate to a specific fire rating. It is an alternative method of protection for conductors and its removal from the NEC will cause a hardship in that it will force installers to use protection methods that may not be superior to 2 in. of concrete.

Panel Meeting Action: Reject

Panel Statement: See 13-75a (Log #CC1303).

Number Eligible to Vote: 21

Ballot Results: Affirmative: 18 Negative: 3

Explanation of Negative:

DEGNAN, J.: See my statement on comment 13-72.

ODE, M.: See my statement on Comment 13-46.

SPINA, M.: See my statement on comment 13-46.

ARTICLE 701 — LEGALLY REQUIRED STANDBY SYSTEMS

13-88 Log #420 NEC-P13 **Final Action: Reject**
(701.2)

Submitter: Daniel J. Caron, Bard, Rao + Athanas Consulting Engineers, LLC

Comment on Proposal No: 13-130

Recommendation: Revise figure as shown:

See Figure 701.2 on Page 394

Substantiation: Figure should be revised to show the various systems that could be connected to the alternate power source and should be consistent between Articles 695, 700, 701, 702 and 708.

Panel Meeting Action: Reject

Panel Statement: CMP 13 rejects the proposed revisions as they are better suited as Handbook material. See 13-65a (Log #CC1301).

Number Eligible to Vote: 21

Ballot Results: Affirmative: 20 Negative: 1

Explanation of Negative:

CARON, D.: See my Explanation of Negative vote on Comment 13-65a.

13-89 Log #755 NEC-P13 **Final Action: Accept**
(701.5(C))

Submitter: James T. Dollard, Jr., IBEW Local 98

Comment on Proposal No: 13-132

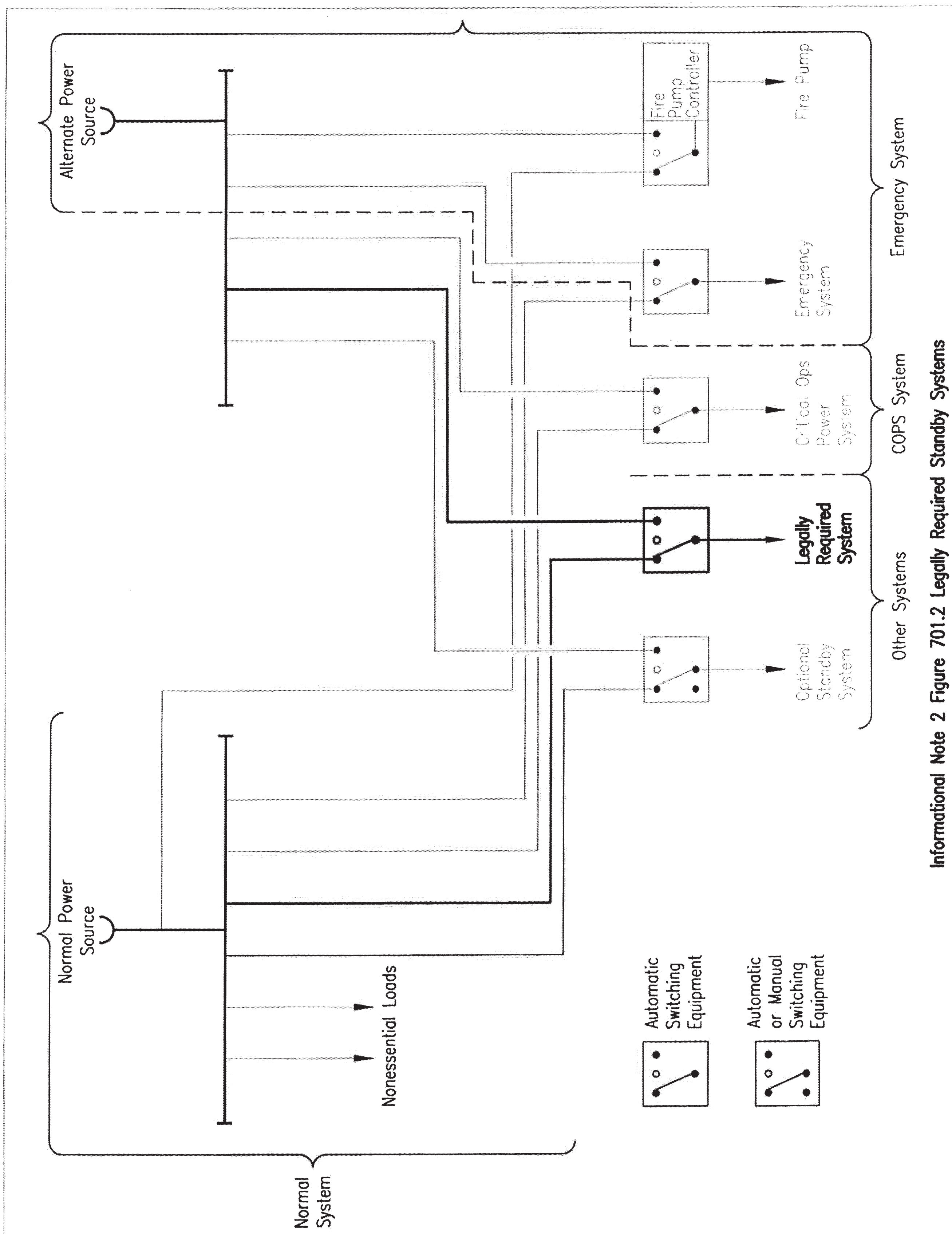
Recommendation: Continue to Accept.

Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The

13-88 (Log #420) Figure 701.2



Informational Note 2 Figure 701.2 Legally Required Standby Systems

success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 21
Ballot Results: Affirmative: 20 Negative: 1
Explanation of Negative:
BROWN, J.: It is recognized that increasing voltage from 600 volts to 1000 volts may be applicable to specific installations. However, adequate technical substantiation has not been provided to support the change in this Article.

13-90 Log #160 NEC-P13 **Final Action: Accept**
(701.12(E))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-181f
Recommendation: It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 13 for action in Article 701.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-13 accepts the direction of the Correlating Committee to take action on proposal 9-181f. CMP-13 Accepts in Principle Proposal 9-181f. See the action taken on Proposal 13-137 which meets the intent of the submitter.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-91 Log #615 NEC-P13 **Final Action: Reject**
(701.12(G) Exception)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 13-116
Recommendation: Revise text to read as follows:
700.12 General Requirements.
(G) Unit Equipment.
Exception: In a separate and uninterrupted area supplied by a minimum of three normal lighting circuits that are not part of a multiwire branch circuit, a separate branch circuit for unit equipment shall be permitted if it originates from the same panelboard as that of the normal lighting circuits that are not part of a multiwire branch circuit and is ~~provided with a lock-on feature.~~ lockable in the closed position.
Substantiation: Exactly the same text as 700.12(F)(2)(3) except:
Parallel the dominate "lockable" text:
110.25 Lockable Disconnecting Means. Where a disconnecting means is required to be *lockable open*, elsewhere in this *Code*, it shall be capable of being l*ocked in the open position*. The provisions for locking shall remain in place with or without the lock installed.
Panel Meeting Action: Reject
Panel Statement: The "lock-on feature" referred to in this exception is typically a device that is screwed tight to prevent inadvertent opening of the circuit.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-92 Log #1435 NEC-P13 **Final Action: Accept in Part**
(701.27)

Submitter: Randy Hunter, Las Vegas, NV
Comment on Proposal No: 13-139
Recommendation: Revise text to read as follows:
701.27 Coordination.
Legally required standby system(s) overcurrent devices shall be selectively coordinated with all supply side overcurrent protective devices. Selective Coordination shall be selected by a licensed professional engineer or other qualified persons that are acceptable to the AHJ engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate
the system.
Exception: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.
Substantiation: This proposal should have been accepted. The panel statement implies that the proposed language requires a licensed professional engineer only, but it does not. The original proposal clearly allows "or other qualified persons" to select the coordination. The qualification "acceptable to the AHJ" makes it clear that the AHJ has final say over who is qualified to choose selective coordination.
The last sentence in the panel substantiation stating that "… nor should the NEC get into licensing and stamping issues." is confusing, since other areas of the NEC (like 399.30 and 240.86(A)) require a licensed professional engineer. Certainly, emergency systems are important enough to justify requiring a qualified person, and being a licensed professional engineer is one way to demonstrate qualification.
Note that Panel 12 accepted similar language in Proposal 12-50 for 620.62.
Panel Meeting Action: Accept in Part
Revise text to read as follows:
700.27 Selective Coordination. Emergency system(s) overcurrent devices shall be selectively coordinated with all supply side overcurrent protective devices.
Selective Coordination shall be selected by a licensed professional engineer or other qualified persons ~~that are acceptable to the AHJ~~ engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.
Exception: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.
Panel Statement: CMP-13 agrees with the substantiation that documentation as required in the revised wording will assist with the enforcement of the requirements for selective coordination. "Acceptable to the AHJ" is not necessary. CMP 13 now recognizes the need for this revision to assist the enforcement community with respect to this requirement.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 20 Negative: 1
Explanation of Negative:
DEGNAN, J.: See my statement on comment 13-85.
Comment on Affirmative:
CARON, D.: See my Affirmative with Comment vote on Comment 13-85.

ARTICLE 702 — OPTIONAL STANDBY SYSTEMS

13-93 Log #421 NEC-P13 **Final Action: Reject**
(702.2)

Submitter: Daniel J. Caron, Bard, Rao + Athanas Consulting Engineers, LLC
Comment on Proposal No: 13-141
Recommendation: Revise figure as shown:

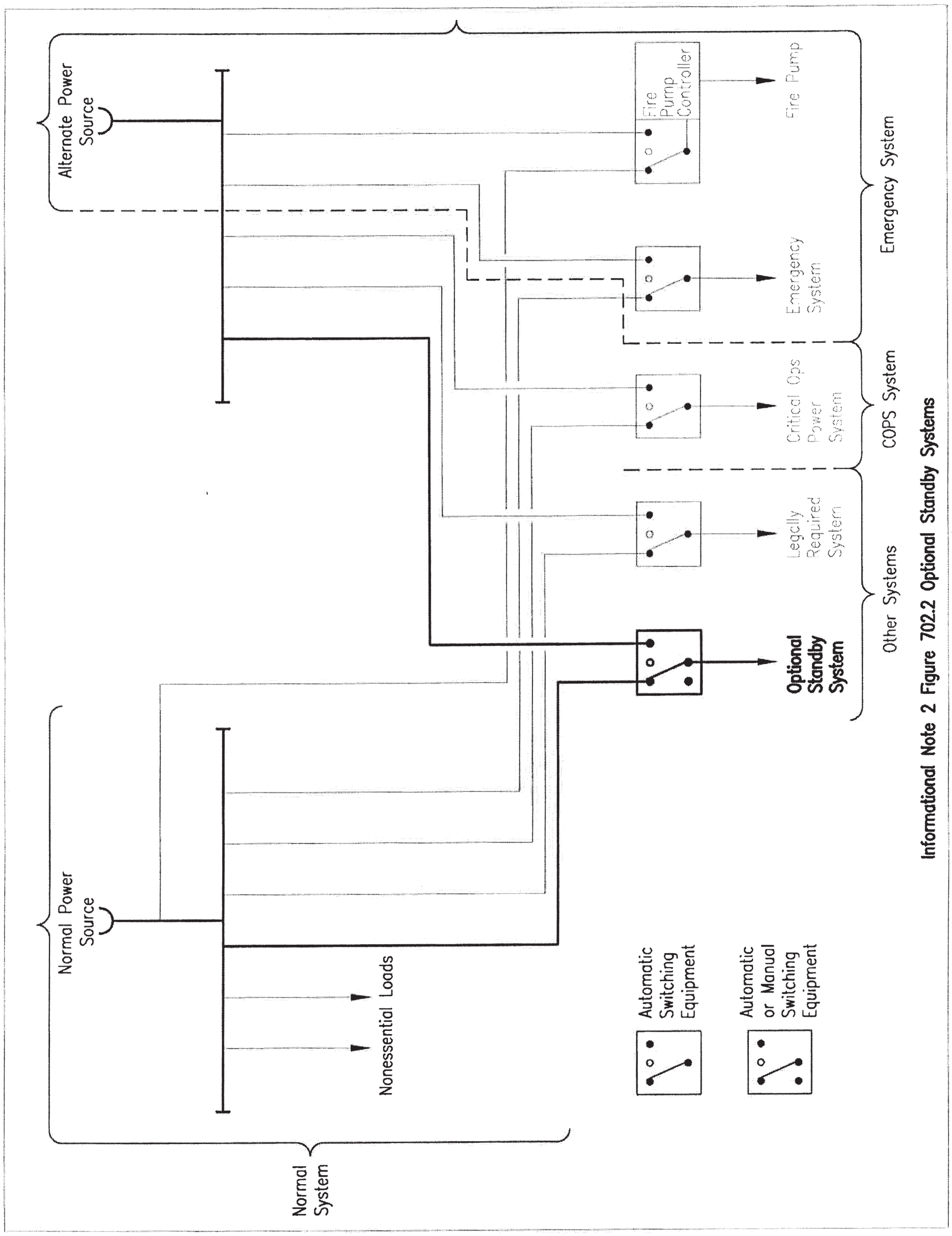
See Figure 702.2 on Page 396

Substantiation: Figure should be revised to show the various systems that could be connected to the alternate power source and should be consistent between Articles 695, 700, 701, 702 and 708.
Panel Meeting Action: Reject
Panel Statement: CMP 13 rejects the proposed revisions as they are better suited as Handbook material. See 13-65a (Log #CC1301).
Number Eligible to Vote: 21
Ballot Results: Affirmative: 20 Negative: 1
Explanation of Negative:
CARON, D.: See my Explanation on Negative vote on Comment 13-65a.

13-94 Log #488 NEC-P13 **Final Action: Accept**
(702.2.Optional Standby Systems and Informational Note)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 13-142
Recommendation: Revise text to read as follows:
Optional Standby Systems. Those systems intended to supply power to public or private facilities or property where life safety does not depend on the performance of the system. These ~~Optional standby~~ systems are intended to supply on-site generated power to selected loads either automatically or manually. **Informational Note:** Optional standby systems are typically installed to provide an alternate source of electric power for such facilities as

13-93 (Log #421) Figure 702.2



Informational Note 2 Figure 702.2 Optional Standby Systems

industrial and commercial buildings, farms, and residences and to serve loads such as heating and refrigeration systems, data processing and communications systems, and industrial processes that, when stopped during any power outage, could cause discomfort, serious interruption of the process, damage to the product or process, or the like.
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term and the NEC manual of style does not permit the definition to contain the defined term. I suggest a rewording that makes it consistent with the definitions of emergency systems and legally required systems.
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Panel Meeting Action: Accept
Panel Statement: No change to the existing informational note.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-95 Log #1362 NEC-P13 **Final Action: Reject**
(702.2.Optional Standby Systems)

Submitter: Mark Magee, Trindera Engineering
Comment on Proposal No: 13-141
Recommendation: Revise Figure 702.2 as follows:

See Figure 702.2 on Page 398

Substantiation: Although the optional standby system is fairly clearly depicted in the diagram, the selectively coordinated portion to interface
with the optional standby system does not appear to be. The optional standby system does need selective coordination downstream of the transfer switch in the
diagram, however, it does need selective coordination from the most upstream overcurrent protective device to the overcurrent protective device of the alternate
source of power. Should this not be accomplished, an overcurrent on the optional standby system could result in a nuisance trip of the alternate power source and all
related branches (700, 70 I, and 708).
Panel Meeting Action: Reject
Panel Statement: CMP 13 rejects the proposed revisions as they are better suited as Handbook material. See 13-65a (Log #CC1301).
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-96 Log #181 NEC-P13 **Final Action: Accept**
(702.7(C) (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 13-146
Recommendation: The Correlating Committee directs that this proposal be reconsidered with regard to the action taken on Proposal 1-114.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: CMP-13 accepts the direction of the correlating committee to reconsider Proposal 13-146 with regard to the action on Proposal 1-114. CMP-13 does not see any conflicts with regard to these separate actions. 702.7(C) will require a label and 110.21 will provide general requirements for all labels.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-97 Log #182 NEC-P13 **Final Action: Accept**
(702.11(A) and (B))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 13-148
Recommendation: The Correlating Committee directs that this proposal be reconsidered with regard to the action taken on Proposal 13-172a.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise 708.20(F)(5) as follows:
(5) Outdoor Generator Sets. Where an outdoor housed generator set is equipped with a readily accessible disconnecting means in accordance with 445.18, and the disconnecting means is located within sight of the building or structure supplied, an additional disconnecting means shall not be required where ungrounded conductors serve or pass through the building or structure. Where the generator supply conductors terminate at in a disconnecting means in or on a building or structure, the disconnecting means shall meet the requirements of 225.36.
Panel Statement: CMP-13 accepts the direction of the Correlating Committee to reconsider proposal 13-148 with regard to the action on proposal 13-172a. CMP-13 revises the action taken on proposal 13-172a for correlation and clarity.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-98 Log #1574 NEC-P13 **Final Action: Reject**
(702.11(C))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 13-149
Recommendation: Accept the proposal.
Substantiation: CMP 13 is to be commended for a remarkably thoughtful and complete panel statement, one of the best in this entire code cycle. The submitter would not pursue this further if it were not for the need for relief. Not only has UL 2201 required neutral bonding, that bonding must not be capable of field reversal. This means that the approach chosen by at least one manufacturer to provide for field bonding/unbonding along with detailed instructions as to when one or the other is appropriate will no longer be tenable. This will create a powerful incentive for untrained individuals, out of desperation, to open generator housings that should not be opened in order to make them work. The requirements in the proposal limit the amount of voltage drop on the neutral return path to a degree that will not pose other than extremely theoretical problems. The portion of the panel statement about a service reference point existing on the opposite side of the building is incorrect due to the distance limitations in the proposed (3) and (4). In addition, the requirement to mark the inlet with the need to unplug the generator after use further decreases the exposure.
Panel Meeting Action: Reject
Panel Statement: No additional technical substantiation has been provided. Transfer switches are readily available in multiple configurations providing the relief desired by the submitter and ensuring compliance with the NEC.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

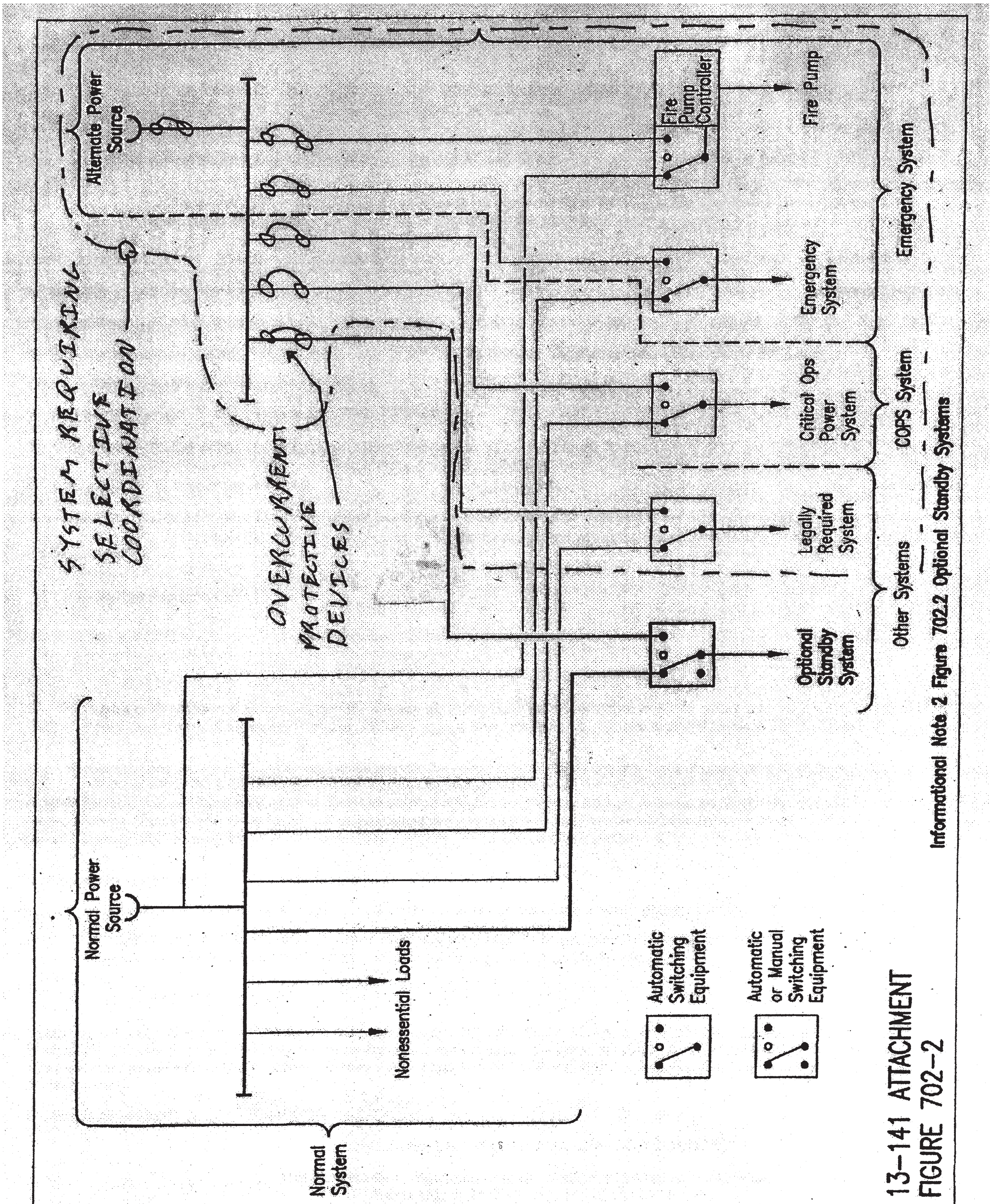
13-99 Log #1163 NEC-P13 **Final Action: Reject**
(702.12)

Submitter: Thomas A. Domitrovich, Eaton Corporation
Comment on Proposal No: 13-150
Recommendation: This proposal should have been accepted.
Substantiation: The panel rejected this proposal based on Section 445.18 of the code which requires a disconnecting means at or near a generator. However, the problem is that in many applications the disconnecting means required by 445.18 is out of the line of sight of remote inlets. When the generator is out of the line of sight from the inlet, the person who disconnects the leads at the inlet may not know whether or not the generator is on, or even that this inlet is supplied by a generator. The problem is that there is NO requirement for the disconnecting means to be at/near the inlet. Anyone can easily unplug the loads from the inlet while the generator is on. This change would ensure that disconnection is performed in a safe manner.
Panel Meeting Action: Reject
Panel Statement: CMP 13 rejects this comment since this may impact equipment not originally considered in the proposal. The submitter is encouraged to develop proposals in the next NEC cycle to incorporate this concept for the connection of portable generators to premises without regard to the type of system. Furthermore, any proposed text should address all levels of ampacity and types of equipment that may be impacted.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

4-194 Log #87 NEC-P04 **Final Action: Accept**
(702.12(D))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-375a
Recommendation: The Correlating Committee directs that the panel change the nonmandatory text to mandatory text in the Exception to (D)(2)(b).
This action will be considered as a public comment.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the recommendation of the Correlating Committee. The panel action on Comment 4-203 addresses the recommendation.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

13-95 (Log #1362) Figure 702.2



ARTICLE 705 — INTERCONNECTED ELECTRIC POWER PRODUCTION SOURCES

4-195 Log #88 NEC-P04 **Final Action: Accept**
(705.2)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 4-375b
Recommendation: The Correlating Committee directs that the panel revise the mandatory text using "shall" in the definitions to nonmandatory text in accordance with 2.3.1.4 of the NFPA Manual of Style.
This action will be considered by as a public comment.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise proposed 705.2 text to read as follows:
705.2 Hybrid System. A system comprised of multiple power sources. These power sources could include photovoltaic, wind, micro-hydro generators, engine-driven generators, and others, but do not include electric power production and distribution network systems. Energy storage systems such as batteries, flywheels, or superconducting magnetic storage equipment do not constitute a power source for the purpose of this definition. The energy regenerated by an overhauling (descending) elevator do not constitute a power source for the purpose of this definition.
Panel Statement: The panel accepts the recommendation of the Correlating Committee. The word "shall" was change to "do" in two locations.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-196 Log #1035 NEC-P04 **Final Action: Accept**
(705.2)

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 4-375b
Recommendation: Accept the propose change, but relocate it to Article 100. Furthermore, delete the definition from 690.2.
Substantiation: Having two definitions of the same thing, located in two different articles, doesn't make sense. Moving it to Article 100 fixes the issue.
Panel Meeting Action: Accept
Relocate Hybrid System definition to Article 100.
Delete Hybrid System definition from 690.2.
Panel Statement: The panel accepts relocating the revised definition in Comment 4-195 of Hybrid System from 705.2 to Article 100. The panel accepts the deletion of the definition of hybrid system from 690.2 to comply with Section 2.2.2.1 of the NEC Style Manual.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-197 Log #1080 NEC-P04 **Final Action: Reject**
(705.12)

Submitter: John C. Wiles, Southwest Technology Development Institute, New Mexico State University
Comment on Proposal No: 4-375a
Recommendation: Modify the ROP 4-375 language as follows:
(D) Utility-Interactive Inverters. The output of a utility interactive inverter shall be permitted to be connected to the load side of the service disconnecting means of the other source(s) at any distribution equipment on the premises. Where distribution equipment, including switchgear, switchboards, or panelboards, is fed simultaneously by a primary source(s) of electricity and one or more utility interactive inverters, and where this distribution equipment is capable of supplying multiple branch circuits or feeders or both, the interconnecting provisions for the utility interactive inverter(s) shall comply with (D)(1) through (D)(7).
(1) Dedicated Overcurrent and Disconnect. The source interconnection of ~~one or more~~ each inverter~~s~~ installed in one system shall be made at a dedicated circuit breaker or fusible disconnecting means.
(2) Bus or Conductor Ampere Rating. For all bus and feeder ampacity calculations, 125% of the inverter output circuit current shall be used. ~~In systems w~~ Where inverter output connections are made ~~at~~ to feeders, the calculations for load connections (taps), if any, shall use the rating of the existing overcurrent device in the circuit plus 125% of the inverter(s) rated output current as the overcurrent device protecting the conductors in the 240.21(B) calculations.
Where an inverter(s) is connected to an existing feeder, that feeder shall have an ampacity no less than the sum of the primary supply overcurrent device plus 125% of the inverter(s) rated output current.
Exception: Where the inverter(s) connection (s) and primary supply are at opposite ends of the feeder, the feeder shall have an ampacity no less than the larger of the primary supply overcurrent device or 125% of the rated output current of the inverter(s). And the feeder shall be marked at accessible point(s) every 3 meters (10 feet) with the following or equivalent wording:

WARNING:
MULTIPLE SOURCES OF POWER
DO NOT TAP

One of the methods in (a)-(d) shall be used to determine the ratings of busbars in panelboards:
(a) The sum of 125% of the inverter(s) output circuit current and the rating of the overcurrent device protecting the busbar shall not exceed the ampacity of the busbar.
Informational Note: This general rule assumes no limitation in the number of the loads or sources applied to a busbar or their locations.
(b) Where two or more sources, one utility and ~~the other an~~ one or more inverters, are located at opposite ends of a busbar that contains loads, the sum of 125% of the inverter(s) output circuit current and the rating of the overcurrent device protecting the busbar shall not exceed 120% the ampacity of the busbar. The busbar shall be sized at least for the loads connected in accordance with Article 220. A permanent warning label shall be applied to the distribution equipment adjacent to the backfed breaker from the inverter with the following or equivalent wording:

WARNING:
INVERTER OUTPUT CONNECTION,
DO NOT RELOCATE THIS OVERCURRENT DEVICE

The warning sign(s) or label (s) shall comply with 110.21(B).
Exception: Equipment with multiple ampacity busbars or center fed panelboards are not addressed by this provision.
(c) The sum of the ampere ratings of all overcurrent devices on panelboards, both load and supply devices, excluding the rating of the overcurrent device protecting the busbar, shall not exceed the ampacity of the busbar. The rating of the overcurrent device protecting the busbar shall not exceed the rating of the busbar. Permanent warning labels shall be applied to distribution equipment with the following or equivalent wording:

WARNING:
THIS EQUIPMENT FED BY MULTIPLE SOURCES.
TOTAL RATING OF ALL OVERCURRENT DEVICES,
EXCLUDING MAIN SUPPLY OVERCURRENT DEVICE,
SHALL NOT EXCEED AMPACITY OF BUSBAR.

The warning sign(s) or label(s) shall comply with 110.21(B).
(d) Connections shall be permitted on multiple ampacity busbars, or center fed panelboards where designed under engineering supervision that include fault studies and busbar load calculations.
(3) Marking. Equipment containing overcurrent devices in circuits supplying power to a busbar or conductor supplied from multiple sources shall be marked to indicate the presence of all sources.
(4) Suitable for Backfeed. Circuit breakers, if backfed, shall be suitable for such operation.
Informational Note: Fused disconnects, unless otherwise marked, are suitable for backfeeding.
(5) Fastening. Listed plug-in-type circuit breakers backfed from utility-interactive inverters that are listed and identified as interactive shall be permitted to omit the additional fastener normally required by 408.36(D) for such applications.
(6) Inverter Output Connection. The position of overcurrent devices supplying current to a conductor or busbar with respect to the position of the overcurrent devices connected to the utility source of supply shall be used to determine the calculated ampacity of the conductor or the rating of the panelboard bus bar in accordance with a, b and c.
(a) Where the overcurrent devices from inverter outputs supplying a panelboard are not located at the opposite end of the busbar from the utility input feeder or main overcurrent device location, the panelboard shall be rated not less than the sum of the ampere ratings of all overcurrent devices supplying it.

(b) In systems with panelboards connected in series, the rating of the first overcurrent device directly connected to the output of a utility-interactive inverter(s) shall be used in the calculations for all busbars and conductors where the circuits from the inverter supply sources are connected to the opposite end of the busbar or conductor from the circuit from the utility source of supply.
A permanent warning label shall be applied to the distribution equipment where backfed overcurrent devices may carry currents from the PV inverters with the following or equivalent wording:

WARNING
INVERTER OUTPUT CONNECTION
DO NOT RELOCATE THIS OVERCURRENT DEVICE

The warning sign(s) or label(s) shall comply with 110.21(B).
(c) The bus or conductor rating shall be sized not less than the loads connected in accordance with Article 220.
(7) Wire Harness and Exposed Cable Arc Fault Protection.
Utility interactive inverter(s) that have a wire harness or cable output circuit,

rated 240V, 30A or less, that is not installed within an enclosed raceway, shall be provided with listed AC AFCI protection.
Substantiation: (D)(1) As written, the text could (and will) be interpreted as allowing inverters to be paralleled on a single disconnect and OCPD and this could result in islanding and possible over loading of conductors under fault conditions. Only listed devices such as microinverters and ac PV modules have this allowance as part of the listing.
12(D)(2) The tap section was revised to clearly (hopefully) indicate that the material apples to load taps on feeders where inverters are on the circuit and does not apply to the inverter connections themselves.
The feeder section was added, because the ampacity of feeders with utility and PV inverter connections is not directly addressed anywhere. Connecting the output of a utility interactive inverter(s) through an OCPD/disconnect to the feeder inside a panel board is quite common in making load side connections. If an inverter is connected to the output of a breaker for a feeder, then that feeder may subject to the combined output of the breaker and the inverter if loads on the feeder are increased. The first paragraph addresses the general requirement for feeder protection. The exception brings common sense and engineering calculations into the equation, that is; where the supplies are at opposite ends of the feeders, then the maximum current that the feeder can see (at any point) is limited to the larger of the two sources. The warning is needed so that taps are not made and the tap rules corrupted when the second source is not known.
(2)(b). Covering the multiple inverter case. We should not have two conflicting ampacity requirements and the "at least" allows the conductors to be larger than load requirements when the inverters have high currents, but keeps the busbars sized to meet load requirements when there are no inverter currents.
(6) Revised for clarity. The language is pretty bad and has been for several cycles.
(6)(b) Revised to indicate that the only way to use the first OCPD device in the series panel calculations is where the OCPDs supplying each panel board or conductor are at the opposite ends of that panel board or conductor. If not, there is a potential for panel board or conductor overloading.
(6)(c) Added "not less than" to remove the conflicting double requirements on the ampacity calculation.
Panel Meeting Action: Reject
Panel Statement: Connections including taps do not require the summation of the output of the feeder breaker and the output of the inverter for ampacity calculations. See panel action on Comment 4-204.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-198 Log #10 NEC-P04 **Final Action: Reject**
(705.12(A))

Submitter: Abel Lampa, Innovative Engineering Inc.
Comment on Proposal No: N/A
Recommendation: Please add the following Text after the paragraph, Clarification:
This article does not include, when the facility is being metered at the high voltage compartment. You are still under the intent of this article, provided you install the PV circuit breaker on the line side of the low voltage main circuit breaker of the switchboard 01' panelboard.
Substantiation: Some inspectors & electricians interpret it otherwise. They thought that, since the main service is 5KV or 13.2 KV, that in order to connect at the line side, you have to connect it at medium or high voltage, that if you connect at the low voltage, you automatically under to load sideconnection article.
It is nice to clarify this, in order to save some time, money & effort.
Panel Meeting Action: Reject
Panel Statement: This comment does not comply with Section 4.4.5(b) of the NFPA Regulations Governing Committee Projects in that it does not identify the document, proposal number to which the comment is directed, and paragraph of the document to which the comment is directed.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-199 Log #161 NEC-P04 **Final Action: Accept**
(705.12(D))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 9-181g
Recommendation: It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 4 for action in Article 705.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-200 Log #1575 NEC-P04 **Final Action: Reject**
(705.12(D))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 4-393
Recommendation: Accept the proposal.
Substantiation: The panel statement is incorrect with respect to the connection of unlisted power sources. Section 705.12(C) specifically allows sources over 100 kW, or medium voltage sources of any size, to be connected at any point provided there is the usual qualified maintenance and supervision. If such sources, particularly large utilization voltage cogenerations systems are connected at the nearest panelboard, the objections addressed for utility-interactive inverters should apply. This submitter vividly recalls wiring a 120 kW 480V cogeneration system as a back-feeding source into the nearest 480V panel. Absolutely no attention was paid to the size relative to the receiving bus and the position of the source breaker on the bus. The work was done in the 1980s, long before these concerns had surfaced. However, this source could be wired today exactly as it was in 1986 because the discrepancies between what is now 705.12(C) and 705.12(D) have never been addressed. The proposal should be accepted in some form so these wiring arrangements do not continue.
Panel Meeting Action: Reject
Panel Statement: Rather than move this information to utility interactive inverter in 705.12(D), a proposal should be submitted at the code cycle to revise 705.12(C) and to address the submitter's concern.
Requirements of 705.12(D) were specifically accepted because utility interactive inverter designs are tested and listed per UL-1741, which provides specific over/under voltage, over/under frequency, and loss of utility connection protection. Synchronous and induction generating systems require specific engineering supervision to design their interconnection, and are not restricted to the requirements of 705.12(D).
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13 Negative: 1
Explanation of Negative:
ROGERS, J.: This comment and the related proposal should have been accepted. The submitter is correct that these systems are being installed and there needs to be a set of requirements to connect these systems in a safe manner. The language that has been submitted provides a clear set of enforceable installation requirements to connect these systems in the same manner as inverter type systems are connected.

4-201 Log #12 NEC-P04 **Final Action: Reject**
(705.12(D)(2))

Submitter: Abel Lampa, Innovative Engineering Inc.
Comment on Proposal No: N/A
Recommendation: Please add the following Text after the paragraph. Clarification:
If the existing Main Panel Board does not have a Main Circuit Breaker, then you can install a circuit breaker feeding the PV inverters which has a capacity equal to 125% of the capacity of the bus bar of the existing Panel Board, provided the total number of circuit breakers at the panel is not more than 5.
Substantiation: Some inspectors & electricians interpret it otherwise, when you connect a circuit breaker at the load side of the panel, which limit the capacity of the circuit breaker that will feed the PV inverters. I say, since there is no main breaker, the main breaker is 0, therefore I can install a circuit breaker that will feed the inverters equal to 125% of the capacity of the main busbar. The industry can save tons on money, if you clarify this.
Panel Meeting Action: Reject
Panel Statement: This comment does not comply with Section 4.4.5(b) of the NFPA Regulations Governing Committee Projects in that it does not identify the document, proposal number to which the comment is directed, and paragraph of the document to which the comment is directed.
See panel action on Comment 4-204. Adding this text would allow panelboards to be overloaded without proper protection.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 14

4-202 Log #871 NEC-P04 **Final Action: Reject**
(705.12(D)(2)(c))

Submitter: C. Douglas White, Center Point Energy / Rep. Edison Electric Institute/Electric Light & Power Group
Comment on Proposal No: 4-375a
Recommendation: The panel should have accepted in principle in part the panel proposal as follows:
Delete section 705.12(D)(2)(c) and re-number 705.12(D)(2)(d) as 705.12(D)(2)(c)
~~(c) The sum of the ampere ratings of all overcurrent devices on panelboards, both load and supply devices, excluding the rating of the overcurrent device protecting the busbar, shall not exceed the ampacity of the busbar. The rating of the overcurrent device protecting the busbar shall not exceed the rating of the busbar. Permanent warning labels shall be applied to distribution equipment with the following or equivalent wording:~~

~~WARNING:~~
~~THIS EQUIPMENT FED BY MULTIPLE SOURCES.~~
~~TOTAL RATING OF ALL OVERCURRENT DEVICES,~~
~~EXCLUDING MAIN SUPPLY OVERCURRENT DEVICE,~~
~~SHALL NOT EXCEED AMPACITY OF BUSBAR.~~

~~The warning sign(s) or label (s) shall comply with 110.21(B)~~.

~~(d)~~ (c) Connections shall be permitted on multiple ampacity busbars, or center fed panelboards where designed under engineering supervision that include fault studies and busbar load calculations.

Substantiation: The proposed 705.12(D)(2)(c) should be removed. The proposed text of this section relies on a field summation of load and source overcurrent device ratings and a warning sign to provide overload protection for an electrical panel. Overload protection should be inherently safe by design and not rely on varying field conditions and adherence to warning placards.

Panel Meeting Action: Reject

Panel Statement: It is possible to limit current on a busbar with the main breaker or by limiting the sum of the branch circuit breakers on the panel. Either method is valid. Historically supply of current only came from the utility supply. With utility interactive inverters current can be sourced on the load side and safely connected to distribution wiring. The sign is a reminder as to how current is limited.

Good practice for anyone adding a load to an electrical system whether supplied by PV or other sources mandates adherence to Chapter 2 of the NEC and load calculations should be considered prior to adding any loads.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13 Negative: 1

Explanation of Negative:

MCDANIEL, R.: The panel action should have been to Accept the comment in Principle and revise the text to limit this requirement to AC combiner panels, where multiple inverter ac output circuits are terminated. This requirement if applied to a service panel will be difficult to enforce. Service panels can be installed with up to 70 single pole overcurrent device spaces. Other articles in the NEC require dedicated branch circuits to specific load areas in 1 and 2 family residential dwellings, which require installation of many overcurrent devices. Many installations exist where the sum of all branch and feeder overcurrent device ratings in a panel exceed the panel's bus ampacity rating. A warning sign may not be sufficient to prohibit the end user from adding additional branch circuit overcurrent devices, such as extending a dedicated branch circuit to a new bathroom. An electrical panel's overcurrent protection should be inherent in the design and not rely on field summation of overcurrent device ratings and adherence to a sign that is not part of the panel's labeling from the manufacturer.

4-203 Log #1507 NEC-P04 **Final Action: Accept**
(705.12(D)(2)(b) Exception)

Submitter: William F. Brooks, Brooks Engineering

Comment on Proposal No: 4-375a

Recommendation: Delete 705.12(D)(2)(b) Exception as follows:

~~Exception: Equipment with multiple ampacity busbars or center fed panelboards are not addressed by this provision.~~

Substantiation: The TCC requested CMP4 to address the non-mandatory wording in the Exception. The most efficient way to address the non-mandatory wording is to remove it. The exception word is unnecessary since multiple ampacity busbars or center-fed panelboards are not addressed in this provision. However, they are addressed in 705.12(D)(2)(d). Removing the extraneous words of the Exception improve the readability of the section and does not alter the meaning or intent of the section in any way. The Exception was actually worded as an Informational Note and yet an Information Note is unnecessary here.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-204 Log #1603 NEC-P04 **Final Action: Accept in Principle**
(705.12(D)(2))

Submitter: William F. Brooks, Brooks Engineering

Comment on Proposal No: 4-375a

Recommendation: Revise text to read as follows:

(2) Bus or Conductor Ampere Rating. ~~For all bus and feeder ampacity calculations,~~ 125% of the inverter output circuit current shall be used in ampacity calculations for the following.

(1) Feeders. Where the inverter output connection is made to a feeder at a location other than the opposite end of the feeder from the primary source overcurrent device, that portion of the feeder on the load side of the inverter output connection shall be protected by one of the following:

a. feeder ampacity shall not be less than the sum of the primary source overcurrent device and 125% of the inverter output circuit current, or

b. an overcurrent device rated not greater than the ampacity of the feeder.

(2) Taps. In systems where inverter output connections are made at feeders, any ~~load~~ taps must be sized based on the sum of 125% of the inverter(s) output circuit current and the rating of the overcurrent device protecting the feeder conductors as calculated in 240.21(B).

(3) Busbars. One of the methods in (a)-(d) shall be used to determine the ratings of busbars in panelboards:

(no change in the remainder of 705.12(D)(2))

Substantiation: The panel proposal 4-375a, and the proposals on which it was based, neglected to provide direction on the proper methods to prevent overcurrent on feeders that have inverter output circuits connected to them. The panel proposal 4-375a did cover load taps and busbars. In order to clarify the enforcement of this section for AHJs and contractors, the three main areas were enumerated for clarity. The key concern is that the addition of a utility-interactive inverter supply presents a potential overload condition for the feeder and main lug only (MLO) panelboards on the load side of the inverter interconnection point. By making sure that the ampacity of the feeder is sufficient for both sources, or by installing an overcurrent device on the feeder on the load side of the inverter interconnection point, the feeder is protected. The busbar of the MLO panelboard can be protected by the overcurrent device installed at the interconnection point or by installing a main overcurrent device on the panelboard to prevent busbar overcurrent. The requirement to protect busbar overcurrent is already found in 705.12(D)(2)(3)(a).

The language for taps and busbars was retained unchanged except for one minor change related to taps. The word "load" was deleted to make it clear that any tap conductor, whether for loads or for an inverter output circuit, would be required to follow the tap rule when the tap rule sizing requirement exceeds the load of the tap or the supply of the inverter output circuit.

Explanatory diagrams have been provided to illustrate the concepts.

Note: Supporting Material is available for review at NFPA headquarters.

Panel Meeting Action: Accept in Principle

Revise wording of 705.12(D)(2) as follows:

(2) Bus or Conductor Ampere Rating. ~~For all bus and feeder ampacity calculations,~~ 125% of the inverter output circuit current shall be used in ampacity calculations for the following.

(1) Feeders. Where the inverter output connection is made to a feeder at a location other than the opposite end of the feeder from the primary source overcurrent device, that portion of the feeder on the load side of the inverter output connection shall be protected by one of the following:

(a) the feeder ampacity shall not be less than the sum of the primary source overcurrent device and 125% of the inverter output circuit current, or

(b) an overcurrent device on the load side of the inverter connection rated not greater than the ampacity of the feeder.

(2) Taps. In systems where inverter output connections are made at feeders, any ~~load~~ taps must be sized based on the sum of 125% of the inverter(s) output circuit current and the rating of the overcurrent device protecting the feeder conductors as calculated in 240.21(B).

(3) Busbars. One of the following methods ~~in (a)-(d)~~ shall be used to determine the ratings of busbars in panelboards:

(no change in the remainder of 705.12(D)(2))

Panel Statement: The word "the" was added in (2)(1)(a). The words "on the load side of the inverter connection" were added in (2)(1)(b).

The word "following" was added and the words "in (a)-(d)" were deleted in (3).

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-205 Log #9 NEC-P04 **Final Action: Reject**
(705.12(D)(2) Exception)

Submitter: Abel Lampa, Innovative Engineering Inc.

Comment on Proposal No: N/A

Recommendation: Add the following text after the paragraph.

Exception: The new panelboard being installed by the installer which feed multiple inverter shall not be included under this requirement. Also we can install warning sign at the panel to say: " Warning: photovoItaic panel, do not add load or circuit breakers to tins panelboard.

Substantiation: Some inspectors & electricians I talked to about this, thought that the new panel board is included on this article & therefore, they have to increase the bus bar capacity of the new panelboard unnecessarily to satisfy the code.

Panel Meeting Action: Reject

Panel Statement: This comment does not comply with Section 4.4.5(b) of the NFPA Regulations Governing Committee Projects in that it does not identify the proposal number to which the comment is directed. The recommended text does not follow the NEC Style Manual.

See panel action on Comment 4-204 which addresses the submitter's concern.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-206 Log #1508 NEC-P04 **Final Action: Accept**
(705.12(D)(6))

Submitter: William F. Brooks, Brooks Engineering

Comment on Proposal No: 4-375a

Recommendation: Remove section erroneously retained by NFPA staff and renumber section accordingly:

~~(6) Inverter Output Connection. Unless the panelboard is rated not less than the~~

~~sum of the ampere ratings of all overcurrent devices supplying it, a connection in a panelboard shall be positioned at the opposite (load) end from the input feeder location or main circuit location. The bus or conductor rating shall be sized for the loads connected in accordance with Article 220. In systems with panelboards connected in series, the rating of the first overcurrent device directly connected to the output of a utility-interactive inverter(s) shall be used in the calculations for all busbars and conductors. A permanent warning label shall be applied to the distribution equipment with the following or equivalent wording:~~

~~WARNING~~
~~INVERTER OUTPUT CONNECTION~~
~~DO NOT RELOCATE THIS OVERCURRENT DEVICE~~
~~The warning sign(s) or label(s) shall comply with 110.21(B).~~

(~~7~~) (6) Wire Harness and Exposed Cable Arc Fault Protection. Utility interactive inverter(s) that have a wire harness or cable output circuit, rated 240V, 30A or less, that is not installed within an enclosed raceway, shall be provided with listed AC AFCI protection.

Substantiation: Panel proposal 4-375a refers to proposals 4-394, 4-396, and 4-401 as the template for 4-375a. In proposal 4-396, the existing 705.12(D)(7) was deleted and some of the content moved to 705.12(D)(2). Given the complexity of these changes, the staff inadvertently included the existing 705.12(D)(7) as the new 705.12(D)(6). 705.12(D) now includes duplicative language.

Panel Meeting Action: Accept

Panel Statement: This comment addresses an error in the ROP Draft.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-207 Log #1384 NEC-P04 **Final Action: Reject**

(705.30 and 705.31 (New))

Submitter: Chad Kennedy, Schneider Electric

Comment on Proposal No: 4-410a

Recommendation: Revise text to read as follows:

705.30 Overcurrent Protection. Overcurrent protection for interconnected power production sources shall be provided in accordance with 750.30 (A) through (G).

(A) General. Conductors shall be protected in accordance with Article 240. Equipment and conductors connected to more than one electrical source shall have a sufficient number of overcurrent devices located so as to provide protection from all sources.

(B) Conductors Connected to Supply Side of Service Disconnecting Means. Where the point of connection to the service conductors is located inside of a building or structure, overcurrent protection for the interconnected power production source conductors shall be provided as close as practicable to the point where they connect to the service conductors. The overcurrent protection shall be permitted to be located inside or outside of the building or structure being supplied.

Informational Note: This overcurrent protection provides protection for the interconnected power production source conductors from short-circuit current introduced by the primary source(s) of electricity.

(C) ~~(A)~~ Solar Photovoltaic Systems. Solar photovoltaic systems shall be protected in accordance with Article 690.

(D) ~~(B)~~ Transformers. Overcurrent protection for a transformer with a source(s) on each side shall be provided in accordance with 450.3 by considering first one side of the transformer, then the other side of the transformer, as the primary.

(E) ~~(C)~~ Fuel Cell Systems. Fuel cell systems shall be protected in accordance with Article 692.

(F) ~~(D)~~ Utility-Interactive Inverters. Utility-interactive inverters shall be protected in accordance with 705.65.

(G) ~~(E)~~ Generators. Generators shall be protected in accordance with 705.130.

~~**705.31 Location of Overcurrent Protection.**~~ Where ~~Overcurrent protection for~~ electric power production source conductors, are ~~connected to the supply side of the service disconnecting means per 705.12(A)~~ and the connection is made inside the building, overcurrent protection ~~shall be located within 3m (10 ft) of~~ as close as practicable to ~~the point where the electric power production source conductors are connected to the service.~~

~~Informational Note: This overcurrent protection protects against short-circuit current supplied from the primary source(s) of electricity.~~

~~*Exception: Where the overcurrent protection for the power production source is located more than 3 m (10 ft) from the point of connection for the electric power production source to the service, cable limiters or current limited circuit breakers for each ungrounded conductor shall be installed at the point where the electric power production conductors are connected to the service.*~~

Substantiation: The provisions of this proposal should be restricted to installations where the connection is made inside the building. The NEC permits unlimited tap lengths in 240.21(B) and 240.21(C) for conductors outside of the building or structure where installed as a service per 230.6 and a disconnecting means is provided either outside or nearest the point of entrance of the conductors. Electric power production source connections ahead of the service disconnecting means located outside of the building or structure should not be required to have overcurrent protection within a specified distance.

In addition, where tap connections are made within large power equipment such as LV switchgear and switchboards the overcurrent protection location will exceed 10 ft of the connection. The requirements should treat such connections as service conductors in regards to the wiring methods and location of overcurrent protection rather than specify a distance constraint. The revised text also eliminates the need for an exception to the proposed requirement.

For clarity purposes, the proposed requirements should be grouped with existing overcurrent protection provisions in 705.30. The existing 705.30 text has not been revised but rather the first paragraph is now located in 705.30(A) and the existing 705.30(A) – 705.30(E) renumbered. The overcurrent protection requirements for supply side connections are located in 705.30(B).

Panel Meeting Action: Reject

Panel Statement: The supply side conductors are not considered a tap.

It is not the intent to limit the installation to only inside the building. CMP 4 intends that conductors connected to alternative energy systems ahead of the service main be protected when they exceed 10 feet from the connection point to limit the effects of fault currents that may be imposed upon them from the service.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-208 Log #89 NEC-P04 **Final Action: Accept**

(705.31 (New))

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 4-410a

Recommendation: The Correlating Committee directs this proposal be clarified by replacing "per 705.12(A)" with "in accordance with 705.12(A)" to conform with 4.1 of the NEC Style Manual.

This action will be considered as a public comment.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

4-209 Log #1509 NEC-P04 **Final Action: Accept in Principle**

(705.100)

Submitter: William F. Brooks, Brooks Engineering

Comment on Proposal No: 4-416

Recommendation: Revise language as follows:

705.100 Unbalanced Interconnections.

(A) Single Phase. Single-phase inverters for hybrid systems and ac modules in interactive hybrid systems shall ~~not~~ be connected to 3-phase power systems ~~unless the interconnected system is designed~~ so that ~~significant~~ unbalanced voltages in excess of 3% do not ~~cannot~~ result. For utility-interactive single-phase inverters, unbalanced voltages shall be prevented by the same methods used for single-phase loads on a 3-phase power system.

Substantiation: The code making panel was in error by not accepting proposal 4-416. The reason given was that sufficient substantiation was not provided. The substantiation was sufficient in that it outlined the problem and how the revised wording addressed the problem. AHJs are routinely misinterpreting this ambiguous language. Since the language is unclear, the common misconception is that the National Electrical Code is prohibiting single-phase inverters on three-phase systems. Since no criteria for acceptance is provided, this overly conservative interpretation is common. The wording in the existing 705.100 violates the style manual, which specifically prohibits unenforceable language such as is found in 705.100.

Quoting from the NEC Style Manual:

"3.2 Word Choices.

3.2.1 Unenforceable Terms. The NEC shall not contain references or requirements that are unenforceable or vague. The terms contained in Table 3.2.1 shall be reviewed in context, and, if the resulting requirement is unenforceable or vague, the term shall not be used." …"Significant".

The current language in 705.100(A) is unenforceable by any means other than prohibiting single-phase generators on 3-phase power systems altogether. This is due to the undefined nature of the term "significant unbalanced voltages." This undefined term is replaced with "unbalanced voltages in excess of 3% do not result." Single phase generators are routinely applied to 3-phase power systems successfully and without special phase voltage sensing equipment. This is accomplished with utility-interactive inverters by applying the well-understood methods used for single-phase loads for 3-phase systems. Single-phase loads are evenly distributed among the phases unless the single phase loads are not divisible by 3. In the event that a 3-phase circuit has extra single-phase loads, those loads are applied to the least loaded phases, therefore reducing imbalance rather than increasing imbalance. With utility-interactive single-phase generators, extra single-phase generators are applied to the most heavily loaded phases, reducing imbalance. Many jurisdictions have been prohibiting the use of single-phase utility-interactive generators on 3-phase systems thinking that these inverters had to be capable of sensing all three phases to prohibit imbalance. Since single-phase loads are not required to monitor all three phases and imbalance is prevented by design, utility-interactive inverters should follow the same, well-understood process. The only method to resolve an unbalanced voltage not caused by the utility system is to balance loads and generation on the building distribution system. Both single-phase load distribution and single-phase generator distribution can be effective means of mitigating unbalanced phase currents that contribute to unbalanced voltages.

Panel Meeting Action: Accept in Principle

Revise the recommended text to read as follows:

705.100 Unbalanced Interconnections.

(A) Single Phase. Single-phase inverters for hybrid systems and ac modules in interactive hybrid systems shall be connected to 3-phase power systems in order to limit unbalanced voltages to not more than 3 percent.

Informational Note: For utility-interactive single-phase inverters, unbalanced voltages can be minimized by the same methods that are used for single-phase loads on a 3-phase power system. See ANSI/C84.1 Electric Power Systems and Equipment - Voltage Calculations.

Panel Statement: The panel has moved the last proposed sentence to an informational note. The text was reworded for clarity. Additionally reference is made to ANSI/C84.1 as a method of calculation.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 14

ARTICLE 708 — CRITICAL OPERATIONS POWER SYSTEMS (COPS)

13-100 Log #422 NEC-P13 **Final Action: Reject**
(708.2)

Submitter: Daniel J. Caron, Bard, Rao + Athanas Consulting Engineers, LLC

Comment on Proposal No: 13-156

Recommendation: Revise figure as shown:

See Figure 708.2 on Page 404

Substantiation: Figure should be revised to show the various systems that could be connected to the alternate power source and should be consistent between Articles 695, 700, 701, 702 and 708.

Panel Meeting Action: Reject

Panel Statement: CMP 13 rejects the proposed revisions as they are better suited as Handbook material. See 13-65a (Log #CC1301).

Number Eligible to Vote: 21

Ballot Results: Affirmative: 20 Negative: 1

Explanation of Negative:

CARON, D.: See my Explanation on Negative vote on Comment 13-65a.

13-101 Log #961 NEC-P13 **Final Action: Reject**
(708.10(C))

Submitter: William A. Wolfe, Steel Tube Institute

Comment on Proposal No: 13-167

Recommendation: Reject this proposal and retain the text in 2011 NEC.

Substantiation: This proposal removes the allowance for 2" of concrete which has for years been a recognized method of providing fire and mechanical protection for conductors. Sufficient substantiation for removing this long-held option was not provided. The submitter states that it is documented in the Intemational Building Code (IBC) that 2 inches of concrete is not equivalent to 2-hr. fire protection. In fact, the 2012 IBC Section 909.20.6.1 (provided) allows control and power wiring to be encased in 2" of concrete as an altemative to the use of 2 hour rated cable, fire barriers, etc. The IBC does not require a "listed" concrete assembly.

The permission for concrete encasement should also be retained in the NEC as a viable altemative to the other methods listed. The NEC 2011 Handbook describes the difference between - not equivalency of - the other 2 methods allowed in 695.6(A)(2)(d): a 2-hour fire rating of an electrical circuit and a 2-hour fire-resistance rating of a structural member, such as a wall. In September 2012, UL removed several Electrical Circuit Protective Systems as allowed in 695.6(A)(2)(d)(3) from the UL Fire Resistive Directory.

Note: Supporting material is available for review at NFPA Headquarters.

Panel Meeting Action: Reject

Panel Statement: See the panel action and substantiation on 13-102a (Log #CC1304).

Number Eligible to Vote: 21

Ballot Results: Affirmative: 18 Negative: 3

Explanation of Negative:

DEGNAN, J.: See my statement on comment 13-72.

ODE, M.: See my statement on Comment 13-46.

SPINA, M.: See my statement on comment 13-46.

13-102 Log #962 NEC-P13 **Final Action: Reject**
(708.10(C))

Submitter: William A. Wolfe, Steel Tube Institute

Comment on Proposal No: 13-168

Recommendation: Reject this proposal and retain the text in 2011 NEC.

Substantiation: This proposal removes the allowance for 2" of concrete which has for years been a recognized method of providing fire and mechanical protection for conductors. Sufficient substantiation for removing this long-held option was not provided. The submitter states that it is documented in the International Building Code (IBC) that 2 inches of concrete is not equivalent to 2-hr. fire protection. In fact, the 2012 IBC Section 909.20.6.1 (provided) allows control and power wiring to be encased in 2" of concrete as an alternative to the use of 2 hour rated cable, fire barriers, etc. The IBC does not require a "listed" concrete assembly.

The permission for concrete encasement should also be retained in the NEC as a viable alternative to the other methods listed. The NEC 201 I Handbook describes the difference between - not equivalency of - the other 2 methods allowed in 695.6(A)(2)(d): a 2-hour fire rating of an electrical circuit and a 2-hour fire-resistance rating of a structural member, such as a wall. In September 2012, UL removed several Electrical Circuit Protective Systems as allowed in 695.6(A)(2)(d)(3) from the UL Fire Resisti ve Directory.

Note: Supporting material is available for review at NFPA Headquarters.

Panel Meeting Action: Reject

Panel Statement: See the action and substantiation on 13-102a (Log #CC1304).

Number Eligible to Vote: 21

Ballot Results: Affirmative: 18 Negative: 3

Explanation of Negative:

DEGNAN, J.: See my statement on comment 13-72.

ODE, M.: See my statement on Comment 13-46.

SPINA, M.: See my statement on comment 13-46.

13-102a Log #CC1304 NEC-P13 **Final Action: Accept**
(708.10(C)(2))

Submitter: Code-Making Panel 13,

Comment on Proposal No: 13-167

Recommendation: Revise the action on Proposal 13-167 as follows:

(2) Fire Protection for Feeders. Feeders shall meet one of the following conditions:

(1) Be a listed electrical circuit protective system with a minimum 2-hour fire rating

Informational Note: UL guide information for electrical circuit protection systems (FHIT) contains information on
proper installation requirements to maintain the fire rating.

(2) Be protected by a listed fire-rated assembly that has a minimum fire rating of 2 hours

(3) Be encased in a minimum ~~50~~ <u>100</u> mm (~~2~~ <u>4</u> in.) of concrete

<u>(4) Be installed under not less than 50 mm (2 in.) of concrete on grade</u>

Substantiation: The committee acknowledges that 2 inches of concrete is not sufficient to provide 2 hours of fire rating for areas other than a slab on grade. The committee continues to accept the 4 inches of concrete concept that was submitted during the 2011 cycle. The committee considers the 4 inch concept to be enforceable.

Panel Meeting Action: Accept

Number Eligible to Vote: 21

Ballot Results: Affirmative: 17 Negative: 4

Explanation of Negative:

CZARNECKI, N.: The allowance for 2" concrete encasement has been an acceptable method for providing protection for years in this section of the Code and no substantiation has been provided to show there is a problem with its use. Contrary to the substantiation in Proposal 13-68, Section 909.20.6.1 of the International Building code does allow control and power wiring to be encased in 2" of concrete as an alternative to the use of 2 hour rated cable, fire barriers, etc. The NEC has long allowed the use of 2" concrete as a viable alternative to other methods allowed and the 2011 NFPA Handbook describes the difference between the allowable methods in 695.6(A)(2)d), not necessarily their equivalency.

DEGNAN, J.: See my statement on comment 13-72.

ODE, M.: See my statement on Comment 13-46.

SPINA, M.: See my statement on comment 13-46.

13-103 Log #790 NEC-P13 **Final Action: Reject**
(708.10(C)(2)(3))

Submitter: Thomas Guida, TJG Services Inc.

Comment on Proposal No: 13-168

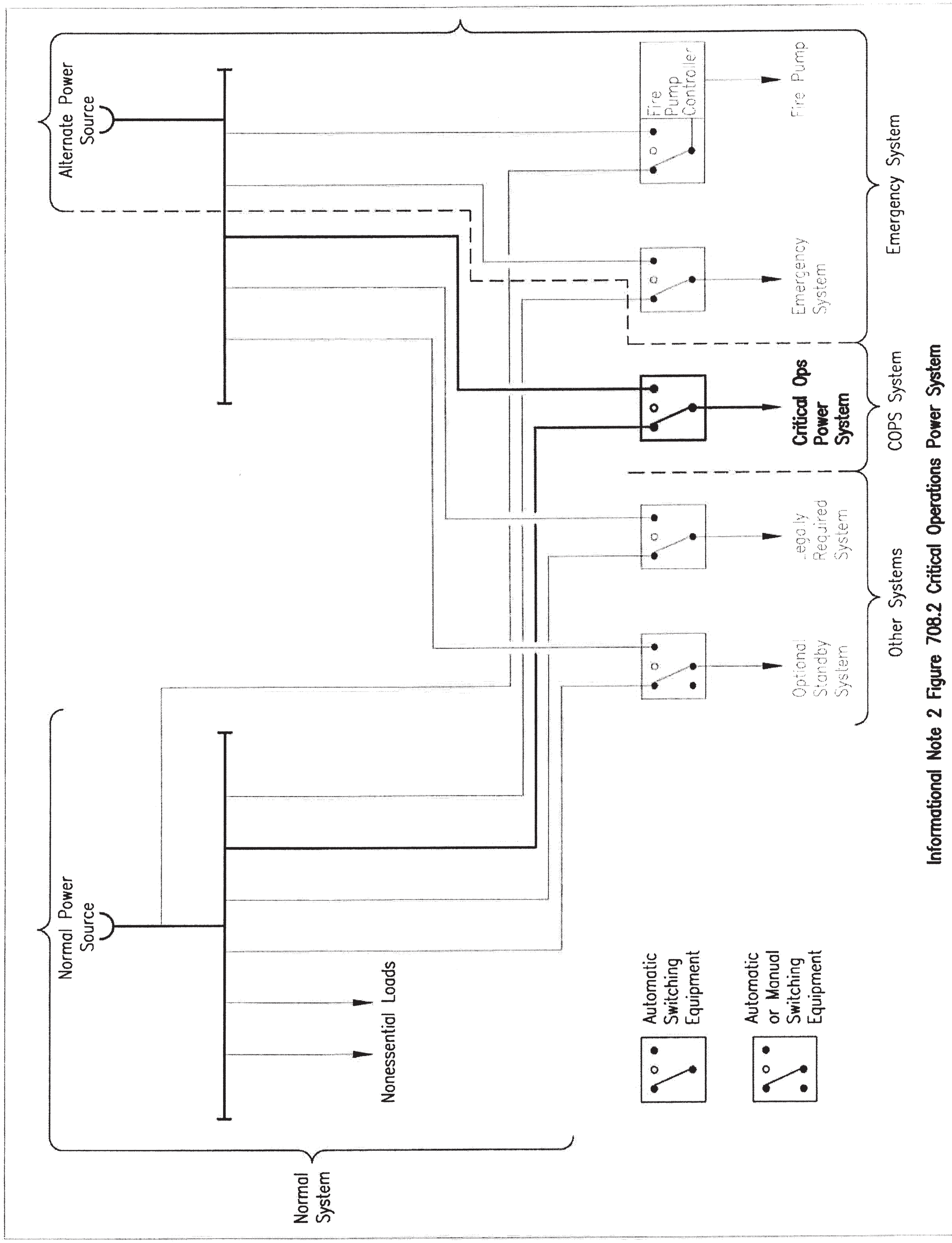
Recommendation: I support the Panel Action on this proposal.

Substantiation: None given.

Panel Meeting Action: Reject

Panel Statement: CMP 13 rejects this comment since it does not comply with the rules governing committee projects 4.4.5(d). No substantiation was provided.

13-100 (Log #422) Figure 708.2



Informational Note 2 Figure 708.2 Critical Operations Power System

Number Eligible to Vote: 21
Ballot Results: Affirmative: 20 Negative: 1
Explanation of Negative:
DEGNAN, J.: See my statement on comment 13-72.

13-104 Log #1216 NEC-P13 **Final Action: Accept in Principle**
(708.10(C)(2))

Submitter: James S. Nasby, Skokie, IL
Comment on Proposal No: 13-167
Recommendation: Do NOT remove the option of using 2 in. of concrete. E.g., Do not delete said text.
Substantiation: 2" concrete requirement appears over a dozen times in NFPA 70 and has been as such for many editions. No problem or difficulty was offered for changing this requirement. No cost-benefit data was given. This is a very ornerous requirement. This would require 280% more concrete for a 3 1/2" conduit installation; plus twice the floor area. This would be even more horrendous no retrofit installations. While I did agree with increasing the requirement for wire protective systems from one hour to tow hours, this requirement does not correlate with how much concrete is equivalent. This also invalidates almost all UL Listed wiring systems.
Panel Meeting Action: Accept in Principle
Panel Statement: See the action and substantiation on 13-102a (Log #CC1304). CMP 13 does not agree with the submitter's substantiation.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 18 Negative: 3
Explanation of Negative:
DEGNAN, J.: See my statement on comment 13-72.
ODE, M.: See my statement on Comment 13-46.
SPINA, M.: See my statement on comment 13-46.

13-105 Log #1217 NEC-P13 **Final Action: Accept in Principle**
(708.10(C)(2)(3))

Submitter: James S. Nasby, Skokie, IL
Comment on Proposal No: 13-168
Recommendation: Do NOT remove the option of using 2 in. of concrete. E.g., Do not delete said text.
Substantiation: 2" concrete requirement appears over a dozen times in NFPA 70 and has been as such for many editions. No problem or difficulty was offered for changing this requirement. No cost-benefit data was given. This is a very ornerous requirement. This would require 280% more concrete for a 3 1/2" conduit installation; plus twice the floor area. This would be even more horrendous no retrofit installations. While I did agree with increasing the requirement for wire protective systems from one hour to two hours, this requirement does not correlate with how much concrete is equivalent. This also invalidates almost all UL Listed wiring systems.
Panel Meeting Action: Accept in Principle
Panel Statement: See the action and substantiation on 13-102a (Log #CC1304). CMP 13 does not agree with the submitter's substantiation.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 18 Negative: 3
Explanation of Negative:
DEGNAN, J.: See my statement on comment 13-72.
ODE, M.: See my statement on Comment 13-46.
SPINA, M.: See my statement on comment 13-46.

13-106 Log #1475 NEC-P13 **Final Action: Reject**
(708.10(C)(2)(3))

Submitter: John R. Kovacik, UL LLC
Comment on Proposal No: 13-168
Recommendation: Reject Proposal 13-168.
Substantiation: There were no incidents cited or problems identified that justify the removal of this requirement. The 2 in of concrete is a long-standing requirement that has a history and proven track record of providing adequate fire protection for conductors.
The added requirement that concrete or other material be listed to achieve a minimum fire rating is impractical for concrete. UL does not test concrete alone for a fire rating and such a program would be difficult if not impossible to develop based on the variables involved in preparation, finishing, curing, treating, etc.
The proponents of this proposal have argued that 2 in. of concrete does not equate to 2 hours of fire protection on the basis that the 2 in. concrete requirement was in the NFPA 20 Fire Pump Standard when the required fire rating for conductors was 1 hour, and the 2 in. concrete requirement was left unchanged when the fire rating for conductors was increased to 2 hours. The 2 in. of concrete has never been claimed to provide a specific time-sensitive fire rating or been considered to equate to a specific fire rating. It is an alternative method of protection for conductors and its removal from the NEC will cause a hardship in that it will force installers to use protection methods that may not be superior to 2 in. of concrete.
Panel Meeting Action: Reject
Panel Statement: See the action and substantiation on 13-102a (Log #CC1304).
Number Eligible to Vote: 21
Ballot Results: Affirmative: 18 Negative: 3
Explanation of Negative:
DEGNAN, J.: See my statement on comment 13-72.
ODE, M.: See my statement on Comment 13-46.
SPINA, M.: See my statement on comment 13-46.

13-107 Log #1476 NEC-P13 **Final Action: Reject**
(708.10(C)(2))

Submitter: John R. Kovacik, UL LLC
Comment on Proposal No: 13-167
Recommendation: Reject Proposal 13-167.
Substantiation: There were no incidents cited or problems identified that justify the removal of this requirement. The 2 in of concrete is a long-standing requirement that has a history and proven track record of providing adequate fire protection for conductors.
The added requirement that concrete or other material be listed to achieve a minimum fire rating is impractical for concrete. UL does not test concrete alone for a fire rating and such a program would be difficult if not impossible to develop based on the variables involved in preparation, finishing, curing, treating, etc.
The proponents of this proposal have argued that 2 in. of concrete does not equate to 2 hours of fire protection on the basis that the 2 in. concrete requirement was in the NFPA 20 Fire Pump Standard when the required fire rating for conductors was 1 hour, and the 2 in. concrete requirement was left unchanged when the fire rating for conductors was increased to 2 hours. The 2 in. of concrete has never been claimed to provide a specific time-sensitive fire rating or been considered to equate to a specific fire rating. It is an alternative method of protection for conductors and its removal from the NEC will cause a hardship in that it will force installers to use protection methods that may not be superior to 2 in. of concrete.
Panel Meeting Action: Reject
Panel Statement: See the action and substantiation on 13-102a (Log #CC1304).
Number Eligible to Vote: 21
Ballot Results: Affirmative: 18 Negative: 3
Explanation of Negative:
DEGNAN, J.: See my statement on comment 13-72.
ODE, M.: See my statement on Comment 13-46.
SPINA, M.: See my statement on comment 13-46.

13-108 Log #915 NEC-P13 **Final Action: Reject**
(708.14(7))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 13-171
Recommendation: Revise text to read as follows:
708.14 Wiring of HVAC, Fire Alarm, Security, Emergency Communications, and Signaling Systems.
(7) All cables for fire alarm, security, and signaling systems shall be riser-rated and shall be a listed 2-hour electrical circuit protective system. Emergency communication cables shall be Type CMR-CI or shall be riser-rated and using a listed 2-hour electrical circuit protective system. **[ROP 13–171]**
Substantiation: Ignoring the fact that UL has dropped all -CI and FHIT listings, the text is not grammatical.
Panel Meeting Action: Reject
Panel Statement: There is no grammatical error in the accepted text.
Number Eligible to Vote: 21
Ballot Results: Affirmative: 21

13-109 Log #756 NEC-P13 **Final Action: Accept**
(708.52(B))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 13-174
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.
The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.
The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or

supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept

Number Eligible to Vote: 21

Ballot Results: Affirmative: 20 Negative: 1

Explanation of Negative:

BROWN, J.: It is recognized that increasing voltage from 600 volts to 1000 volts may be applicable to specific installations. However, adequate technical substantiation has not been provided to support the change in this Article.

13-110 Log #1436 NEC-P13 **Final Action: Accept in Part**
(708.54)

TCC Action: The Correlating Committee understands that the proposed revisions were intended to be made to 708.54.

Submitter: Randy Hunter, Las Vegas, NV

Comment on Proposal No: 13-176

Recommendation: Revise text to read as follows:

708.54 Coordination.

Critical operations power system(s) overcurrent devices shall be selectively coordinated with all supply side overcurrent protective devices. <u>Selective Coordination shall be selected by a licensed professional engineer or other qualified persons that are acceptable to the AHJ engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.</u>

Revise text to read as follows:

Substantiation: This proposal should have been accepted. The panel statement implies that the proposed language requires a licensed professional engineer only, but it does not. The original proposal clearly allows "or other qualified persons" to select the coordination. The qualification "acceptable to the AHJ" makes it clear that the AHJ has final say over who is qualified to choose selective coordination.

The last sentence in the panel substantiation stating that "… nor should the NEC get into licensing and stamping issues." is confusing, since other areas of the NEC (like 399.30 and 240.86(A)) require a licensed professional engineer. Certainly, emergency systems are important enough to justify requiring a qualified person, and being a licensed professional engineer is one way to demonstrate qualification.

Note that Panel 12 accepted similar language in Proposal 12-50 for 620.62.

Panel Meeting Action: Accept in Part

Revise the text to read as follows:

700.27 <u>Selective</u> Coordination. Emergency system(s) overcurrent devices shall be selectively coordinated with all supply side overcurrent protective devices.

<u>Selective Coordination shall be selected by a licensed professional engineer or other qualified persons that are acceptable to the AHJ engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.</u>

Exception: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.

Panel Statement: CMP-13 agrees with the substantiation that documentation as required in the revised wording will assist with the enforcement of the requirements for selective coordination. "Acceptable to the AHJ" is not necessary. CMP 13 now recognizes the need for this revision to assist the enforcement community with respect to this requirement.

Number Eligible to Vote: 21

Ballot Results: Affirmative: 20 Negative: 1

Explanation of Negative:

DEGNAN, J.: See my statement on comment 13-85.

Comment on Affirmative:

CARON, D.: See my Affirmative with Comment vote on Comment 13-85.

ARTICLE 725 — CLASS 1, CLASS 2, AND CLASS 3 REMOTE-CONTROL, SIGNALING, AND POWER-LIMITED CIRCUITS

3-40 Log #296 NEC-P03 **Final Action: Accept in Principle**
(725.2, 725.179, and 725.3)

TCC Action: See the Correlating Committee action on Comment 3-41 to hold proposed 725.3(M).

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.

Comment on Proposal No: 3-118

Recommendation: Revise the panel action on proposal 3-118 as follows:

Reject the definition of cable routing assembly recommended for 725.2.

Reject the changes recommended for 725.179 (listing requirements for cable routing assemblies).

<u>**725.3(M)**</u> (new) <u>**Cable Routing Assemblies.** The definition in 800.2, the applications in Table 800.154(c) and the installation rules in 800.110 and 800.113 shall apply to Article 725.</u>

Substantiation: Cable routing assemblies were introduced into the 2011 NEC. The definition, applications and installation rules for cable routing assemblies do not need to be repeated in every Article that has provisions for installing cables in cable routing assemblies.

The definition of cable routing assemblies is in 770.2. Proposal 16-23 recommended moving the definition to 800.2 so it would be in the same Article with the listing and application requirements. Panel 16 action on proposal 16-23 duplicated it in 800.2. We have submitted a comment delete the definition of cable routing assembly from 770.2 and have it in 800.2 only.

The listing requirements for cable routing assemblies are in 770.182 and 800.182. Panel 16 accepted proposal 16-81 which recommended deleting 770.182, which has listing requirements for cable routing assemblies and optical fiber raceways. The listing requirements for optical fiber raceways were no longer needed because panel 16 accepted proposals to replace optical fiber raceways with communications raceways and the listing requirements for cable routing assemblies in 770.182 were redundant. Acceptance of proposal 16-81 removed the redundancy.

The applications of cable routing assemblies are covered in Table 770.154(a). Panel 16 action on proposal 16-71 deleted the applications of cable routing assemblies from 770.154 including Table 770.154(a). Panel 16 action on proposal 16-131 established Table 800.154(c) which covers the applications of cable routing assemblies.

The definition, listing requirements, applications and installation rules for cable routing assemblies do not need to be repeated in multiple articles. Having them all in Article 800 is sufficient.

The Correlating Committee, in its actions on proposal 3-118 and 3-171, directed that the definition of cable routing assembly be located in a single Article of Chapter 8. The correlating committee also directed in it actions on proposals 16-37, 16-163 and 16-222 that the Panel 16 actions to establish references to the definition, applications and installation rules for cable routing assemblies in 770.3, 820.3 and 830.3 be correlated with Articles 725 and 760., Acceptance of this comment will bring the panel action into conformance with the Correlating Committee directives.

Panel Meeting Action: Accept in Principle

Panel Statement: Refer to the panel action and statement on Comment 3-41, which addresses the same issue.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 12 Negative: 1

Ballot Not Returned: 1 Sepulveda, M.

Explanation of Negative:

STENE, S.: See the negative statement in Comment 3-41

Comment on Affirmative:

WALSH, R.: I believe the statement in the new text; "installation rules in 800.110 and 800.113 shall apply to Article 725", to be too general since it can be interpreted to include Class 1 circuits for installation in Cable Routing Assemblies. I submit that the comment should be evaluated by the Correlating Committee.

3-41 Log #711 NEC-P03 **Final Action: Hold**
(725.2)

TCC Action: The Correlating Committee directs that proposed 725.3(M) in this comment be reported as "Hold." The Correlating Committee action on Comment 3-2 changed the location of the definition of Cable Routing Assemblies to Article 100. The Correlating Committee rejects the definition of Cable Routing Assembly in 725.2. The installation requirements in 800.110 and 800.113 do not apply globally and negate some of the requirements in Article 725.
The Correlating Committee will appoint a task group to address installation issues regarding Cable Routing Assemblies throughout the Code.
The Correlating Committee notes that:
1) Only the revisions to 725.3(M) are being held
2) Accepts the revision of 725.179 (Introduction), 725.179(M), 725.179(N), and 725.179(O) as noted in Proposal 3-118
3) Reflect changes in the title of 725.179 by adding "Cable Routing Assemblies" and as a result of the action on Proposal 3-163a change the term "signaling raceways" to "communication raceways". The title to 725.179 will now read
"725.179. Listing and Marking of Class 2, Class 3, Type PLTC Cables, Communication Raceways, and Cable Routing Assemblies."
4) The remainder of the panel action for the comment stands with existing (L) becoming new (O) without any change.
Submitter: George Bish, Secure Watch Security
Comment on Proposal No: 3-118
Recommendation: Continue to Accept in Principle in Part with the following changes:
a. Reject the part to add a definition for "Cable Routing Assembly"
b. Accept the part to revise 725.133
c. Continue to Accept the part to revise 725.139 per original Panel Action
d. Reject the part to revise 725.179 (Introduction), 725.179(L), 725.1179(M), 725.179(N), and 725.179(O)
e. Add 725.3 (M) **Cable Routing Assemblies**. The definition in 800.2, the applications in Table 800.154(c), the listing requirements of 800.182 and the installation rules in 800.110 and 800.113 shall apply to Article 725
Substantiation: Rejecting the addition of a definition of "Cable Routing Assembly" to 725.2 is in keeping with the Correlating Committee Note to Proposal 3-118 to locate the definition in a single article of Chapter 8. See companion comment on Proposal 16-23 that not only relocates the definition to 800.2, but revises it as well.
The change to 725.133 should be accepted as it refers to 725.139 that now includes cable routing assemblies. For consistency, cable routing assemblies should be mentioned in the title of 725.133
Through the Panel Action of Panel 16 on Proposal 16-81, listing requirements for cable routing assemblies are contained in 800.182 and do not need to be repeated in 725. Locating cable routing assembly listing requirements in a single article is in keeping with the spirit of the Correlating Committee directive.
Now that the definition of Cable Routing Assembly is located in 800.2 and the listing requirements in 800.182 a new paragraph 725.3(M) is needed directing the reader to Article 800 for the appropriate information.
This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to locate a correlated definition of Cable Routing Assemblies in a single Article of Chapter 8 for use in Article 725, 760, 770, and Chapter 8.
The Task Group members were:
George Bish, Chair, representing Satellite Broadcasting & Communication Association
Harry Ohde, representing IBEW
James Brunssen, representing Alliance for Telecommunications Industry Solutions
George Straniero, representing National Electrical Manufacturers Association
Robert Walsh, representing International Association of Electrical Inspectors
Wendell Whistler, representing Intertek Testing Services
Panel Meeting Action: Accept in Principle in Part
(1) Accept recommendation "a" through "c" and "e".
(2) Accept in principle in part recommendation "d": Correct the typographical error "725.1179(M)" to be "725.179(M)," and retain current 725.179(O) and renumber as appropriate.
(3) Revise the title of 725.179 to read: 725.179 Listing and Marking of Class 2, Class 3, Type PLTC Cables, and Signaling Raceways.
Panel Statement: (1) The panel accepts recommendation "e" contingent on the understanding that CMP 16 will accept the following joint (CMP 3 and CMP 16) task group recommendation for Comment 16-5:
Add a new definition in 800.2 to read as follows: "Cable Routing Assembly. A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support and route communications wires and cables, optical fiber cables, data cables associated with information technology and communications equipment, Class 2 and Class 3 cables."
Note that CMP 3 agrees with this basic definition, but has identified an oversight that should be corrected as shown below:
Add a new definition in 800.2 to read as follows: "Cable Routing Assembly. A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support and route communications wires and cables, optical fiber cables, data cables associated with information technology and communications equipment, Class 2 and Class 3 cables, and power-limited fire alarm cables."
The added phrase is currently permitted in Article 760 and should have been included in the task group work.
CMP 3 requests the correlating committee to review the actions of CMP 16 on Comment 16-5 to be sure that the intended correlation is provided consistent with CMP 3's understanding of the task group work.
(2) Changes are made to correct a typo. Also the panel rejects the removal of current 725.179(O) since the requirements for marking need to be retained.
(3) As a consequence of removal of cable routing assemblies from 725.179, the term needs to be removed from the title as well.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 12 Negative: 1
Ballot Not Returned: 1 Sepulveda, M.
Explanation of Negative:
STENE, S.: The comment text as accepted would apply the application of Table 800.145(c), the listing requirements in 800.182 and the installation rules in 800.110 and 800.113 to all of Article 725, not just to cable routing assemblies within Article 725. This would permit this application for Class 1 circuits, as well as Class 2 and 3 applications and that was never the intent. In addition, the application, listing requirements, and installation requirements as referenced in this accepted text in Article 800 only applies to communications wiring, cables, and raceways, not Class 2 and Class 3 remote control, power limited applications and signaling systems, unless installed in accordance with 725.139(D) in the same cable as communications circuits. This comment should be rejected or held for next Code cycle since it would not be possible to fix it at this time. The Correlating Committee should also direct Panel 16 to locate this definition in Article 100 since it appears in more than one article and there is no technical or compelling reason to have the definition located in Article 800.
Comment on Affirmative:
KAHN, S.: See my Explanation of Affirmative with Comment on Comment no. 3-1.
WALSH, R.: I believe the statement in the new text; "installation rules in 800.110 and 800.113 shall apply to Article 725", to be too general since it can be interpreted to include Class 1 circuits for installation in Cable Routing Assemblies. I submit that the comment should be evaluated by the Correlating Committee.

3-42 Log #822 NEC-P03 **Final Action: Reject**
(725.2)

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 3-118
Recommendation: Revise the definition of a Cable Routing Assembly to remove the word "conductors" and replace it with "circuits".
Substantiation: A Cable Routing Assembly is not a Wireway as defined in 376.2 and 378.2 and should not be treated as such. Cable Routing Assemblies are not permitted to route conductors. Wireways are listed for the routing and support of electrical conductors.
Panel Meeting Action: Reject
Panel Statement: The definition for Cable Routing Assembly has been deferred to Article 800 and the word "conductors" does not appear in the recommended definition.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-43 Log #982 NEC-P03 **Final Action: Accept in Principle**
(725.2, 725.3, and 725.179)

TCC Action: See the Correlating Committee action on Comment 3-41 to hold part of the comment.
Submitter: Robert W. Jensen, dbi-Telecommunication Infrastructure Design
Comment on Proposal No: 3-118
Recommendation: Revise the panel action on proposal 3-118 as follows:
Reject the definition of cable routing assembly recommended for 725.2.
Reject the changes recommended for 725.179 (listing requirements for cable routing assemblies).
725.3(M) (new) **Cable Routing Assemblies.** The definition in 800.2, the applications in Table 800.154(c) and the installation rules in 800.110 and 800.113 shall apply to Article 725.
Substantiation: Cable routing assemblies were introduced into the 2011 NEC. The definition, applications and installation rules for cable routing assemblies do not need to be repeated in every Article that has provisions for installing cables in cable routing assemblies.
The definition of cable routing assemblies is in 770.2. Proposal 16-23 recommended moving the definition to 800.2 so it would be in the same Article with the listing and application requirements. Panel 16 action on proposal 16-23 duplicated it in 800.2. We have submitted a comment delete the definition of cable routing assembly from 770.2 and have it in 800.2 only.

The listing requirements for cable routing assemblies are in 770.182 and 800.182. Panel 16 accepted proposal 16-81 which recommended deleting 770.182, which has listing requirements for cable routing assemblies and optical fiber raceways. The listing requirements for optical fiber raceways were no longer needed because panel 16 accepted proposals to replace optical fiber raceways with communications raceways and the listing requirements for cable routing assemblies in 770.182 were redundant. Acceptance of proposal 16-81 removed the redundancy.

The applications of cable routing assemblies are covered in Table 770.154(a). Panel 16 action on proposal 16-71 deleted the applications of cable routing assemblies from 770.154 including Table 770.154(a). Panel 16 action on proposal 16-131 established Table 800.154(c) which covers the applications of cable routing assemblies.

The definition, listing requirements, applications and installation rules for cable routing assemblies do not need to be repeated in multiple articles. Having them all in Article 800 is sufficient.

The Correlating Committee, in its actions on proposal 3-118 and 3-171, directed that the definition of cable routing assembly be located in a single Article of Chapter 8. The correlating committee also directed in it actions on proposals 16-37, 16-163 and 16-222 that the Panel 16 actions to establish references to the definition, applications and installation rules for cable routing assemblies in 770.3, 820.3 and 830.3 be correlated with Articles 725 and 760., Acceptance of this comment will bring the panel action into conformance with the Correlating Committee directives.

Panel Meeting Action: Accept in Principle

Panel Statement: Refer to the panel action and statement for Comment 3-41 that addresses the same issue.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 12 Negative: 1

Ballot Not Returned: 1 Sepulveda, M.

Explanation of Negative:

STENE, S.: See the negative statement in Comment 3-41

Comment on Affirmative:

WALSH, R.: I believe the statement in the new text; "installation rules in 800.110 and 800.113 shall apply to Article 725", to be too general since it can be interpreted to include Class 1 circuits for installation in Cable Routing Assemblies. I submit that the comment should be evaluated by the Correlating Committee.

3-44 Log #460 NEC-P03 **Final Action: Reject**
(725.2.Class 2 Circuit and Informational Note (New))

Submitter: Marcelo M. Hirschler, GBH International

Comment on Proposal No: 3-119

Recommendation: Revise text to read as follows:

Class 2 Circuit. The portion of the wiring system between the load side of a Class 2 power source and the connected equipment. ~~Due to its power limitations, a Class 2 circuit considers safety from a fire initiation standpoint and provides acceptable protection from electric shock.~~

Informational Note: Due to its power limitations, a Class 2 circuit considers safety from a fire initiation standpoint and provides acceptable protection from electric shock.

Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term "Class 2 circuit" and the NEC manual of style does not permit the definition to contain the defined term. If CMP3 believes that this information is a requirement it should place it somewhere else in Article 725, for example as a new section 725.4 or a similar new location, since NEC definitions shall not contain requirements.

An example of an alternate approach is:

725.4 Class 2 and Class 3 circuits and power limitations.

725.4.1 Due to its power limitations, a Class 2 circuit considers safety from a fire initiation standpoint and provides acceptable protection from electric shock.

725.4.2 Due to its power limitations, a Class 3 circuit considers safety from a fire initiation standpoint. Since higher levels of voltage and current than for Class 2 are permitted, additional safeguards are specified to provide protection from an electric shock hazard that could be encountered.

The suggested section 725.4.2 is associated with the definition of class 3 circuits (proposal 3-120).

The NEC Manual of Style states as follows:

2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.

Panel Meeting Action: Reject

Panel Statement: The recommended changes do not provide any additional clarity and in fact, are detrimental to the application.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13

Ballot Not Returned: 1 Sepulveda, M.

Comment on Affirmative:

STENE, S.: The definition is actually located in the first sentence and does not contain the phrase "Class 2 circuit" so it complies with the NEC Style Manual. The second sentence in the definition is a declarative sentence that Class 2 considers safety from a fire initiation standpoint and provides protection from shock.

3-45 Log #461 NEC-P03 **Final Action: Reject**
(725.2.Class 3 Circuit and Informational Note (New))

Submitter: Marcelo M. Hirschler, GBH International

Comment on Proposal No: 3-120

Recommendation: Revise text to read as follows:

Class 3 Circuit. The portion of the wiring system between the load side of a Class 3 power source and the connected equipment. ~~Due to its power limitations, a Class 3 circuit considers safety from a fire initiation standpoint. Since higher levels of voltage and current than for Class 2 are permitted, additional safeguards are specified to provide protection from an electric shock hazard that could be encountered.~~

Informational Note: Due to its power limitations, a Class 3 circuit considers safety from a fire initiation standpoint. Since higher levels of voltage and current than for Class 2 are permitted, additional safeguards are specified to provide protection from an electric shock hazard that could be encountered.

Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term "Class 3 circuit" and the NEC manual of style does not permit the definition to contain the defined term. If CMP3 believes that this information is a requirement it should place it somewhere else in Article 725, for example as a new section 725.4 or a similar new location, since NEC definitions shall not contain requirements.

An example of an alternate approach is:

725.4 Class 2 and Class 3 circuits and power limitations.

725.4.1 Due to its power limitations, a Class 2 circuit considers safety from a fire initiation standpoint and provides acceptable protection from electric shock.

725.4.2 Due to its power limitations, a Class 3 circuit considers safety from a fire initiation standpoint. Since higher levels of voltage and current than for Class 2 are permitted, additional safeguards are specified to provide protection from an electric shock hazard that could be encountered.

The suggested section 725.4.1 is associated with the definition of class 2 circuits (proposal 3-119).

The NEC Manual of Style states as follows:

2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.

Panel Meeting Action: Reject

Panel Statement: The recommended changes do not provide any additional clarity and in fact, are detrimental to the application.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13

Ballot Not Returned: 1 Sepulveda, M.

Comment on Affirmative:

STENE, S.: The definition is actually located in the first sentence and does not contain the phrase "Class 3 circuit" so it complies with the NEC Style Manual. The second sentence in the definition is a declarative sentence that Class 3 considers safety from a fire initiation standpoint and provides additional protection from shock.

3-45a Log #CC300 NEC-P03 **Final Action: Accept**
(725.2.Power-Limited Tray Cable)

TCC Action: The Correlating Committee directs the acronym '"PLTC" be placed after the defined term and before the definition as follows: "Power-Limited Tray Cable (PLTC)" for consistency in accordance with the NEC Style Manual.

Submitter: Code-Making Panel 3,

Comment on Proposal No: 7-15

Recommendation: Add a new definition in 725.2 for Power-Limited Tray Cable to read as follows: Power-Limited Tray Cable. A factory assembly of two or more insulated conductors rated at 300 volts, with or without associated bare or insulated equipment grounding conductors, under a nonmetallic jacket.

Substantiation: The panel has modified the definition recommended in Proposal 7-15 to be consistent with that in 336.2 and has included the voltage rating for insulation as applied to Class 2 and 3 applications. The modification of the proposed new definition more appropriately applies to 725.179(E) for PLTC.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13

Ballot Not Returned: 1 Sepulveda, M.

Comment on Affirmative:

STENE, S.: The acronym 'PLTC' should be placed after the defined term and before the definition as follows: "Power-Limited Tray Cable (PLTC)" for consistency in accordance with the NEC Style.

3-46 Log #41 NEC-P03 **Final Action: Accept**
(725.3(K) and (L))

TCC Action: The Correlating Committee directs that 725.3(L) be revised to read as follows: "Corrosive, Damp, or Wet Locations. Class 2 and Class 3 cables, installed in corrosive, damp, or wet locations, shall comply with the applicable requirements in 110.11, 300.5(B), 300.6, 300.9, and 310.10(G)."

This action modifies the text by adding "Class 2 and Class 3 cables," to distinguish what must comply with this subsection and adds "the applicable requirements in" before the references to make it clear that the cables do not have to comply with all of the requirements in those sections, only those requirements that apply to the specific application. This action ensures compliance with 3.4.2 and 3.4.3 in the NEC Style Manual.

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 3-122a
Recommendation: The Correlating Committee notes that 725.3(L) does not contain a requirement and is inconsistent in style.

Code-Making Panel 3 is directed to review this section for compliance with the NEC Style Manual.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept

Modify Section 725.3 (L) to read: Corrosive, Damp, or Wet Locations. Where installed in corrosive, damp, or wet locations, installations shall comply with 110.11, 300.5(B), 300.6, 300.9, and 310.10(G).

Panel Statement: The panel accepts the Correlating Committee direction to review and has modified the requirement in (L) to be consistent with the NEC Style Manual.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.
Comment on Affirmative:

STENE, S.: Accept the Correlating Committee direction and modify the text by adding "Class 2 and Class 3 cables," to distinguish what must comply with this subsection and add "the applicable requirements in" before the references to make it clear that the cables do not have to comply with all of the requirements in those sections, only those requirements that apply to the specific application. The subsection should read as follows: "725.3(L): Corrosive, Damp, or Wet Locations. Class 2 and Class 3 cables, installed in corrosive, damp, or wet locations, shall comply with the applicable requirements in 110.11, 300.5(B), 300.6, 300.9, and 310.10(G). 110.11, 300.5(B), 300.6, 300.9, and 310.10(G)." The changes provided in new 725.3(L) ensures compliance with 3.4.2 and 3.4.3 in the NEC Style Manual as suggested by the NEC Correlating Committee.

3-47 Log #913 NEC-P03 **Final Action: Reject**
(725.3(K) Exception No. 1)

Submitter: Mark C. Wirfs, R & W Engineering, Inc.
Comment on Proposal No: 3-122a
Recommendation: Add text to read as follows:
Exception No. 1 <u>Air tubing, serving pneumatically operated equipment or devices and having a line pressure no greater than 125 psig, shall be permitted in a common raceway or cable tray with Class 2 or 3 circuit(s) wherein the low voltage wiring is functionally associated with the equipment or other related devices. Pneumatic air tubing shall have a minimum working pressure rating of 125 psig.</u>
Substantiation: The addition of the requirement to comply with 300.8 is a huge change from decades of NEC editions that has permitted specialized applications to exist. The substantiation by the panel is simply a statement of what the new language does. There is no <u>technical justification</u> of any kind to make this change and no problems or issues with the existing code text have been presented or demonstrated in any way. The substantiation text simply reiterates the text from 300.8, which in itself is not a technical basis.
I personally believe that coexisting with fluids is an issue even though this has never been reported to be a problem. We have electrical technology with 600-volt and higher systems where cables are integrally water-cooled, bus-bars are encapsulated in water, and we put capacitors and windings in permanent oil tanks. Coexistence with air is not an issue or technical problem. It seems basically logical to prohibit coexistence with fluid systems. The wiring in the world is surrounded by environmental air and coexistence with a tubing system with oil-free conditioned low pressure air has no technical problem that we can contemplate or foresee. Many years ago a pneumatically operated high-security locking system was developed for the corrections industry. This uses low pressure air to operate the locking mechanisms with low voltage (24VDC) circuits in lieu of higher powered electrical motor locks. This provides the same level of security while vastly reducing the energy requirements, wiring, and installation costs. Tens of Thousands of these locks have been installed throughout the United States with the air supply tubing and low-voltage wiring contained within the same raceway. There has not been a single reported incident of any issues with these systems operationally and they have provided for the latest in technology for securing inmates. Adding the full requirements of 300.8 will require separate piping/tubing systems for the air supply and will, most likely, require extensive added costs to detention facility construction and even return to motorized systems that have higher operating and installation costs.
At the end use point of the pneumatically locking assembly the wiring and air supply system coexist within the device! Why separate the supply system when the most likely source of an air leak is inside the lock assembly and this will still enter the low-voltage wiring raceway. <u>See attached exhibit of a locking device.</u>
We are proposing that you maintain the proposed additional requirements 300.8 but provide an appropriate exception for coexistence with air supply systems where they are functionally associated devices.
Also see our comment on proposal 3-154.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: The addition of the reference to 300.8 was made to assure Article 725 cables and conductors correlated with the similar requirements in Article 760 as the applications are similar. Simply stating that the practice of installing tubing systems in raceways with wires and cables should be acceptable since it has always been done does not substantiate the assertion in the comment.

Special circumstances could allow the electrical inspector, based on 90.4 second paragraph where he or she is assured that safety would not be compromised, to accept an installation as stated in the Comment substantiation. There may be other circumstances, such as heat, cold, sharp parts, fittings or similar issues, that could preclude this installation from being accepted and should only be accepted on a case by case basis, not just generally in all cases.

Number Eligible to Vote: 14
Ballot Results: Affirmative: 12 Negative: 1
Ballot Not Returned: 1 Sepulveda, M.
Explanation of Negative:

STENE, S.: See the negative statement in Comment 3-41

3-47a Log #CC304 NEC-P03 **Final Action: Hold**
(725.3(N) (New))

TCC Action: The Correlating Committee directs that this comment be reported as "Hold."

The Correlating Committee action on Comment 16-3 changed the location of the definition of Communication Raceways to Article 100. The installation requirements in 800.110 and 800.113 do not apply globally and negate some of the requirements in Article 725. The Correlating Committee will appoint a task group to address installation issues regarding Communication Raceways throughout the Code.

Submitter: Code-Making Panel 3,
Comment on Proposal No: 3-163a
Recommendation: Add new 725.3(N) to read as follows:
"(N) Communications Raceways. The definition in 800.2, the applications in Table 800.154(b), the listing requirements of 800.182 and the installation rules in 800.110 and 800.113 shall apply to Article 725."
Substantiation: The new paragraph is added to retain the reference to the information deleted from 725.179 regarding communications raceways. Refer to the panel action and statement on Comment 3-71.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.
Comment on Affirmative:

WALSH, R.: I believe the statement in the new text; "installation rules in 800.110 and 800.113 shall apply to Article 725", to be too general since it can be interpreted to include Class 1 circuits for installation in Cable Routing Assemblies. I submit that the comment should be evaluated by the Correlating Committee.

3-48 Log #298 NEC-P03 **Final Action: Accept**
(725.24)

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 3-126
Recommendation: Continue to reject the proposal.
Substantiation: The submitter is trying to apply a uniform set of installation rules to power, and power-limited circuit cables without considering the inherent safety features of power-limited circuits.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-49 Log #710 NEC-P03 **Final Action: Accept**
(725.24)

Submitter: George Bish, Secure Watch Security
Comment on Proposal No: 3-125
Recommendation: Continue to Accept in Principle.
Substantiation: The Task Group understands that the Panel Action to Accept in Principle refers to the Panel Action on Proposal 3-86 and that the listing of cable ties for use in other spaces used for environmental air is covered by reference to 300.22(C)(1) in 725.3(C)

Continued Panel Action to Accept in Principle is in keeping with the Correlating Committee's directive to correlate requirements addressing the listing of cable ties across Article 300, 770, 800, 820 and 830.

This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to correlate the requirements of Cable Ties in Articles 300, 770, 800, 820 and 830

The Task Group members were:

George Bish, Chair, representing Satellite Broadcasting & Communication Association

Harry Ohde, representing IBEW

James Brunssen, representing Alliance for Telecommunications Industry Solutions

George Straniero, representing National Electrical Manufacturers Association

Robert Walsh, representing International Association of Electrical Inspectors

Wendell Whistler, representing Intertek Testing Services

Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-50 Log #654 NEC-P03 **Final Action: Accept**
(725.48(B)(4)(2))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 3-136
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-51 Log #655 NEC-P03 **Final Action: Accept**
(725.49(B))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 3-138
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-52 Log #656 NEC-P03 **Final Action: Accept**
(725.121)

TCC Action: The Correlating Committee understands that the change from 600 to 1000 volts occurs in Figure 725.121.
Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 3-140
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.
The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.
The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity.
The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.
Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.
Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.
If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-53 Log #42 NEC-P03 **Final Action: Accept**
(725.121, 725.179, 727.6, 760.176, and 760.179, Informational Note)

TCC Action: The format and language used in this code follows guidelines established by NFPA and published in the NEC Style Manual.
Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 3-141
Recommendation: The Correlating Committee directs that the action on this proposal be reconsidered and accepted without the revision date in parenthesis to comply with the NEC Style Manual regarding referencing other standards in Informational notes and Annex A.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise the references to the standards listed as follows:
UL 60950-1 2011
UL 1666 2012
UL 1685 2010
UL 1581 2011
UL 2196 2012
Panel Statement: The panel recognizes that the Correlating Committee, in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects, does indeed have the responsibility to direct Code-Making Panels to comply with the NEC Style Manual.
The panel also recognizes that the NEC Style Manual states:
"4.2 References to Other Standards. References to other standards shall not be in mandatory Code text. References to product standards shall be in an informative annex. References to other Standards shall be in the Informational Notes."
The entire section for references to other standards does not preclude the inclusion of specific revisions as shown in the previous panel action for Proposal 3-141.
The panel recommends that the practice of including the revision dates as originally proposed by Panel 3 be reviewed by a task group appointed by the Correlating Committee to develop a comprehensive position for the 2017 NEC cycle.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-54 Log #578 NEC-P03 **Final Action: Hold**
(725.121(A)(4) and Informational Note)

Submitter: Thomas M. Burke, UL LLC
Comment on Proposal No: 3-141
Recommendation: Revise Section 725.121(A)(4) to reflect publication of UL 62368-1 in February 2012:
(4) Listed <u>audio/video,</u> information (computer) <u>and communication technology</u> equipment limited-power circuits.
Informational Note: One way to determine applicable requirements for listing of information technology (computer) equipment is to refer to UL 60950-1-2007 (Rev: 2011), *Standard for Safety of Information Technology Equipment*. <u>Another way to determine applicable requirements for listing of audio/video, information and communication technology equipment is to refer to UL 62368-1-2012, *Standard for Safety of Audio/Video, Information and Communication Technology Equipment.*</u> Typically such circuits are used to interconnect such equipment for the purpose of exchanging information (data).
Substantiation: This is one in a series of comments to update NFPA 70 to add a reference to newly published UL 62368-1.
ANSI/UL 62368-1, Audio/video, information and communication technology equipment – Part 1: Safety requirements, was published on February 17, 2012. This new standard will eventually replace (later this decade) both, UL 60065, Audio, Video, and Similar Electronic Apparatus-Safety Requirements, and UL 60950-1, Information Technology Equipment Safety - Part 1: General Requirements. In the meantime, multiple references to UL 60950-1 in the body of the Code should be supplemented by a reference to UL 62368-1 since similar equipment complying with, and Listed to both standards will be installed per the Code. In fact, equipment already is being Listed to UL 62368-1. The requirements for limited power sources are the same in both standards.
Panel Meeting Action: Hold
Panel Statement: This comment introduces new material and the recommended revision has not yet been reviewed by the panel for applicability. The panel, therefore, recommends that this comment be held for the next NEC revision cycle.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.
Comment on Affirmative:
STENE, S.: The Correlating Committee should review the actions taken on Comments 1-111, 12-54, 12-57, 12-63, 16-64 and 16-116 and include the reference to UL 62638-1 in the informational note to 725.121(A)(4).

3-55 Log #1443 NEC-P03 **Final Action: Reject**
(725.122)

Submitter: Mike Weitzel, Richland, WA
Comment on Proposal No: 3-124
Recommendation: Add text to read as follows:
<u>**Non-Safety Control Devices.** Devices, other than cables and raceways, operating at Less than 50-volts, and current limited to100-Volt amperes maximum and installed in industrial facilities, where qualified persons perform installation and maintenance, shall not be required to be listed.</u>
<u>*Exception: Non-Safety Control Devices installed in the following locations shall be listed:*</u>
<u>1) Wet Locations</u>
<u>2) Hazardous Locations</u>
Informational Note: Power supplies must meet the requirements of 725.121 (A) and (B).

Substantiation: I agree that the power supplies should require listing by an OSHA-approved NRTL. And, I understand and agree with Panel 3's concerns with the installations over 100 VA.

What I am trying to target is the little 0 to 5 volt DC, or 24 volt AC devices such as a pressure transmitter or transducer, which operates at minute amounts of power and is not a shock or fire hazard. There are some regulatory personnel who want to take this issue to the extreme and require listing of these types of products, even when installed in a non-classified, non-hazardous location.

Many times, for the nuclear industry, there are no listed products available. In that case, it is either complete a mountain of paperwork for each little device to justify an AHJ approval, or hire an NRTL to field evaluate these little devices, which seems excessive.

Panel Meeting Action: Reject

Panel Statement: The suggested text of "less than 50 volts and current limited to 100 volt-amperes" would permit unlisted power supplies with up to 2 amps of current without regard to the available peak current as limited by the Imax values in Table 11(A) and (B) to not more than 8 amperes. By not restricting the available fault peak current of listing in accordance with the restrictions in Tables 11(A) and (B), the peak current could cause a person to be subjected to a injurious or fatal shock or could initiate a fire.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13

Ballot Not Returned: 1 Sepulveda, M.

3-56 Log #299 NEC-P03 **Final Action: Accept in Principle**

(725.133 and 725.135 (New))

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.

Comment on Proposal No: 3-144a

Recommendation: Revise text to read as follows:

725.133 Installation of Conductors and Equipment in Cables, Compartments, Cable Trays, Enclosures, Manholes, Outlet Boxes, Device Boxes, ~~and~~ Raceways and Cable Routing Assemblies for Class 2 and Class 3 Circuits. Conductors and equipment for Class 2 and Class 3 circuits shall be installed in accordance with 725.135 ~~725.136~~ through 725.143.

725.135 Installation of Class 2, Class 3 and PLTC Cables. Installation of Class 2, Class 3 and PLTC cables shall comply with 725.135(A) through (L).

(A) Listing. Class 2, Class 3 and PLTC cables installed in buildings shall be listed.

(B) Other Spaces Used for Environmental Air (Plenums). The following cables shall be permitted in other spaces used for environmental air as described in 300.22(C):

(1) Types CL2P and CL3P cables

(2) Types CL2P and CL3P cables installed in plenum communications raceways

(3) Types CL2P and CL3P cables and plenum communications raceways supported by open metallic cable trays or cable tray systems

(4) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X and PLTC cables installed in raceways that are installed in compliance with 300.22(C)

(5) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X and PLTC cables supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C).

(6) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X and PLTC cables installed in plenum communications raceways, riser communications raceways and general-purpose communications raceways supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

(C) Risers — Cables in Vertical Runs. The following cables shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

(1) Types CL2P, CL3P, CL2R and CL3R cables

(2) Types CL2P, CL3P, CL2R and CL3R cables installed in:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

Informational Note: See 300.21 for firestop requirements for floor penetrations.

(D) Risers — Cables in Metal Raceways. The following cables shall be permitted in metal raceways in a riser having firestops at each floor:

(1) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X and PLTC cables

(2) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X and PLTC cables installed in:

a. Plenum communications raceways

b. Riser communications raceways

c. General-purpose communications raceways

Informational Note: See 300.21 for firestop requirements for floor penetrations.

(E) Risers — Cables Fireproof Shafts. The following shall be permitted to be installed in fireproof riser shafts having firestops at each floor:

(1) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X and PLTC cables

(2) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables installed in:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

Informational Note: See 300.21 for firestop requirements for floor penetrations.

(F) Risers — One- and Two-Family Dwellings. The following cables shall be permitted in one- and two-family dwellings:

(1) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables

(2) Type CL2X and CL3X cables less than 6 mm (0.25 in.) in diameter

(3) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables installed in:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

(G) Cable Trays. Cables installed in cable trays outdoors shall be Type PLTC. The following cables and shall be permitted to be supported by cable trays in buildings:

(1) Types CM CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables

(2) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables installed in:

a. Plenum communications raceways

b. Riser communications raceways

c. General-purpose communications raceways

(H) Cross-Connect Arrays. The following cables shall be permitted to be installed in cross-connect arrays:

(1) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables

(2) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables installed in:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

(I) Industrial Establishments. In industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type PLTC cable shall be permitted in accordance with either (1) or (2):

(1) Where the cable is not subject to physical damage, Type PLTC cable that complies with the crush and impact requirements of Type MC cable and is identified as PLTC-ER for such use shall be permitted to be exposed between the cable tray and the utilization equipment or device. The cable shall be continuously supported and protected against physical damage using mechanical protection such as dedicated struts, angles, or channels. The cable shall be supported and secured at intervals not exceeding 1.8 m (6 ft).

(2) Type PLTC cable, with a metallic sheath or armor in accordance with 725.179(E), shall be permitted to be installed exposed. The cable shall be continuously supported and protected against physical damage using mechanical protection such as dedicated struts, angles, or channels. The cable shall be secured at intervals not exceeding 1.8 m (6 ft).

(J) Other Building Locations. The following wires, cables shall be permitted to be installed in building locations other than the locations covered in 725.135(B) through (I):

(1) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables

(2) A maximum of 3 m (10 ft) of exposed Type CL2X in nonconcealed spaces

(3) A maximum of 3 m (10 ft) of exposed Type CL3X in nonconcealed spaces

(4) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables installed in:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

(5) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X and PLTC cables installed in raceways recognized in Chapter 3

(6) Type CMUC undercarpet communications wires and cables installed under carpet

(K) Multifamily Dwellings. The following wires and cables shall be permitted to be installed in multifamily dwellings in locations other than the locations covered in 725.135(B) through (I):

(1) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables

(2) Type CL2X less than 6 mm (0.25 in.) in diameter in nonconcealed spaces

(3) Type CL3X less than 6 mm (0.25 in.) in diameter in nonconcealed spaces

(4) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables installed in:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

(5) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X and PLTC cables installed in raceways recognized in Chapter 3

(6) Type CMUC undercarpet communications wires and cables installed under carpet

(L) One- and Two-Family Dwellings. The following wires and cables shall be permitted to be installed in one- and two-family dwellings in locations other

than the locations covered in 725.135 (B) through (I):
(1) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables
(2) Type CL2X less than 6 mm (0.25 in.) in diameter
(3) Type CL3X less than 6 mm (0.25 in.) in diameter
(4) Communications wires and Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables installed in:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceways
d. Riser cable routing assemblies
e. General-purpose communications raceways
f. General-purpose cable routing assemblies
(5) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X and PLTC cables installed in raceways recognized in Chapter 3
(6) Type CMUC undercarpet communications wires and cables installed under carpet

Substantiation: Proposals 3-144a and 3-154a were submitted as a package.

Proposal 3-154a deals with 725.154, *Applications of Listed Class 2, Class 3, and PLTC Cables*. Notwithstanding the title of 725.154, it contains a mixture of applications and installation rules. The primary objectives of proposals 3-144a and 3-154a are to separate the installation rules from the applications and to express the applications as simply as possible by using a table. If this concept is accepted in Articles 725 (proposals 3-144a & 3-154a) and 760 (proposals 3-197 & 3-202), then the cable applications and installation sections will be editorially consistent with Articles 770, 800, 820 and 830.

CMP-3 accepted 3-154a in principle in part by correcting the errors in the proposed Table 725.154 (accept in principle) and retaining the text in 725.154. Table 725.154 clearly prohibits the installation of plenum cable routing assemblies in plenums; permitting them to be used only in place of riser and general-purpose cable routing assemblies.

We also submitted proposal 3-156 as alternate to splitting 725.154 into an applications and installation parts; it just recommended changing the text of 725.154 to permit the use of cable routing assemblies and the use of communications raceways as an alternate to signaling raceways.

Instead of retaining signaling raceways and permitting communications to be used in place of them the panel action on proposal 3-156 consolidated the number of redundant raceways by eliminating signaling raceways and replaced them with communications raceways; This is a welcome simplification.

However the text accepted by the panel in its action on proposal 3-156 has several serious conflicts and omissions:

725.154(A) permits the installation of plenum cable routing assemblies in plenums (other space used for environmental air) which conflicts with Table 725.154.

725.154(A) only permits the installation of Types CL2P and CL3P cables in plenum communications raceways that are installed in plenums, which conflicts with 770.113(C), 800.113(C), 820.113(C) and 830.113(C) which permit the installation of optical fiber, communications, CATV and network-powered communications plenum cables in plenum communications raceways that are installed in plenums.

725.154(B) only permits the installation of Types CL2R, CL3R, CL2P and CL3P cables in riser and plenum communications raceways that are installed in risers, which conflicts with 770.113(D), 800.113(D), 820.113(D) and 830.113(D) which permit the installation of optical fiber, communications, CATV and network-powered communications riser and plenum cables in riser communications raceways that are installed in risers.

Whereas 725.154(B) is overly restrictive in the cables permitted to be installed in plenum and riser raceways, it has no restrictions on the cables that are permitted to be installed in cable routing assemblies, opening up the possibility of a general-purpose cable (CL2 or CL3) being installed in a riser cable routing assembly in a riser application.

The solution to fixing the text accepted in action on 3-156 is to take three actions, 1) accept the text recommended in this comment for 725.135(new) which contains all the installation requirements, 2) and to also accept our companion comment on proposal 3-154a for 725.154 and 3) changing the action proposal 3-156 to accept in principle with reference to the acceptance of this comment on proposal 3-144a and our comment on proposal 3-154a.

Proposal 3-144a included a recommendation for wiring in ducts specifically fabricated for environmental air. This comment has deletes that section in order to correlate with panel action on proposal 3-82 which prohibited wiring in ducts specifically fabricated for environmental air.

Proposal 3-144a was not correlated with (couldn't anticipate the panel action) action on proposal 3-160 which required cables penetrating one or more floors to be riser or plenum rated. The comment recommends text for 725.135(C) that correlates with the panel action on proposal 3-160. The text accepted by CMP 3 on proposals 3-159 and 3-160 used the phrase "penetrating from floor to floor" instead of "penetrating one or more floors" as recommended by the submitters. The correlating committee directed that the CMP 3 action be correlated with CMP 16 existing text. CMP 16 uses "penetrating one or more floors" in 770.113(D), 800.113(D), 820.113(D) and 830.113(D). Since there were no proposals to change "penetrating one or more floors", the only way to correlate is to use "penetrating one or more floors" in CMP 3 text for Articles 725 and 760. If this comment and its companion comment on proposal 3-154a are accepted, the action on proposal 3-160 should be changed to accept in principle with reference to the acceptance of this comment on proposal 3-144a and our comment on proposal 3-154a.

Proposal 3-144a included installation requirements for signaling raceways. The recommended text for this comment has eliminated all mention of signaling raceways and replaced signaling raceways with communications raceways to collate with the panel action on proposal 3-156. It provides installation requirements for the installation of class 2, class 3 and PLTC cables in communications raceways and in cable routing assemblies. It does not cover the installation of communications raceways or cable routing assemblies because that would be redundant.

Proposal 3-144a included a sub-section on distributing frames and cross-connect arrays that has been changed in this comment to just cross-connect arrays to correlate with panel action of Table 725.154 in proposal 3-154a and the existing text in 725.154(F).

Panel Meeting Action: Accept in Principle
Panel Statement: Refer to the panel action and statement on Comment 3-57, which addresses the same issues.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-57 Log #983 NEC-P03 **Final Action: Accept in Principle**
(725.133 and 725.135 (New))

Submitter: Robert W. Jensen, dbi-Telecommunication Infrastructure Design
Comment on Proposal No: 3-144a
Recommendation: Revise text to read as follows:

725.133 Installation of Conductors and Equipment in Cables, Compartments, Cable Trays, Enclosures, Manholes, Outlet Boxes, Device Boxes, ~~and~~ Raceways and Cable Routing Assemblies for Class 2 and Class 3 Circuits. Conductors and equipment for Class 2 and Class 3 circuits shall be installed in accordance with 725.135 ~~725.136~~ through 725.143.

725.135 Installation of Class 2, Class 3 and PLTC Cables. Installation of Class 2, Class 3 and PLTC cables shall comply with 725.135(A) through (M).

(A) Listing. Class 2, Class 3 and PLTC cables installed in buildings shall be listed.

(B) Fabricated Ducts Used for Environmental Air. The following wires and cables shall be permitted in ducts used for environmental air as described in 300.22(B) if they are directly associated with the air distribution system:
(1) Up to 1.22 m (4 ft) of Type CL2P and CL3P cables
(2) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X and PLTC cables and installed in raceways that are installed in compliance with 300.22(B)
Informational Note: For information on fire protection of wiring installed in fabricated ducts see 4.3.4.1 and 4.3.11.3.3 in NFPA 90A-2009, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

(C) Other Spaces Used for Environmental Air (Plenums). The following cables shall be permitted in other spaces used for environmental air as described in 300.22(C):
(1) Types CL2P and CL3P cables
(2) Types CL2P and CL3P cables installed in plenum communications raceways
(3) Types CL2P and CL3P cables and plenum communications raceways supported by open metallic cable trays or cable tray systems
(4) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X and PLTC cables installed in raceways that are installed in compliance with 300.22(C)
(5) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X and PLTC cables supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C).
(6) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X and PLTC cables installed in plenum communications raceways, riser communications raceways and general-purpose communications raceways supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

(D) Risers — Cables in Vertical Runs. The following cables shall be permitted in vertical runs penetrating from floor to floor and in vertical runs in a shaft:
(1) Types CL2P, CL3P, CL2R and CL3R cables
(2) Types CL2P, CL3P, CL2R and CL3R cables installed in:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceways
d. Riser cable routing assemblies
Informational Note: See 300.21 for firestop requirements for floor penetrations.

(E) Risers — Cables in Metal Raceways. The following cables shall be permitted in metal raceways in a riser having firestops at each floor:
(1) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X and PLTC cables
(2) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X and PLTC cables installed in:
a. Plenum communications raceways
b. Riser communications raceways
c. General-purpose communications raceways
Informational Note: See 300.21 for firestop requirements for floor penetrations.

(F) Risers — Cables Fireproof Shafts. The following shall be permitted to be installed in fireproof riser shafts having firestops at each floor:
(1) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X and PLTC cables

(2) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables installed in:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceways
d. Riser cable routing assemblies
e. General-purpose communications raceways
f. General-purpose cable routing assemblies
Informational Note: See 300.21 for firestop requirements for floor penetrations.
(G) Risers — One- and Two-Family Dwellings. The following cables shall be permitted in one- and two-family dwellings:
(1) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables
(2) Type CL2X and CL3X cables less than 6 mm (0.25 in.) in diameter
(3) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables installed in:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceways
d. Riser cable routing assemblies
e. General-purpose communications raceways
f. General-purpose cable routing assemblies
(H) Cable Trays. Cables installed in cable trays outdoors shall be Type PLTC. The following cables and shall be permitted to be supported by cable trays in buildings:
(1) Types CM CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables
(2) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables installed in:
a. Plenum communications raceways
b. Riser communications raceways
c. General-purpose communications raceways
(I) Cross-Connect Arrays. The following cables shall be permitted to be installed in cross-connect arrays:
(1) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables
(2) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables installed in:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceways
d. Riser cable routing assemblies
e. General-purpose communications raceways
f. General-purpose cable routing assemblies
(J) Industrial Establishments. In industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type PLTC cable shall be permitted in accordance with either (1) or (2):
(1) Where the cable is not subject to physical damage, Type PLTC cable that complies with the crush and impact requirements of Type MC cable and is identified as PLTC-ER for such use shall be permitted to be exposed between the cable tray and the utilization equipment or device. The cable shall be continuously supported and protected against physical damage using mechanical protection such as dedicated struts, angles, or channels. The cable shall be supported and secured at intervals not exceeding 1.8 m (6 ft).
(2) Type PLTC cable, with a metallic sheath or armor in accordance with 725.179(E), shall be permitted to be installed exposed. The cable shall be continuously supported and protected against physical damage using mechanical protection such as dedicated struts, angles, or channels. The cable shall be secured at intervals not exceeding 1.8 m (6 ft).
(K) Other Building Locations. The following wires, cables shall be permitted to be installed in building locations other than the locations covered in 725.135(B) through (I):
(1) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables
(2) A maximum of 3 m (10 ft) of exposed Type CL2X in nonconcealed spaces
(3) A maximum of 3 m (10 ft) of exposed Type CL3X in nonconcealed spaces
(4) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables installed in:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceways
d. Riser cable routing assemblies
e. General-purpose communications raceways
f. General-purpose cable routing assemblies
(5) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X and PLTC cables installed in raceways recognized in Chapter 3
(6) Type CMUC undercarpet communications wires and cables installed under carpet
(L) Multifamily Dwellings. The following wires and cables shall be permitted to be installed in multifamily dwellings in locations other than the locations covered in 725.135(B) through (I):
(1) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables
(2) Type CL2X less than 6 mm (0.25 in.) in diameter in nonconcealed spaces
(3) Type CL3X less than 6 mm (0.25 in.) in diameter in nonconcealed spaces
(4) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables installed in:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceways
d. Riser cable routing assemblies
e. General-purpose communications raceways
f. General-purpose cable routing assemblies
(5) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X and PLTC cables installed in raceways recognized in Chapter 3
(6) Type CMUC undercarpet communications wires and cables installed under carpet
(M) One- and Two-Family Dwellings. The following wires and cables shall be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 725.135 (B) through (I):
(1) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables
(2) Type CL2X less than 6 mm (0.25 in.) in diameter
(3) Type CL3X less than 6 mm (0.25 in.) in diameter
(4) Communications wires and Types CL2P, CL3P, CL2R, CL3R, CL2, CL3 and PLTC cables installed in:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceways
d. Riser cable routing assemblies
e. General-purpose communications raceways
f. General-purpose cable routing assemblies
(5) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X and PLTC cables installed in raceways recognized in Chapter 3
(6) Type CMUC undercarpet communications wires and cables installed under carpet

Substantiation: Proposals 3-144a and 3-154a were submitted as a package.

Proposal 3-154a deals with 725.154, *Applications of Listed Class 2, Class 3, and PLTC Cables*. Notwithstanding the title of 725.154, it contains a mixture of applications and installation rules. The primary objectives of proposals 3-144a and 3-154a are to separate the installation rules from the applications and to express the applications as simply as possible by using a table. If this concept is accepted in Articles 725 (proposals 3-144a & 3-154a) and 760 (proposals 3-197 & 3-202), then the cable applications and installation sections will be editorially consistent with Articles 770, 800, 820 and 830.

CMP-3 accepted 3-154a in principle in part by correcting the errors in the proposed Table 725.154 (accept in principle) and retaining the text in 725.154. Table 725.154 clearly prohibits the installation of plenum cable routing assemblies in plenums; permitting them to be used only in place of riser and general-purpose cable routing assemblies.

Instead of retaining signaling raceways and permitting communications to be used in place of them the panel action on proposal 3-156 consolidated the number of redundant raceways by eliminating signaling raceways and replaced them with communications raceways; This is a welcome simplification.

However the text accepted by the panel in its action on proposal 3-156 has several serious conflicts and omissions:

725.154(A) permits the installation of plenum cable routing assemblies in plenums (other space used for environmental air) which conflicts with Table 725.154.

725.154(A) only permits the installation of Types CL2P and CL3P cables in plenum communications raceways that are installed in plenums, which conflicts with 770.113(C), 800.113(C), 820.113(C) and 830.113(C) which permit the installation of optical fiber, communications, CATV and network-powered communications plenum cables in plenum communications raceways that are installed in plenums.

725.154(B) only permits the installation of Types CL2R, CL3R, CL2P and CL3P cables in riser and plenum communications raceways that are installed in risers, which conflicts with 770.113(D), 800.113(D), 820.113(D) and 830.113(D) which permit the installation of optical fiber, communications, CATV and network-powered communications riser and plenum cables in riser communications raceways that are installed in risers.

Whereas 725.154(B) is overly restrictive in the cables permitted to be installed in plenum and riser raceways, it has no restrictions on the cables that are permitted to be installed in cable routing assemblies, opening up the possibility of a general-purpose cable (CL2 or CL3) being installed in a riser cable routing assembly in a riser application.

The solution to fixing the text accepted in action on 3-156 is to take three actions, 1) accept the text recommended in this comment for 725.135(new) which contains all the installation requirements, 2) and to also accept our companion comment on proposal 3-154a for 725.154 and 3) changing the action proposal 3-156 to accept in principle with reference to the acceptance of this comment on proposal 3-144a and our comment on proposal 3-154a.

Proposal 3-144a was not correlated with (couldn't anticipate the panel action) action on proposal 3-160 which required cables penetrating one or more floors to be riser or plenum rated. The comment recommends text for 725.135(C) that correlates with the panel action on proposal 3-160.

Proposal 3-144a included installation requirements for signaling raceways. The recommended text for this comment has eliminated all mention of signaling raceways and replaced signaling raceways with communications raceways to collate with the panel action on proposal 3-156. It provides installation requirements for the installation of class 2, class 3 and PLTC cables in communications raceways and in cable routing assemblies. It does not cover the installation of communications raceways or cable routing assemblies because that would be redundant.

Proposal 3-144a included a sub-section on distributing frames and cross-connect arrays that has been changed in this comment to just cross-connect arrays to correlate with panel action of Table 725.154 in proposal 3-154a and the existing text in 725.154(F).

Panel Meeting Action: Accept in Principle

The panel accepts the comment with the following modifications:

(1) Modify (B)(1) to read: (1) Type CL2P and CL3P cables in lengths as

short as practicable to perform the required function

(2) Modify the charging sentence of (D) as follows:

(D) Risers — Cables in Vertical Runs. The following cables shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft: (remainder unchanged)

(3) Modify the charging sentence of (F) to read: (F) Risers — Cables in Fireproof Shafts. (remainder unchanged)

Panel Statement: The panel recognizes the requirements of NFPA 90A and modified (B)(1) to clarify the need to be consistent with NFPA 90A section 4.3.4.3.

The panel modified (D) to align with the Correlating Committee direction and the joint (CMP 3 and CMP 16) task group conclusions.

The panel also corrected the typographical error in (F) by inserting "in" for clarity.

Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-58 Log #297 NEC-P03 **Final Action: Accept**
(725.139)

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 3-118
Recommendation: Continue to accept proposals 3-152 and 3-153 in principle based on the acceptance of the recommended text in proposal 3-118 for 725.139.
Substantiation: I submitted proposal 3-152 to permit the installation of Class 2 and Class 3 cables along with optical fiber and communications cables in cable routing assemblies. The recommended text in proposals 3-152 and 3-152 and the text accepted for 725.139 in proposal 3-118 are identical.

CMP-3 action on these proposals will facilitate the use of cable routing assemblies in data centers where they are used to support and manage large installations of data cables.

Thank you. Y'all done good.

Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-59 Log #914 NEC-P03 **Final Action: Reject**
(725.140 (New))

Submitter: Mark C. Wirfs, R & W Engineering, Inc.
Comment on Proposal No: 3-154
Recommendation: Accept the original wording in the proposal.
Substantiation: Article 760 is not a valid reference or technical justification. The reference to 300.8 has not been 'missing' but was done purposefully and there has been no evidence to indicate otherwise for decades. Fill calculations can be simply done by treating the tubing size as a conductor of the same dimensions and this has been done for many years in the corrections industry. See substantiation in comment of proposal 3-122a.
Panel Meeting Action: Reject
Panel Statement: The panel maintains its position that the recommended change does not support the purpose of the Code to maintain a separate electrical system.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-60 Log #300 NEC-P03 **Final Action: Accept in Principle**
(725.154)

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 3-154a
Recommendation: Revise the panel action on proposal 3-154a as follows:
Delete 725.154(A) through (F)

725.154 Applications of Listed Class 2, Class 3 and PLTC Cables. Class 2, Class 3 and PLTC cables shall comply with any of the requirements described in 725.154(A) through (C ~~I~~) and as indicated in Table 725.154.

See Table 725.154 on Page 416

(A ~~G~~) Class 2 and Class 3 Cable Substitutions. The substitutions for Class 2 and Class 3 cables listed in Table 725.154(A ~~G~~) and illustrated in Figure 725.154(A ~~G~~) shall be permitted. Where substitute cables are installed, the wiring requirements of Article 725, Parts I and III, shall apply.

Informational Note: For information on Types CMP, CMR, CM, and CMX, see 800.179.

Renumber existing Table 725.154(G) to 725.154(A).

Renumber existing Figure 725.154(G) to Figure 725.154(A).

(B ~~H~~) Class 2, Class 3, PLTC Circuit Integrity (CI) Cable or Electrical Circuit Protective System. Circuit integrity (CI) cable or a listed electrical circuit protective system shall be permitted for use in remote control, signaling, or power-limited systems that supply critical circuits to ensure survivability for continued circuit operation for a specified time under fire conditions.

(C ~~I~~) Thermocouple Circuits. Conductors in Type PLTC cables used for Class 2 thermocouple circuits shall be permitted to be any of the materials used for thermocouple extension wire.

In Table 396.10(A) Cable Types in the column labeled "Section" make the following change:

~~725.154(C) and~~ 725.179(E)

In 600.33(A) and 600.33(A)(2) make the following change:

Table 725.154(A ~~G~~)

In 640.3(C) Informational Note, make the following change:

Table 725.154 ~~(C)~~

In 725.3(C) exception make the following change:

Exception: As permitted in Table 725.154 ~~(A)~~.

In 645.3(B) make the following changes:

(B) Plenums. The provisions of ~~Sections~~ 300.22(C)(1), 725.135(B) ~~725.154(A),~~ 760.53(B)(2), 760.135(B) ~~760.154(A),~~ 770.113(C), 800.113(C), and 820.113(C) and Tables 725.154, 760.154, 770.154(A), 800.154(A) and 820.154(A) shall apply to wiring and cabling in a plenum (other space used for environmental air) above an information technology equipment room.

In 645.32 (645.10(B) renumbered by CMP-12 action on proposal 12-109)

645.32 Under Raised Floors in a Critical Operations Data system. Signal wiring under a raised floor in a critical operations data system shall be in compliance with 300.22(C), 725.135(B) and Table 725.154 ~~(A),~~ 770.113(C) and Table 770.154(a), 800.113(C) and Table 800.154(a), or 820.113(C) and Table 820.154(a).

Substantiation: Proposals 3-144a and 3-154a were submitted as a package. Proposal 3-154a deals with 725.154, Applications of Listed Class 2, Class 3, and PLTC Cables. Notwithstanding the title of 725.154, it contains a mixture of applications and installation rules. The primary objectives of proposals 3-144a and 3-154a are to separate the installation rules from the applications and to express the applications as simply as possible by using a table. If this concept is accepted in Articles 725 (proposals 3-144a & 3-154a) and 760 (proposals 3-197 & 3-202), then the cable applications and installation sections will be editorially consistent with Articles 770, 800, 820 and 830.

CMP-3 accepted 3-154a in principle in part by correcting the errors in the proposed Table 725.154 (accept in principle) and retaining the text in 725.154. Table 725.154 clearly prohibits the installation of plenum cable routing assemblies in plenums; permitting them to be used only in place of riser and general-purpose cable routing assemblies.

We also submitted proposal 3-156 as alternate to splitting 725.154 into an applications and installation parts; it just recommended changing the text of 725.154 to permit the use of cable routing assemblies and the use of communications raceways as an alternate to signaling raceways. Instead of retaining signaling raceways and permitting communications to be used in place of them the panel consolidated the number of redundant raceways and eliminated signaling raceways and replaced them with communications raceways; that's a welcome simplification. However the text accepted by the panel in its action on proposal 3-156 has several serious conflicts and omissions:

725.154(A) permits the installation of plenum cable routing assemblies in plenums (other space used for environmental air) which conflicts with Table 725.154.

725.154(A) only permits the installation of Types CL2P and CL3P cables in plenum communications raceways, which conflicts with 770.113(C), 800.113(C), 820.113(C) and 830.113(C) which permit the installation of optical fiber, communications, CATV and network-powered communications plenum cables in plenum communications raceways.

725.154(B) only permits the installation of Types CL2R, CL3R, CL2P and CL3P cables in rider and plenum communications raceways, which conflicts with 770.113(D), 800.113(D), 820.113(D) and 830.113(D) which permit the installation of optical fiber, communications, CATV and network-powered communications riser and plenum cables in riser cables communications raceways.

Whereas 725.154(B) is overly restrictive in the cables permitted to be installed in plenum and riser raceways, it has no restrictions on the cables that are permitted to be installed in cable routing assemblies opening up the possibility of a general-purpose cable (CL2 or CL3) being installed in a riser cable routing assembly in a riser application.

The solution to fixing the text accepted in action on 3-156 is to accept this comment and to also accept the companion comment on proposal 3-154a which also deals with 725.154. If these two actions are taken we recommend changing the action on 3-156 to "accept in principle" with reference to the panel action on this comment.

Note that a change has been made in Table 725.154 to correlate with the panel action on proposal 3-82 which rejected the use of any plenum cable in a duct specifically fabricated for environmental air.

Part of the panel statement was "The panel rejects the remainder of the proposal because deletion of the text and subsections would create a disparity with other articles that reference specific subsections of 725.154." The comment includes correlating renumbering (or re-lettering) of the affected references throughout the code. The recommended changes to 645.3 correlate with CMP-12 action on proposal 12-109.

Table 725.154
Applications of Listed Class 2, Class 3 and PLTC Cables in Buildings

Applications		**Wire and Cable Type**					
		CL2P & CL3P	CL2R & CL3R	CL2 & CL3	CL2X & CL3X	CMUC	PLTC
In Fabricated Ducts as Described in 300.22(B)	In fabricated ducts	N	N	N	N	N	N
	In metal raceway that complies with 300.22(B)	Y*	Y*	Y*	Y*	N	Y*
In Other Spaces Used for Environmental Air as Described in 300.22(C)	In other spaces used for environmental air	Y*	N	N	N	N	N
	In metal raceway that complies with 300.22(C)	Y*	Y*	Y*	Y*	N	Y*
	In plenum communications raceways	Y*	N	N	N	N	N
	In plenum cable routing assemblies	NOT PERMITTED					
	Supported by open metal cable trays	Y*	N	N	N	N	N
	Supported by solid bottom metal cable trays with solid metal covers	Y*	Y*	Y*	Y*	N	N
In Risers	In vertical runs	Y*	Y*	N	N	N	N
	In metal raceways	Y*	Y*	Y*	Y*	N	Y*
	In fireproof shafts	Y*	Y*	Y*	Y*	N	Y*
	In plenum communications raceways	Y*	Y*	N	N	N	N
	In plenum cable routing assemblies	Y*	Y*	N	N	N	N
	In riser communications raceways	Y*	Y*	N	N	N	N
	In riser cable routing assemblies	Y*	Y*	N	N	N	N
	In one- and two-family dwellings	Y*	Y*	Y*	Y*	N	Y*
Within Buildings in Other Than Air-Handling Spaces and Risers	General	Y*	Y*	Y*	Y*	N	Y*
	In one- and two-family dwellings	Y*	Y*	Y*	Y*	Y*	Y*
	In multifamily dwellings	Y*	Y*	Y*	Y*	Y*	Y*
	In nonconcealed spaces	Y*	Y*	Y*	Y*	Y*	Y*
	Supported by cable trays	Y*	Y*	Y*	N	N	Y*
	Under carpet	N	N	N	N	Y*	N
	In cross-connect arrays	Y*	Y*	Y*	N	N	Y*
	In any raceway recognized in Chapter 3	Y*	Y*	Y*	Y*	N	Y*
	In plenum communications raceways	Y*	Y*	Y*	N	N	Y*
	In plenum cable routing assemblies	Y*	Y*	Y*	N	N	Y*
	In riser communications raceways	Y*	Y*	Y*	N	N	Y*
	In riser cable routing assemblies	Y*	Y*	Y*	N	N	Y*
	In general-purpose communications raceways	Y*	Y*	Y*	N	N	Y*
	In general-purpose cable routing assemblies	Y*	Y*	Y*	N	N	Y*

Note: An ‘N’ in the table indicates that the cable type shall not be permitted to be installed in the application. A ‘Y*’ indicates that the cable shall be permitted to be installed in the application, subject to the limitations described in 725.130 through 725.143.

We are submitting correlating comments on proposals 7-76 [Table 396.19(A)], 18-124 (600.33) and 12-109 (Article 645) to revise the references to Article 725.

Panel Meeting Action: Accept in Principle

Panel Statement: See panel action and statement for Comments 3-57 and 3-63 which meets the intent of the submitter.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13

Ballot Not Returned: 1 Sepulveda, M.

3-61 Log #301 NEC-P03 **Final Action: Accept in Principle**
(725.154)

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.

Comment on Proposal No: 3-156

Recommendation: Revise the panel action on proposal 3-154a as follows:

Continue to accept proposal 3-156 in principle but change the panel action to "See panel action on comments 3-xx and 3-yy", where comment 3-xx is the comment I submitted in proposal 3-144a and 3-yy in the comment that I submitted on proposal 3-154a.

Substantiation: Proposals 3-144a and 3-154a were submitted as a package. Proposal 3-154a deals with 725.154, *Applications of Listed Class 2, Class 3, and PLTC Cables*. Notwithstanding the title of 725.154, it contains a mixture of applications and installation rules. The primary objectives of proposals 3-144a and 3-154a are to separate the installation rules from the applications and to express the applications as simply as possible by using a table. If this concept is accepted in Articles 725 (proposals 3-144a & 3-154a) and 760 (proposals 3-197 & 3-202), then the cable applications and installation sections will be editorially consistent with Articles 770, 800, 820 and 830.

CMP-3 accepted 3-154a in principle in part by correcting the errors in the proposed Table 725.154 (accept in principle) and retaining the text in 725.154. Table 725.154 clearly prohibits the installation of plenum cable routing assemblies in plenums; permitting them to be used only in place of riser and general-purpose cable routing assemblies.

We also submitted proposal 3-156 as alternate to splitting 725.154 into an applications and installation parts; it just recommended changing the text of 725.154 to permit the use of cable routing assemblies and the use of communications raceways as an alternate to signaling raceways. Instead of retaining signaling raceways and permitting communications to be used in place of them the panel consolidated the number of redundant raceways and eliminated signaling raceways and replaced them with communications raceways; that's a welcome simplification. However the text accepted by the panel in its action on proposal 3-156 has several serious conflicts and omissions:

725.154(A) permits the installation of plenum cable routing assemblies in plenums (other space used for environmental air) which conflicts with Table 725.154.

725.154(A) only permits the installation of Types CL2P and CL3P cables in plenum communications raceways, which conflicts with 770.113(C), 800.113(C), 820.113(C) and 830.113(C) which permit the installation of optical fiber, communications, CATV and network-powered communications plenum cables in plenum communications raceways.

725.154(B) only permits the installation of Types CL2R, CL3R, CL2P and CL3P cables in rider and plenum communications raceways, which conflicts with 770.113(D), 800.113(D), 820.113(D) and 830.113(D) which permit the installation of optical fiber, communications, CATV and network-powered communications riser and plenum cables in riser cables communications raceways.

Whereas 725.154(B) is overly restrictive in the cables permitted to be installed in plenum and riser raceways, it has no restrictions on the cables that are permitted to be installed in cable routing assemblies opening up the possibility of a general-purpose cable (CL2 or CL3) being installed in a riser cable routing assembly in a riser application.

The solution to fixing the text accepted in action on 3-156 is to accept my comments on proposals 3-144a and proposal 3-154a. If these two actions are taken we recommend changing the action on 3-156 to "accept in principle" with reference to the panel action on my comments on proposals 3-144a and proposal 3-154a.

Panel Meeting Action: Accept in Principle

Panel Statement: See panel action and statement for Comments 3-57 and 3-63 which meets the intent of the submitter.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13

Ballot Not Returned: 1 Sepulveda, M.

3-62 Log #879 NEC-P03 **Final Action: Accept**
(725.154)

Submitter: Terry Peters, The Society of the Plastics Industry

Comment on Proposal No: 3-155

Recommendation: Continue to reject proposal 3-155.

Substantiation: The submitter's recommendation to prohibit the installation of plenum cables in plenum raceways is absurd. Plenum raceways are designed to be used with plenum cables. The Society of the Plastics Industry supports the panel action to reject this proposal.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13

Ballot Not Returned: 1 Sepulveda, M.

3-63 Log #984 NEC-P03 **Final Action: Accept in Principle in Part**
(725.154)

TCC Action: The Correlating Committee understands the Panel Meeting Action should have stated that the "panel accepts the proposal with the modifications below." The panel accepted the deletion of 725.154(A) thru (F) and the relettering of the remaining sections in addition to the changes noted in the Panel Meeting Action.

Submitter: Robert W. Jensen, dbi-Telecommunication Infrastructure Design

Comment on Proposal No: 3-154a

Recommendation: Revise the panel action on proposal 3-154a as follows:

Delete 725.154(A) through (F)

725.154 Applications of Listed Class 2, Class 3 and PLTC Cables. Class 2, Class 3 and PLTC cables shall comply with any of the requirements described in 725.154(A) through (C ~~I~~) and as indicated in Table 725.154.

Insert Table 725.154

See Table 725.154 on Page 418

(A ~~G~~) Class 2 and Class 3 Cable Substitutions. The substitutions for Class 2 and Class 3 cables listed in Table 725.154(A ~~G~~) and illustrated in Figure 725.154(A ~~G~~) shall be permitted. Where substitute cables are installed, the wiring requirements of Article 725, Parts I and III, shall apply.

Informational Note: For information on Types CMP, CMR, CM, and CMX, see 800.179.

Renumber existing Table 725.54(G) to 725.154(A).

Insert Table 725.154(A) Cable Substitutions (not submitted)

Renumber existing Figure 725.154(G) to Figure 725.154(A).

Insert Figure 725.154(A) Cable Substitution Hierarchy (not submitted)

(B ~~H~~) Class 2, Class 3, PLTC Circuit Integrity (CI) Cable or Electrical Circuit Protective System. Circuit integrity (CI) cable or a listed electrical circuit protective system shall be permitted for use in remote control, signaling, or power-limited systems that supply critical circuits to ensure survivability for continued circuit operation for a specified time under fire conditions.

(C ~~I~~) Thermocouple Circuits. Conductors in Type PLTC cables used for Class 2 thermocouple circuits shall be permitted to be any of the materials used for thermocouple extension wire.

In Table 396.10(A) Cable Types in the column labeled "Section" make the following change:

~~725.154(C) and~~ 725.179(E)

In 600.33(A) and 600.33(A)(2) make the following change:

Table 725.154(A ~~G~~)

In 640.3(C) Informational Note, make the following change:

Table 725.154 ~~(C)~~

In 725.3(C) exception make the following change:

Exception: As permitted in Table 725.154 ~~(A)~~.

In 645.3(B) make the following changes:

(B) Plenums. The provisions of ~~Sections~~ 300.22(C)(1), 725.135(B) ~~725.154(A),~~ 760.53(B)(2), 760.135(B) ~~760.154(A),~~ 770.113(C), 800.113(C), and 820.113(C) and Tables 725.154, 760.154, 770.154(A), 800.154(A) and 820.154(A) shall apply to wiring and cabling in a plenum (other space used for environmental air) above an information technology equipment room.

In 645.32 (645.10(B) renumbered by CMP-12 action on proposal 12-109)

645.32 Under Raised Floors in a Critical Operations Data system. Signal wiring under a raised floor in a critical operations data system shall be in compliance with 300.22(C), 725.135(B) and Table 725.154 ~~(A),~~ 770.113(C) and Table 770.154(a), 800.113(C) and Table 800.154(a), or 820.113(C) and Table 820.154(a).

Substantiation: Proposals 3-144a and 3-154a were submitted as a package. Proposal 3-154a deals with 725.154, Applications of Listed Class 2, Class 3, and PLTC Cables. Notwithstanding the title of 725.154, it contains a mixture of applications and installation rules. The primary objectives of proposals 3-144a and 3-154a are to separate the installation rules from the applications and to express the applications as simply as possible by using a table. If this concept is accepted in Articles 725 (proposals 3-144a & 3-154a) and 760 (proposals 3-197 & 3-202), then the cable applications and installation sections will be editorially consistent with Articles 770, 800, 820 and 830.

CMP-3 accepted 3-154a in principle in part by correcting the errors in the proposed Table 725.154 (accept in principle) and retaining the text in 725.154. Table 725.154 clearly prohibits the installation of plenum cable routing assemblies in plenums; permitting them to be used only in place of riser and general-purpose cable routing assemblies.

The text accepted by the panel in its action on proposal 3-156 has several serious conflicts and omissions:

725.154(A) permits the installation of plenum cable routing assemblies in plenums (other space used for environmental air) which conflicts with Table 725.154.

Table 725.154 Applications of Listed Class 2, Class 3 and PLTC Cables in Buildings							
Applications		**Wire and Cable Type**					
		CL2P & CL3P	CL2R & CL3R	CL2 & CL3	CL2X & CL3X	CMUC	PLTC
In Fabricated Ducts as Described in 300.22(B)	In fabricated ducts	Y*	N	N	N	N	N
	In metal raceway that complies with 300.22(B)	Y*	Y*	Y*	Y*	N	Y*
In Other Spaces Used for Environmental Air as Described in 300.22(C)	In other spaces used for environmental air	Y*	N	N	N	N	N
	In metal raceway that complies with 300.22(C)	Y*	Y*	Y*	Y*	N	Y*
	In plenum communications raceways	Y*	N	N	N	N	N
	In plenum cable routing assemblies	NOT PERMITTED					
	Supported by open metal cable trays	Y*	N	N	N	N	N
	Supported by solid bottom metal cable trays with solid metal covers	Y*	Y*	Y*	Y*	N	N
In Risers	In vertical runs	Y*	Y*	N	N	N	N
	In metal raceways	Y*	Y*	Y*	Y*	N	Y*
	In fireproof shafts	Y*	Y*	Y*	Y*	N	Y*
	In plenum communications raceways	Y*	Y*	N	N	N	N
	In plenum cable routing assemblies	Y*	Y*	N	N	N	N
	In riser communications raceways	Y*	Y*	N	N	N	N
	In riser cable routing assemblies	Y*	Y*	N	N	N	N
	In one- and two-family dwellings	Y*	Y*	Y*	Y*	N	Y*
Within Buildings in Other Than Air-Handling Spaces and Risers	General	Y*	Y*	Y*	Y*	N	Y*
	In one- and two-family dwellings	Y*	Y*	Y*	Y*	Y*	Y*
	In multifamily dwellings	Y*	Y*	Y*	Y*	Y*	Y*
	In nonconcealed spaces	Y*	Y*	Y*	Y*	Y*	Y*
	Supported by cable trays	Y*	Y*	Y*	N	N	Y*
	Under carpet	N	N	N	N	Y*	N
	In cross-connect arrays	Y*	Y*	Y*	N	N	Y*
	In any raceway recognized in Chapter 3	Y*	Y*	Y*	Y*	N	Y*
	In plenum communications raceways	Y*	Y*	Y*	N	N	Y*
	In plenum cable routing assemblies	Y*	Y*	Y*	N	N	Y*
	In riser communications raceways	Y*	Y*	Y*	N	N	Y*
	In riser cable routing assemblies	Y*	Y*	Y*	N	N	Y*
	In general-purpose communications raceways	Y*	Y*	Y*	N	N	Y*
	In general-purpose cable routing assemblies	Y*	Y*	Y*	N	N	Y*
Note: An ‘N’ in the table indicates that the cable type shall not be permitted to be installed in the application. A ‘Y*’ indicates that the cable shall be permitted to be installed in the application, subject to the limitations described in 725.130 through 725.143.							

725.154(A) only permits the installation of Types CL2P and CL3P cables in plenum communications raceways, which conflicts with 770.113(C), 800.113(C), 820.113(C) and 830.113(C) which permit the installation of optical fiber, communications, CATV and network-powered communications plenum cables in plenum communications raceways.

725.154(B) only permits the installation of Types CL2R, CL3R, CL2P and CL3P cables in rider and plenum communications raceways, which conflicts with 770.113(D), 800.113(D), 820.113(D) and 830.113(D) which permit the installation of optical fiber, communications, CATV and network-powered communications riser and plenum cables in riser cables communications raceways.

Whereas 725.154(B) is overly restrictive in the cables permitted to be installed in plenum and riser raceways, it has no restrictions on the cables that are permitted to be installed in cable routing assemblies opening up the possibility of a general-purpose cable (CL2 or CL3) being installed in a riser cable routing assembly in a riser application.

The solution to fixing the text accepted in action on 3-156 is to accept this comment and to also accept the companion comment on proposal 3-154a which also deals with 725.154. If these two actions are taken we recommend changing the action on 3-156 to “accept in principle” with reference to the panel action on this comment.

Part of the panel statement was “The panel rejects the remainder of the proposal because deletion of the text and subsections would create a disparity with other articles that reference specific subsections of 725.154.” The comment includes correlating renumbering (or re-lettering) of the affected references throughout the code. The recommended changes to 645.3 correlate with CMP-12 action on proposal 12-109.

Panel Meeting Action: Accept in Principle in Part

The panel accepts the proposed recommendation modified below:

In new Table 725.154, correct the last line in the section “In Other Spaces Used for Environmental Air as Described in 300.22(C)” for PLTC to read “Y*”.

The panel rejects the changes to Table 396.10(A); 600.33(A) and 600.33(A)(2); 640.3(C); 645.3(B); and 645.32

Panel Statement: The panel corrected the application of PLTC in Table 725.154 to allow PLTC to be supported by solid bottom metal cable trays with solid metal covers in other spaces for environmental air.

The rejected parts of the comment are based on the fact that they are outside the scope of the panel.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13

Ballot Not Returned: 1 Sepulveda, M.

Comment on Affirmative:

STENE, S.: The Panel Meeting Action should have stated that the ‘panel accepts the proposal with the modifications below’. The panel accepted the deletion of 725.154(A) thru (F) and the relettering of the remaining sections in addition to the changes noted in the Panel Meeting Action.

3-64 Log #1364 NEC-P03 **Final Action: Reject**
(Table 725.154)

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)

Comment on Proposal No: 3-154a

Recommendation: Delete plenum cable routing assemblies from the second column of Table 725.154.

Substantiation: Cable Routing assemblies are not permitted in Plenums or other spaces used for environmental air by either the NEC or by NFPA 90A that has jurisdiction over wiring in air handling plenum spaces. Inclusion of plenum cable routing assemblies is misleading and could cause it to be used where it is not permitted. Companion comment on proposal 3-118 proposes an Informational Note that would permit the substitution of plenum cable routing assemblies for Riser cable routing assemblies

Panel Meeting Action: Reject

Panel Statement: The panel asserts that the table, as presented, states very clearly where the plenum rated cable routing assemblies are allowed to be installed.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13

Ballot Not Returned: 1 Sepulveda, M.

3-65 Log #880 NEC-P03 **Final Action: Accept**
(725.154(A))

Submitter: Terry Peters, The Society of the Plastics Industry

Comment on Proposal No: 3-157

Recommendation: Continue to reject proposal 3-157.

Substantiation: The Society of the Plastics Industry agrees that the recommended text is contradictory and supports the panel action to reject this proposal.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13

Ballot Not Returned: 1 Sepulveda, M.

3-66 Log #905 NEC-P03 **Final Action: Accept in Principle**
(725.154(A))

Submitter: Marcelo M. Hirschler, GBH International

Comment on Proposal No: 3-156

Recommendation: Revise text to read as follows:

725.154 Applications of Listed Class 2, Class 3, and PLTC Cables. Class 2, Class 3, and PLTC cables shall comply with any of the requirements described in 725.154 (A) through (I).

(A) Plenums. Cables installed in ducts, plenums, and other spaces used for environmental air shall be Type CL2P or CL3P. Listed wires and cables installed in compliance with 300.22 shall be permitted. Listed plenum communications raceways ~~and listed plenum cable routing assemblies~~ shall be permitted to be installed in other spaces used for environmental air as described in 300.22(C). Only Types CL2P or CL3P cables shall be permitted to be installed in these plenum communications raceways.

Substantiation: This section contains a mistake in that it allows plenum cable routing assemblies” into plenums. This is inconsistent with NFPA 90A, with the table 725.154 and with the requirements in articles 760, 770, 800, 820 and 830.

Plenum cable routing assemblies are permitted to be listed and are permitted to be used in risers, cable trays and so on but are not permitted to be used in plenums.

Panel Meeting Action: Accept in Principle

Panel Statement: See panel action and statement for Comment 3-63, which meets the intent of the submitter.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13

Ballot Not Returned: 1 Sepulveda, M.

3-67 Log #1365 NEC-P03 **Final Action: Accept in Principle**
(725.154(A))

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)

Comment on Proposal No: 3-156

Recommendation: Delete the proposed permitted use of Listed plenum cable routing assemblies in plenums in 725.154(A):

(A) Plenums. Cables installed in ducts, plenums, and other spaces used for environmental air shall be Type CL2P or CL3P. Listed wires and cables installed in compliance with 300.22 shall be permitted. Listed plenum communications raceways ~~and listed plenum cable routing assemblies~~ shall be permitted to be installed in other spaces used for environmental air as described in 300.22(C). Only Types CL2P or CL3P cables shall be permitted to be installed in these plenum communications raceways.

Substantiation: The text in 725.154 accepted by the panel permits plenum rated cable routing assemblies to be installed in other spaces used for environmental air as described in 300.22(C). Cable Routing assemblies are not permitted in other spaces used for environmental air by either the NEC or by NFPA 90A that has jurisdiction over wiring in air handling plenum spaces.

Panel Meeting Action: Accept in Principle

Panel Statement: See panel action and statement for Comment 3-63 which meets the intent of the submitter.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13

Ballot Not Returned: 1 Sepulveda, M.

3-68 Log #302 NEC-P03 **Final Action: Accept in Principle**
(725.154(B)(1))

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.

Comment on Proposal No: 3-160

Recommendation: Revise the panel action on proposal 3-154a as follows:

Continue to accept proposal 3-156 in principle but change the panel action to “See panel action on comments 3-xx and 3-yy”, where comment 3-xx is the comment I submitted in proposal 3-144a and 3-yy in the comment that I submitted on proposal 3-154a.

Substantiation: This is a companion comment to our comments on proposals 3-144a and 3-154a. Our comment on proposal 3-144a has text to correlate with the panel action on proposal 3-160.

If the panel accepts our comments on proposals 3-144a and 3-154a, the action on this proposal should be changed to accept in principle with references to the actions on our comments on 3-144a and 3-154a.

Panel Meeting Action: Accept in Principle

Panel Statement: See panel action and statement for Comments 3-57 and 3-63 which meets the intent of the submitter.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13

Ballot Not Returned: 1 Sepulveda, M.

3-69 Log #707 NEC-P03 **Final Action: Accept in Principle in Part**
(725.154(B)(1))

Submitter: George Bish, Secure Watch Security
Comment on Proposal No: 3-160
Recommendation: Continue to "Accept in Principle".
Revise Panel Statement to: "See Panel Action and Panel Statement on Proposal 3-159."
Substantiation: It is the recommendation of the Task Group to correlate with the current language used in Chapter 8, Sections 800.113(D), 820.113(D) and 830.113(D), as well as 770.113(D). The Acceptance in Principle of Proposal 3-160 with reference to the Panel Action and Panel Statement on Proposal 3-159 as recommended by the Task Group will accomplish this. This action will fulfill the Correlating Committee's request to correlate the phrase "penetrating one or more floors" and "from floor to floor" in Proposals 3-159, 3-192, 3-193, 3-205 and 3-206
This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to address the correlation of the term "floor to floor" vs. "more than one floor"
The Task Group members were:
George Bish, Chair, representing Satellite Broadcasting & Communication Association
Harry Ohde, representing IBEW
James Brunssen, representing Alliance for Telecommunications Industry Solutions
George Straniero, representing National Electrical Manufacturers Association
Robert Walsh, representing International Association of Electrical Inspectors
Wendell Whistler, representing Intertek Testing Services
Panel Meeting Action: Accept in Principle in Part
Revise the panel action on Proposal 3-160 to read as follows:
(1) Cables installed in vertical runs and penetrating one or more floors or cables installed in vertical runs in a shaft, shall be Type CL2R or CL3R. Floor penetrations requiring Type CL2R or CL3R shall contain only cables suitable for riser or plenum use. Listed riser signaling raceways and listed plenum signaling raceways shall be permitted to be installed in vertical riser runs in a shaft from floor to floor.
Only Type CL2R, CL3R, CL2P, or CL3P cables shall be permitted to be installed in these raceways.
Reject the recommendation to "Revise panel statement to "See panel action and panel statement on Proposal 3-159".
Panel Statement: The changes made by the panel to 725.154(B)(1) meet the intent of the submitter.
The panel cannot revise the panel statement in the ROP as suggested in the recommendation.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-70 Log #709 NEC-P03 **Final Action: Accept in Principle**
(725.154(B)(1))

Submitter: George Bish, Secure Watch Security
Comment on Proposal No: 3-159
Recommendation: Revise Panel Action to Accept Proposal 3-159.
Substantiation: It is the recommendation of the Task Group to Accept this proposal as this will correlate with the language used in Chapter 8, Sections 800.113(D), 820.113(D) and 830.113(D), as well as 770.113(D). This action will fulfill the TCC's request to correlate the phrase "penetrating one or more floors" and "from floor to floor" in Proposals 3-159, 3-192, 3-193, 3-205, and 3-206. The Task Group realizes that there are other sections of Articles 770 and Chapter 8 where this phrase is not consistent and recommends that a Task Group be appointed to work on the complete correlation for the 2017 edition
This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to address the correlation of the term "floor to floor" vs. "more than one floor"
The Task Group members were:
George Bish, Chair, representing Satellite Broadcasting & Communication Association
Harry Ohde, representing IBEW
James Brunssen, representing Alliance for Telecommunications Industry Solutions
George Straniero, representing National Electrical Manufacturers Association
Robert Walsh, representing International Association of Electrical Inspectors
Wendell Whistler, representing Intertek Testing Services
Panel Meeting Action: Accept in Principle
Panel Statement: Refer to the panel action and statement in Comment 3-69, which meets the intent of the submitter.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-71 Log #303 NEC-P03 **Final Action: Accept in Principle**
(725.179)

TCC Action: See the Correlating Committee action on Comment 3-41 which revises the introductory paragraph and title of 725.179.
Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 3-163a
Recommendation: Delete 725.179(I), 725.179(J) and 725.179(K).
Renumber 725.179(L) to 725.179(I).
In the introductory paragraph of 725.179, change 725.179(L) to 725.179(I).
Substantiation: The panel deleted signaling raceways and replaced them with communications raceways. The listing requirements for communications raceways are in 800.182. There is no need to have redundant listing requirements in multiple Articles. Having the listing requirements for communications raceways in 800.182 is sufficient.
Panel Meeting Action: Accept in Principle
The panel accepts the recommendation except as modified below:
(1) Revise the introductory paragraph to reflect the deleted paragraphs.
(2) Change the title to read: 725.179 Listing and Marking of Class 2, Class 3, and Type PLTC Cables.
Panel Statement: With the deletion of "communications raceways" from 725.179, the title needed to be changed.
The information related to communications raceways contained in the deleted material is addressed in the action on 3-47a (Log #CC304).
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-72 Log #985 NEC-P03 **Final Action: Accept in Principle**
(725.179)

Submitter: Robert W. Jensen, dbi-Telecommunication Infrastructure Design
Comment on Proposal No: 3-163a
Recommendation: Delete 725.179(I), 725.179(J) and 725.179(K).
Renumber 725.179(L) to 725.179(I).
In the introductory paragraph of 725.179, change 725.179(L) to 725.179(I).
Substantiation: The panel deleted signaling raceways and replaced them with communications raceways. The listing requirements for communications raceways are in 800.182. There is no need to have redundant listing requirements in multiple Articles. Having the listing requirements for communications raceways in 800.182 is sufficient.
Panel Meeting Action: Accept in Principle
Panel Statement: Refer to the panel action and statement on Comment 3-71 which addresses the same changes.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-73 Log #1366 NEC-P03 **Final Action: Reject**
(725.179)

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 3-118
Recommendation: Delete the proposed new 725.179(L), re-letter proposed new 725.179(M) as (L) and add an Informational Note following it as follows:
<u>Informational Note: Cable routing assemblies that exhibit a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with the plenum test in UL 2024 Signaling, Optical Fiber and Communications Raceways and Cable Routing Assemblies are considered suitable wherever cable routing assemblies that pass the requirements of the test for flame propagation (riser) in UL 2024 Signaling, Optical Fiber and Communications Raceways and Cable Routing Assemblies are required.</u>
Substantiation: Proposed new 725.179(L) includes requirements for a plenum rated cable routing assembly where there is no corresponding application for the product. While it is permitted as a substitute for the riser and lower rated Cable Routing assemblies, its use in plenums is not permitted by the NEC or by NFPA 90A that has jurisdiction over wiring in air handling plenum spaces. An Informational Note after the requirements for Riser cable routing assemblies would be appropriate in place of the proposed requirement.
Panel Meeting Action: Reject
Panel Statement: See the panel statement for Comment 3-64 which addresses the subject of where cable routing assemblies are permitted to be used. The informational note is not needed.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-74 Log #708 NEC-P03 **Final Action: Accept in Principle in Part**
(725.179(F))

Submitter: George Bish, Secure Watch Security
Comment on Proposal No: 3-165
Recommendation: Continue to Accept in Principle with the following changes
725.179(F)(1) "Circuit integrity (-CI) cables used in raceways shall ~~only~~ be ~~permitted to be installed in a raceway where specifically~~ listed and marked as part of an Electrical Circuit Protective System as covered in (F)(2)"
725.179(F)(2) "printed on the outer jacket of the cable and ~~shall be~~ installed"
725.179(F)(2) Informational Note 1 "UL 2196-200~~2~~1"
725.179(F)(2) Informational Note 2 "~~UL guide~~ The listing organization provides information for Electrical Circuit Protective Systems (FHIT) ~~contains information on proper~~ including installation requirements to maintain the fire rating."
Substantiation: The recommended changes to 725.179(F)(1) and (F)(2) will correlate these sections with 770.179(E)(1) & (E)(2) and 800.179(G)(1) & (G)(2) as contained in companion comments to Proposals 16-26a and 16-85a and similar changes recommended in companion comments to Proposals 3-208 and 3-210.
The correct date is provided for UL 2196 in Informational Note No 1. Informational note No 2 is revised to indicate that the listing organization provides information, including installation requirements for FHIT systems.
This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to correlate the Panel Action on Proposals 16-26a, 16-79, 16-85a, 16-137, 3-165, 3-208, and 3-210
The Task Group members were:
George Bish, Chair, representing Satellite Broadcasting & Communication Association
Harry Ohde, representing IBEW
James Brunssen, representing Alliance for Telecommunications Industry Solutions
George Straniero, representing National Electrical Manufacturers Association
Robert Walsh, representing International Association of Electrical Inspectors
Wendell Whistler, representing Intertek Testing Services
Panel Meeting Action: Accept in Principle in Part
Accept the recommendation: 725.179(F)(2) printed on the outer jacket of the cable and ~~shall be~~ installed, and reject the remaining recommendations.
Modify 725.179(F)(2) Informational Note 1 to read:
One method of defining circuit integrity (CI) cable or an Electrical Circuit Protective System is by establishing a minimum 2-hour fire resistive rating when tested in accordance with UL 2196-2012, Standard for Tests of Fire Resistive Cables.
Panel Statement: The panel asserts that the original language of 725.179(F)(1) should remain.
The panel agrees that the second "shall be" should be removed in 725.179(F)(2)
The reference to UL 2196 in 725.179(F)(2) Informational Note 1 was modified to reflect the current revision of the standard.
There is no need to modify 725.179(F)(2) Informational Note 2.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-75 Log #1182 NEC-P03 **Final Action: Accept in Principle**
(725.179(F)(2), Informational Note 1)

Submitter: Susan L. Stene, UL LLC
Comment on Proposal No: 3-141
Recommendation: Revise text to read as follows:
(F) Circuit Integrity (CI) Cable or Electrical Circuit Protective System. Cables that are used for survivability of critical circuits under fire conditions shall meet either (F)(1) or (F)(2) as follows (1) Circuit Integrity (CI) Cables. Circuit Integrity (CI) cables, specified in 725.154(A), (B), (D)(1), and (E), and used for survivability of critical circuits shall have the additional classification using the suffix "-CI". Circuit integrity (CI) cables shall only be permitted to be installed in a raceway where specifically listed and marked as part of an electrical circuit protective system as covered in (F)(2).
(2) Electrical Circuit Protective System. Cables, specified in 725.154(A), (B), (D)(1), (E) and (F)(1) that are part of an electrical circuit protective system, shall be identified with the protective system number and hourly rating printed on the outer jacket of the cable and shall be in- stalled in accordance with the listing of the protective system.
Informational Note No. 1: One method of defining circuit integrity (CI) cable or an Electrical Circuit Protective System is by establishing a minimum 2-hour fire resistive rating when tested in accordance with UL 2196-~~2001~~ (2012), Standard for Tests of Fire Resistive Cables.
Informational Note No. 2: UL guide information for electrical circuit protective systems (FHIT) contains information on proper installation.
Substantiation: UL 2196, the Standard for Tests for Fire Resistive Cables was revised in 2012. References to UL Standards in the NEC should reflect the current edition.
Panel Meeting Action: Accept in Principle
Revise the date as shown in the recommendation but remove the parentheses.
Panel Statement: The removal of the parentheses is needed to comply with the manual of style. Also refer to the panel statement in Comment 3-53 for further explanation.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

ARTICLE 728—FIRE RESISTIVE CABLE SYSTEMS (PROPOSED)

3-76 Log #554 NEC-P03 **Final Action: Reject**
(728 (New))

Submitter: Richard E. Loyd, Sun Lakes, AZ
Comment on Proposal No: 3-170
Recommendation: Reject this proposal.
Substantiation: Effective 09-12-12 UL issued Interim Guidelines for testing CI cables and Fire-Resistive cables that are part of the Electrical Circuit Protective Systems covered in this new Article. UL will be reviewing the requirements for these systems which will very likely lead to changes in the standard and in installation requirements for these systems.
The substantiation provided by the submitter is to inform the installers details including specific materials that must be used in association with CI cable. It is likely all these specifics will be changed by this UL action. Until that work is completed, this proposal should be rejected.
Panel Meeting Action: Reject
Panel Statement: While listed fire rated cable is currently undergoing scrutiny, an interim listing program exists that will allow the use of this article. Article 728, developed from the actions on Proposal 3-170 and Comments 3-79, 3-80, 3-81, 3-83, 3-88, Comment 3-83a (Log #CC302), 3-83b (Log #CC303), and 3-47a (Log #CC304) contains generic requirements which should allow for flexibility for the installation of these systems.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-77 Log #955 NEC-P03 **Final Action: Reject**
(728 (New))

Submitter: William A. Wolfe, Steel Tube Institute
Comment on Proposal No: 3-170
Recommendation: Reject this proposal.
Substantiation: Effective 09-12-12 ULpulled the listings on many of these systems and cables and issued Interim Guidelines for testing CI cables and Fire-Resistive cables that are part of the Electrical Circuit Protective Systems covered in this new Article. The Standards Technical Panel (STP) for UL 2196 Fire Resistive Cables has been expanded and will be charged with reviewing the requirements for these systems which will very likely lead to changes in the standard and in the requirements for these systems. Until that work is completed, this proposal should be rejected.
Panel Meeting Action: Reject
Panel Statement: Refer to the panel action and statement on Comment 3-76, which addresses the same issue.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-78 Log #968 NEC-P03 **Final Action: Reject**
(728)

Submitter: Edward Walton, WC Services
Comment on Proposal No: 3-170
Recommendation: Delete entire article.
Substantiation: As a manufacturer of fire resistive cable systems, we (and the installer) must follow the detailed requirements in our specific Electrical Circuit Protective System, the FHIT.GuideInfo provided by UL, code requirements as they appear in other articles and our own manufacturers instructions for each specific cable product. Many of our qualified installation requirements (and future qualified products) are (would be) in conflict with this article. This article does not provide any new material and conflicts with existing code articles (article 760, conduit support spacing; article 708, use of rigid conduit; etc). Finally, the updating of specific requirements in this article would not be practical on a three year cycle. I suggest this is good annex material.
Panel Meeting Action: Reject
Panel Statement: Refer to the panel action and statement on Comment 3-76, which addresses the same issue.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-79 Log #792 NEC-P03 **Final Action: Accept in Principle**
(728.4, 728.5)

TCC Action: The Correlating Committee directs that commas be added editorially after "system" in two places in 728.4 and after "room" in 728.5 as follows:
"728.4 General. Fire resistive cables, fire resistive conductors and components shall be tested and listed as a complete system, shall be designated for use in a specific fire rated system, and shall not be interchangeable between systems. Fire resistive cables, conductors and components shall be approved.
728.5 Installations. Fire resistive cable systems installed outside the fire-rated rooms that they serve, such as the electrical room or the fire pump room, shall comply with the following requirements and all other installation instructions provided in the listing."
Submitter: Thomas Guida, TJG Services Inc.
Comment on Proposal No: 3-170
Recommendation: Revise text to read as follows:
728.4 General. Fire resistive cables, fire resistive conductors and components shall be tested and listed as a complete system. The cables, conductors and components shall be designated for use in a specific fire rated system and shall not be interchangeable between systems. Fire resistive cables, conductors and components shall be suitable for use with the wiring methods in this code ~~Chapter 3~~ as applicable.
728.5 Installations.
Fire resistive cable systems installed outside the fire-rated rooms that they serve, such as the electrical room or the fire pump room shall comply with the following requirements and all other installation instructions provided in the listing.
(A) Mounting surface. The fire resistive cable system shall be fastened to a concrete or masonry wall or a concrete floor-ceiling assembly or other surfaces described in the installation instructions provided in the listing. The fire rating of the wall or floor-ceiling assembly upon which the electrical circuit protective system is mounted shall be equal to or greater than the rating of the fire resistive cable system.
Substantiation: These revisions to the text better define where these systems are used.
Panel Meeting Action: Accept in Principle
Revise text to read as follows:
728.4 General. Fire resistive cables, fire resistive conductors and components shall be tested and listed as a complete system. ~~The cables, conductors and components shall be~~ designated for use in a specific fire rated system and shall not be interchangeable between systems. Fire resistive cables, conductors and components shall be approved. ~~suitable for use with the wiring methods in Chapter 3 as applicable.~~
728.5 Installations.
Fire resistive cable systems installed outside the fire-rated rooms that they serve, such as the electrical room or the fire pump room shall comply with the following requirements and all other installation instructions provided in the listing.
(A) Mounting. ~~**surface.**~~ The fire resistive cable system shall be secured to the building structure in accordance with the listing and manufacturer's installation instructions. ~~fastened to a concrete or masonry wall or a concrete floor-ceiling assembly.~~ The fire rating of the wall or floor-ceiling assembly upon which the electrical circuit protective system is mounted shall be equal to or greater than the rating of the fire resistive cable system.
Panel Statement: The panel made changes to clarify the requirements for installation of fire resistive cable systems.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-80 Log #1184 NEC-P03 **Final Action: Accept**
(728.4 (New))

Submitter: Susan L. Stene, UL LLC
Comment on Proposal No: 3-170
Recommendation: Revise text to read as follows:
728.4 General. Fire resistive cables, fire resistive conductors and components shall be tested and listed as a complete system. The cables, conductors and components shall be designated for use in a specific fire rated system and shall not be interchangeable between systems. Fire resistive cables, conductors and components shall be suitable for use with the wiring methods in Chapter 3 as applicable.
Informational Note No. 1: One method of defining the fire rating is by testing the system in accordance with UL 2196-~~2006~~ 2012, Standard for Tests of Fire Resistive Cables.
Informational Note No. 2: Fire resistive cable systems are considered part of an Electrical Circuit Protective System.
Substantiation: UL 2196, the Standard for Tests for Fire Resistive Cables was revised in 2012. References to UL Standards in the NEC should reflect the current edition.
Panel Meeting Action: Accept
Panel Statement: Also see panel action and statement for Comment 3-53 for an explanation.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-81 Log #1107 NEC-P03 **Final Action: Accept in Principle**
(728.5(B))

Submitter: Edward Walton, WC Services
Comment on Proposal No: 3-170
Recommendation: Revise text to read as follows:
(B) Supports. ~~Fire resistive cabling systems shall be supported with steel support hardware, such as steel struts, clamps, straps or fasteners.~~ The fire resistive system shall be supported in accordance with the manufacturer's listing. ~~and, if not specified, at intervals not to exceed 1.5 m (5 ft).~~ At termination points, the fire resistive system shall be supported within 610 mm (24 in.) of each junction box, pull point, or enclosure.
Informational Note: The supports are an important part of the systems and each individual system may have specific support requirements. These supports are critical and must survive under fire condition to ensure the survivability of the system.
Substantiation: Limiting supports to "steel" would eliminate other qualified components that are not steel. A qualified example from FHIT.25 is approved "reinforced thermosetting resin conduit (RTRC)." This non corrosive conduit system is qualified to UL 2196 and important to transit, underground and chemical plant applications.
Panel Meeting Action: Accept in Principle
Modify the recommendation as follows:
(B) Supports. ~~Fire resistive cabling systems shall be supported with steel support hardware, such as steel struts, clamps, straps or fasteners.~~ The fire resistive system shall be supported in accordance with the listing and the manufacturer's installation instructions ~~listing~~. ~~and, if not specified, at intervals not to exceed 1.5 m (5 ft). At termination points, the fire resistive system shall be supported within 610 mm (24 in.) of each junction box, pull point, or enclosure.~~
Informational Note: The supports are critical for survivability of the system. Each system will have its specific support requirements. ~~The supports are an important part of the systems and each individual system may have specific support requirements. These supports are critical and must survive under fire condition. to ensure the survivability of the system.~~
Panel Statement: The panel has revised the text for clarity and to be consistent with the changes made in Comment 3-79. The last sentence of the requirement is deleted because these type provisions would be addressed in the listing and manufacturer's installation instructions.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-82 Log #1185 NEC-P03 **Final Action: Accept in Principle**
(728.5(B))

Submitter: Susan L. Stene, UL LLC
Comment on Proposal No: 3-170
Recommendation: Revise text to read as follows:
(B) Supports. Fire resistive cabling systems shall be supported with steel support hardware, such as steel struts, clamps, straps or fasteners. The fire resistive system shall be supported in accordance with the manufacturer's listing ~~and, if not specified, at intervals not to exceed 1.5 m (5 ft)~~. At termination points, the fire resistive system shall be supported within 610 mm (24 in.) of each junction box, pull point, or enclosure.
Substantiation: All listed Fire Resistive Cabling systems are tested using the support distance specified in the manufacturer's instructions. Therefore, there should be no system where the support length is unspecified.
Panel Meeting Action: Accept in Principle
Panel Statement: Refer to the panel action and statement on Comment 3-81, which addresses the same issue.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-83 Log #1108 NEC-P03 **Final Action: Accept**
(728.5(C))

Submitter: Edward Walton, WC Services
Comment on Proposal No: 3-170
Recommendation: Revise text to read as follows:
(C) Raceways and Couplings. Where the fire resistive system is listed to be installed in a raceway, the raceways enclosing the system, any couplings, and connectors shall be ~~steel. Only raceways and fittings~~ listed as part of the fire rated system~~. shall be used~~.
Substantiation: Limiting supports to "steel" would eliminate other qualified components that are not steel. A qualified example from FHIT.25 is approved "reinforced thermosetting resin conduit (RTRC)." This non corrosive conduit system is qualified to UL 2196 and important to transit, underground and chemical plant applications.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-83a Log #CC302 NEC-P03 **Final Action: Accept**
(728.5(D) and (E))

Submitter: Code-Making Panel 3,
Comment on Proposal No: 3-170
Recommendation: Revise 728.5(D) and (E) as follows:
(D) Cable Tray. Cable tray used as part of a fire resistive system shall be listed as part of the fire resistive system. ~~Fire resistive systems listed for cable tray installations shall only use steel cable trays and steel components.~~
(E) Boxes. Boxes or enclosures used as part of a fire resistive system shall be listed as part of the fire resistive system ~~shall be steel only~~ and shall be secured ~~fastened~~ to the building structure ~~fire rated surface~~ independently of the raceways or cables listed in the system.
Substantiation: The panel has revised the text for clarity and to be consistent with the changes made in Comment 3-79 and 3-81.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-83b Log #CC303 NEC-P03 **Final Action: Accept**
(728.5(F) (G), and (H))

Submitter: Code-Making Panel 3,
Comment on Proposal No: 3-170
Recommendation: Revise 728.5(F),(G) and (H) as follows:
(F) Pulling Lubricants. Fire resistive cable systems, installed in a raceway shall only use pulling lubricants listed ~~for~~ as part of the fire resistive cable system~~s~~.
(G) Vertical Supports. Cables and conductors installed in vertical raceways shall be supported in accordance with the listing ~~300.19(B). The cable supports shall be steel and shall be identified in the~~ of the fire resistive cable system.
(H) Splices. Only splices that are part of the listing for the fire resistive cable system shall be used. Splices shall have manufacturer's installation instructions. ~~Splices shall be specific for each cable manufacturer.~~
Substantiation: The panel has revised the text for clarity and to be consistent with the changes made in Comment 3-79, 3-81 and Log CC 302.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-84 Log #1109 NEC-P03 **Final Action: Reject**
(728.5(F))

Submitter: Edward Walton, WC Services
Comment on Proposal No: 3-170
Recommendation: Delete and renumber
~~**(F) Pulling Lubricants.** Fire resistive systems, installed in a raceway shall only use pulling lubricants listed for fire resistive systems.~~
Substantiation: There are no provisions within the UL 2196 Standard for the installation or testing of cable lubricants during the fire test. There are no lubricants listed for use with "fire resistive systems". Lubricants are listed per UL Subject 267, "Outline of Investigation for Wire-Pulling Compounds." They are tested for compatibility with the cable jacket using IEEE 1210, "Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable" which demonstrates there are no short or long term effects on the cable jacket properties. Manufacturers recommend lubricants that meet these criteria.
Panel Meeting Action: Reject
Panel Statement: Pulling lubricants need to be addressed as part of the fire resistive system.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

3-85 Log #1110 NEC-P03 **Final Action: Reject**
(728.120)

Submitter: Edward Walton, WC Services
Comment on Proposal No: 3-170
Recommendation: Delete entire Paragraph
~~728.120 Marking. In addition to the marking required in 310.120, system cables and conductors shall be surface marked with the suffix "–FRR" (Fire Resistive Rating), along with the circuit integrity duration in hours and with the system identifier.~~
Substantiation: UL standards and follow up procedures specify marking requirements for listed and classified systems (including marking required in 310.120). Example " XX AWG RHW-2 600V (UL) R19359 CLASSIFIED 2 HOUR FIRE RATING (SYS #25)". In some cases 728.120 duplicates existing requirements or directly conflicts with current requirements (-CI listed products must be rated for two hours, see NEC articles 725, 760 and 800). System identifier is not defined. The suffix "–FRR" (Fire Resistive Rating) does not add any additional information.
Panel Meeting Action: Reject
Panel Statement: The provisions of 310.120(D) permits the conductors to be marked in this manner.
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

ARTICLE 760 — FIRE ALARM SYSTEMS

3-86 Log #304 NEC-P03 **Final Action: Accept in Principle**
(760.2 and 760.3)

TCC Action: See Correlating Committee action on Comment 3-88.
Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 3-171
Recommendation: Revise the panel action on proposal 3-171 as follows:
Reject the definition of cable routing assembly recommended for 760.2.
760.3(L) (new) **Cable Routing Assemblies.** The definition in 800.2, the applications in Table 800.154(c) and the installation rules in 800.110 and 800.113 shall apply to Article 760.
Substantiation: Cable routing assemblies were introduced into the 2011 NEC. The definition, applications and installation rules for cable routing assemblies do not need to be repeated in every Article that has provisions for installing cables in cable routing assemblies.
The definition of cable routing assemblies is in 770.2. Proposal 16-23 recommended moving the definition to 800.2 so it would be in the same Article with the listing and application requirements. Panel 16 action on proposal 16-23 duplicated it in 800.2. We have submitted a comment to delete the definition of cable routing assembly from 770.2 and have it in 800.2 only.
The definition, listing requirements, applications and installation rules for cable routing assemblies do not need to be repeated in multiple articles. Having them all in Article 800 is sufficient.
The Correlating Committee, in its actions on proposal 3-118 and 3-171, directed that the definition of cable routing assembly be located in a single Article of Chapter 8. The correlating committee also directed in it actions on proposals 16-37, 16-163 and 16-222 that the Panel 16 actions to establish references to the definition, applications and installation rules for cable routing assemblies in 770.3, 820.3 and 830.3 be correlated with Articles 725 and 760., Acceptance of this comment will bring the panel action into conformance with the Correlating Committee directives.
Panel Meeting Action: Accept in Principle
Panel Statement: Refer to the panel action and statement on Comment 3-88.
With the removal of the definition of Cable Routing Assembly from Article 760, the panel agrees that the pointer to Article 800 needs to be in included for the information regarding the cable routing assembly.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 12 Negative: 1
Ballot Not Returned: 1 Sepulveda, M.
Explanation of Negative:
STENE, S.: The comment text as accepted would apply the application of Table 800.145(c), the listing requirements in 800.182 and the installation rules in 800.110 and 800.113 to all of Article 760, not just to cable routing assemblies within Article 760. This would permit this application for non-power-limited fire alarm circuits, as well as power-limited fire alarm circuit applications and that was never the intent. In addition, the application, listing requirements, and installation requirements as referenced in this accepted text in Article 800 only applies to communications wiring, cables, and raceways, not power-limited fire alarm circuits. This comment should be rejected or held for next Code cycle since it would not be possible to fix it at this time. The Correlating Committee should direct Panel 16 to locate this definition in Article 100 since it appears in more than one article and there is no technical or compelling reason to have the definition located in Article 800.
Comment on Affirmative:
WALSH, R.: I believe the statement in the new text; "installation rules in 800.110 and 800.113 shall apply to Article 70", to be too general since it can be interpreted to include NPLFA circuits and not just to the installation of Cable Routing Assemblies. I submit that the comment should be evaluated by the Correlating

3-87 Log #705 NEC-P03 **Final Action: Accept in Principle**
(760.2)

TCC Action: See Correlating Committee action on Comment 3-88.
Submitter: George Bish, Secure Watch Security
Comment on Proposal No: 3-171
Recommendation: Continue to Accept in Principle in Part with the following changes:
a. Reject the part to add a definition for "Cable Routing Assembly"
b. Add 760.3 (L) **Cable Routing Assembly**. The definition in 800.2, the applications in Table 800.154(c), the listing requirements of 800.182 and the installation rules in 800.110 and 800.113 shall apply to Article 760.
Substantiation: Rejecting the addition of a definition of "Cable Routing Assembly" to 760.2 is in keeping with the Correlating Committee Note to Proposal 3-171 to locate the definition in a single article of Chapter 8. See companion comment on Proposal 16-23 that not only relocates the definition to 800.2, but revises it as well.
Now that the definition of Cable Routing Assembly is located in 800.2 and the listing requirements in 800.182 a new paragraph 760.3(L) is needed directing the reader to Article 800 for the appropriate information.

This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to locate a correlated definition of Cable Routing Assembly in a single Article of Chapter 8 for use in Article 725, 760, 770, and Chapter 8.

The Task Group members were:

George Bish, Chair, representing Satellite Broadcasting & Communication Association

Harry Ohde, representing IBEW

James Brunssen, representing Alliance for Telecommunications Industry Solutions

George Straniero, representing National Electrical Manufacturers Association

Robert Walsh, representing International Association of Electrical Inspectors

Wendell Whistler, representing Intertek Testing Services

Panel Meeting Action: Accept in Principle

Panel Statement: Refer to the panel action and statement on Comment 3-86, which addresses the same issue.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 12 Negative: 1

Ballot Not Returned: 1 Sepulveda, M.

Explanation of Negative:

STENE, S.: See the negative statement in Comment 3-86

Comment on Affirmative:

WALSH, R.: I believe the statement in the new text; "installation rules in 800.110 and 800.113 shall apply to Article 70", to be too general since it can be interpreted to include NPLFA circuits and not just to the installation of Cable Routing Assemblies. I submit that the comment should be evaluated by the Correlating

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3-88 Log #986 NEC-P03 **Final Action: Hold**
(760.2 and 760.3)

TCC Action: The Correlating Committee directs that the proposed 760.3(L) in this comment be reported as "Hold."

The Correlating Committee action on Comment 16-5 changed the location of the definition of Cable Routing Assemblies to Article 100. The installation requirements in 800.110 and 800.113 do not apply globally and negate some of the requirements in Article 760. The Correlating Committee will appoint a task group to address installation issues regarding Cable Routing Assemblies throughout the Code.

The Correlating Committee notes that only the revisions to 760.3(L) are being held.

Submitter: Robert W. Jensen, dbi-Telecommunication Infrastructure Design

Comment on Proposal No: 3-171

Recommendation: Revise the panel action on proposal 3-171 as follows:

Reject the definition of cable routing assembly recommended for 760.2.

<u>**760.3(L)**</u> (new) <u>**Cable Routing Assemblies.** The definition in 800.2, the applications in Table 800.154(c) and the installation rules in 800.110 and 800.113 shall apply to Article 760.</u>

Substantiation: Cable routing assemblies were introduced into the 2011 NEC. The definition, applications and installation rules for cable routing assemblies do not need to be repeated in every Article that has provisions for installing cables in cable routing assemblies.

The definition of cable routing assemblies is in 770.2. Proposal 16-23 recommended moving the definition to 800.2 so it would be in the same Article with the listing and application requirements. Panel 16 action on proposal 16-23 duplicated it in 800.2. We have submitted a comment to delete the definition of cable routing assembly from 770.2 and have it in 800.2 only.

The definition, listing requirements, applications and installation rules for cable routing assemblies do not need to be repeated in multiple articles. Having them all in Article 800 is sufficient.

The Correlating Committee, in its actions on proposal 3-118 and 3-171, directed that the definition of cable routing assembly be located in a single Article of Chapter 8. The correlating committee also directed in it actions on proposals 16-37, 16-163 and 16-222 that the Panel 16 actions to establish references to the definition, applications and installation rules for cable routing assemblies in 770.3, 820.3 and 830.3 be correlated with Articles 725 and 760., Acceptance of this comment will bring the panel action into conformance with the Correlating Committee directives.

Panel Meeting Action: Accept

Panel Statement: The panel accepts the recommendation contingent on the understanding that CMP 16 will accept the following joint (CMP 3 and CMP 16) task group recommendation for Comment 16-5:

Add a new definition in 800.2 to read as follows: "Cable Routing Assembly. A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support and route communications wires and cables, optical fiber cables, data cables associated with information technology and communications equipment, Class 2 and Class 3 cables."

Note that CMP 3 agrees with this basic definition, but has identified an oversight that should be corrected as shown below:

Add a new definition in 800.2 to read as follows: "Cable Routing Assembly. A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support and route communications wires and cables, optical fiber cables, data cables associated with information technology and communications equipment, Class 2 and Class 3 cables<u>, and power-limited fire alarm cables</u>."

The added phrase is currently permitted in Article 760 and should have been included in the task group work.

CMP 3 requests the correlating committee to review the actions of CMP 16 on Comment 16-5 to be sure that the intended correlation is provided consistent with CMP 3's understanding of the task group work.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 12 Negative: 1

Ballot Not Returned: 1 Sepulveda, M.

Explanation of Negative:

STENE, S.: See the negative statement in Comment 3-86

Comment on Affirmative:

KAHN, S.: See my Explanation of Affirmative with Comment on Comment no. 3-1.

WALSH, R.: I believe the statement in the new text; "installation rules in 800.110 and 800.113 shall apply to Article 70", to be too general since it can be interpreted to include NPLFA circuits and not just to the installation of Cable Routing Assemblies. I submit that the comment should be evaluated by the Correlating

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3-89 Log #1265 NEC-P03 **Final Action: Reject**
(760.2.Cable Routing Assembly)

Submitter: David H. Kendall, Thomas & Betts Corporation

Comment on Proposal No: 3-171

Recommendation: Revise the definition of a Cable Routing Assembly to remove the word " conductors" and replace it with "circuits·.

Substantiation: A Cable Routing Assembly is not a Wireway as defined in 376.2 and 378.2 and should not be treated as such. Cable Routing Assemblies are not permitted to route conductors. Wireways are listed for the routing and support of electrical conductors,

Panel Meeting Action: Reject

Panel Statement: The definition for Cable Routing Assembly has been deferred to Article 800 and the word "conductors" does not appear in the recommended definition. Also refer to the panel action and statement on Comment 3-88.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13

Ballot Not Returned: 1 Sepulveda, M.

3-90 Log #462 NEC-P03 **Final Action: Reject**
(760.2.Fire Alarm Circuit)

Submitter: Marcelo M. Hirschler, GBH International

Comment on Proposal No: 3-172

Recommendation: Revise text to read as follows:

Fire Alarm Circuit. The portion of the wiring system between the load side of the overcurrent device or the power-limited supply and the connected equipment of all circuits powered and controlled by the fire alarm system. ~~Fire alarm circuits are classified as either non–power-limited or power-limited.~~ <u>**Informational Note:** Fire alarm circuits are classified as either non–power-limited or power-limited.</u>

Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term "Fire alarm circuit" and the NEC manual of style does not permit the definition to contain the defined term. If CMP3 believes that this information is a requirement it should place it somewhere else in Article 760, for example as a new section 760.4 or a similar new location, since NEC definitions shall not contain requirements.

An example of an alternate approach is:

<u>**760.4 Fire alarm circuits and power limitations**.</u>

<u>**760.4.1** Fire alarm circuits are classified as either non–power-limited or power-limited.</u>

The NEC Manual of Style states as follows:

2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.

Panel Meeting Action: Reject

Panel Statement: The recommended changes do not provide any additional clarity and in fact, are detrimental to the application.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13

Ballot Not Returned: 1 Sepulveda, M.

3-91 Log #282 NEC-P03 **Final Action: Accept**
(760.4 (New))

Submitter: Code-Making Panel 9,

Comment on Proposal No: 3-174

Recommendation: The panel should continue to reject this proposal to correlate with the panel action on Proposal 9-38.

Substantiation: The 35% parameter has not been substantiated. This provision [314.16(B)(4)] in concert with 314.24, which was as modified in the 2011 NEC based on actual device sizing measurements, will provide enough volume for all but the most unusual cases, which can be addressed by the AHJ using the parent language of the section as cited in the substantiation. The mathematical analysis presented fails completely because the volume provisions of this section were never intended to directly correlate with the occluded volume of the component. For example, an 11-inch wire and a 6-inch wire have the same volume allowance, as is the case with a crow foot and a hickey, as is with the case of an NM cable clamp compared to a MC or AC cable clamp. Each of these examples has significantly differing relative sizes. This has been the case since the principle of sizing boxes based on volume allowances for the contained wiring entered the NEC in the 1933 edition. CMP 9 made a major revision to require a double allowance for device fill in the 1990 edition. However inexact, the procedure works, and CMP 9 would need to see compelling substantiation that a code-compliant installation, performed by qualified persons adhering to sound workmanship, could be expected to constitute a hazard in even a small (but not infinitesimal) minority of cases.

12 Eligible to vote
11 Affirmative
1 Ballot Not Returned (J.M. Ferrara, Voting Alternate)
No Comments on Vote were received.

Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-92 Log #43 NEC-P03 **Final Action: Accept**
(760.24)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 3-176
Recommendation: The Correlating Committee directs that the action on this proposal be reconsidered and correlated with action taken on Proposal 3-125.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the direction to reconsider as documented in the panel action and statement on Comment 3-94.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-93 Log #306 NEC-P03 **Final Action: Accept**
(760.24)

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 3-177
Recommendation: Continue to reject the proposal.
Substantiation: The submitter is trying to apply a uniform set of installation rules to power, and power-limited circuit cables without considering the inherent safety features of power-limited circuits.
Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-94 Log #706 NEC-P03 **Final Action: Accept in Principle**
(760.24)

Submitter: George Bish, Secure Watch Security
Comment on Proposal No: 3-176
Recommendation: Revise Panel Action to Accept in Principle.
Substantiation: Revising the Panel Action to "Accept in Principle" will correlate with the Panel Action on Proposals 3-125 and 3-86. Based upon the Panel Statement, the revised Panel Action to Accept in Principle refers to the Panel Action on Proposal 3-86 and listing of cable ties for use in other spaces used for environmental air is covered by reference to 300.22(C)(1) in 760.3(B)

The revised Panel Action to Accept in Principle is in keeping with the Correlating Committee's directive to correlate requirements addressing the listing of cable ties across Article 300, 770, 800, 820 and 830.

This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to correlate the requirements of Cable Ties in Articles 300, 770, 800, 820 and 830.

The Task Group members were:

George Bish, Chair, representing Satellite Broadcasting & Communication Association

Harry Ohde, representing IBEW

James Brunssen, representing Alliance for Telecommunications Industry Solutions

George Straniero, representing National Electrical Manufacturers Association

Robert Walsh, representing International Association of Electrical Inspectors

Wendell Whistler, representing Intertek Testing Services

Panel Meeting Action: Accept in Principle
Panel Statement: The panel accepts the need to correlate the overall subject of Proposals 3-86, 3-125 and 3-176, but rejects the revision to the previous panel statement. Section 760.3(B) refers to 300.22 for wiring methods. The panel accepted the addition of cable ties into 300.22(C)(1) by action on Proposal 3-86.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-95 Log #657 NEC-P03 **Final Action: Accept**
(760.49(B))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 3-182
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-96 Log #528 NEC-P03 **Final Action: Hold**
(760.51(B))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 3-183
Recommendation: Revise text to read as follows:
760.51 Number of Conductors in Cable Trays and Raceways, and Ampacity Adjustment Factors.
(B) Power-Supply Conductors and NPLFA Circuit Conductors. Where power-supply conductors and nonpower-limited fire alarm circuit conductors are permitted in a raceway in accordance with 760.48, the number of conductors shall be determined in accordance with 300.17. The ampacity

adjustment factors given in 310.15(B)(3)(a) shall apply as follows: [ROP 3–183]
(1) To all conductors where ~~the~~ any fire alarm circuit conductors carry continuous loads in excess of 10 percent of the ampacity of each conductor ~~and where the total number of conductors is more than three~~
(2) To the power-supply conductors only, where none of the fire alarm circuit conductors ~~do not~~ carry continuous loads in excess of 10 percent of the ampacity of each conductor ~~and where the number of power-supply conductors is more than three~~
Substantiation: The requirement for 10% or over current is not clear in either (1) or (2) as to whether it applies to some or all of the conductors.
The requirement for 3 or more conductors is unnecessary since there is no derating – for count – for 3 or less.
Panel Meeting Action: Hold
Panel Statement: Hold the comment. This comment presents new material which cannot be introduced at this point in this cycle. Proposal 3-183 did not modify 760.51(B)(1) and (2).
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-97 Log #702 NEC-P03 **Final Action: Accept in Principle**
(760.53(B)(3))

Submitter: George Bish, Secure Watch Security
Comment on Proposal No: 3-192
Recommendation: Revise Panel action to accept Proposal 3-192.
Substantiation: It is the recommendation of the Task Group to Accept this proposal as this will correlate with the language used in Chapter 8, Sections 800.113(D), 820.113(D) and 830.113(D), as well as 770.113(D). This action will fulfill the TCC's request to correlate the phrase "penetrating one or more floors" and "from floor to floor" in Proposals 3-159, 3-192, 3-193, 3-205, and 3-206. The Task Group realizes that there are other sections of Articles 770 and Chapter 8 where this phrase is not consistent and recommends that a Task Group be appointed to work on the complete correlation for the 2017 edition
This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to address the correlation of the term "floor to floor" vs. "more than one floor"
The Task Group members were:
George Bish, Chair, representing Satellite Broadcasting & Communication Association
Harry Ohde, representing IBEW
James Brunssen, representing Alliance for Telecommunications Industry Solutions
George Straniero, representing National Electrical Manufacturers Association
Robert Walsh, representing International Association of Electrical Inspectors
Wendell Whistler, representing Intertek Testing Services
Panel Meeting Action: Accept in Principle
Panel Statement: Refer to the panel action and statement in Comment 3-98, which meets the intent of the submitter.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-98 Log #703 NEC-P03 **Final Action: Accept in Principle in Part**
(760.53(B)(3))

Submitter: George Bish, Secure Watch Security
Comment on Proposal No: 3-193
Recommendation: Continue Panel Action to Accept in Principle Proposal 3-193.
Revise Panel Statement to "See Panel Action and Panel Statement on Proposal 3-192"
Substantiation: It is the recommendation of the Task Group to correlate with the current language used in Chapter 8, Sections 800.113(D), 820.113(D) and 830.113(D), as well as 770.113(D). The Acceptance in Principle of Proposal 3-193 with reference to the Panel Action and Panel Statement on Proposal 3-192 as recommended by the Task Group will accomplish this. This action will fulfill the TCC's request to correlate the phrase "penetrating one or more floors" and "from floor to floor" in Proposals 3-159, 3-192, 3-193, 3-205, and 3-206.
This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to address the correlation of the term "floor to floor" vs. "more than one floor"
The Task Group members were:
George Bish, Chair, representing Satellite Broadcasting & Communication Association
Harry Ohde, representing IBEW
James Brunssen, representing Alliance for Telecommunications Industry Solutions
George Straniero, representing National Electrical Manufacturers Association
Robert Walsh, representing International Association of Electrical Inspectors
Wendell Whistler, representing Intertek Testing Services
Panel Meeting Action: Accept in Principle in Part
Revise the panel action on Proposal 3-193 to read as follows:
(3) Cables installed in vertical runs and penetrating one or more floors or cables installed in vertical runs in a shaft, shall be Type NPLFR. Floor penetrations requiring Type NPLFR shall contain only cables suitable for riser or plenum use.
Reject the recommendation to "Revise Panel Statement to "See Panel Action and Panel Statement on Proposal 3-192".
Panel Statement: The changes made by the panel to 760.53(B)(3) meet the intent of the submitter.
The panel cannot revise the panel statement in the ROP as suggested in the recommendation.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-99 Log #1096 NEC-P03 **Final Action: Reject**
(760.121(B))

Submitter: Ron B. Chilton, Rep. NC Code Clearing Committee
Comment on Proposal No: 3-175
Recommendation: This Proposal should have been "Accepted" to correlate with the current NFPA 72.
Substantiation: For dwellings the International Residential Code allows both a smoke alarm system and a fire alarm system with no provision prohibiting AFCI protection, and must be provided with a battery-backed or secondary source, which NFPA 72 requires also. Section 760.121(B) is being incorrectly interpreted to prohibit AFCI on a circuit providing power to 120-volt smoke alarm devices that are not part of a central fire alarm system in dwellings, and not an NFPA 72 system. If NFPA 72 still does not prohibit AFCI for protection of the branch circuit, for those specific fire alarm systems, then Section 760.121(B) of NFPA 70 should not.
If the fire alarm panel for a dwelling is installed in one of those areas requiring AFCI protection per Section 210.12(A) then you would violate either that Section or Section 760.121(B), or you must install it in the kitchen, laundry, bathroom, attic, basement, crawl space, garage, or another area not requiring AFCI. The NEC should not reflect an implication of conflict in this issue, the Code Making Panel should have deleted the AFCI reference and allowed the Technical Committee Task Group on Intercoordination to confirm a resolution agreeable to both NFPA Groups. Currently the 2010 NFPA 72 document permits it and there is no guarantee those Committee would see the need to prohibit AFCI as it has been a factor to consider since the 2002 NEC.
Panel Meeting Action: Reject
Panel Statement: The main concern of the panel is that unattended systems may trip off which would leave a facility unprotected for an indeterminate period of time until it became known to the responsible party. Whether to have AFCI and GFCI protection on fire alarm panels was discussed in both the 2008 and 2011 code cycles with the pros and cons discussed for quite some time. The panel agreed to exclude these protection devices from the power circuits for the following reason:
Connecting a fire alarm system (not a single or multiple station smoke alarm which is a self-contained device) to an AFCI device may create a life safety situation. Where the fire alarm panel has a generator standby power system with 4 hours of battery standby power or the system has 24 hours of battery standby power, loss of the power source to the fire alarm panel by tripping an AFCI device could very well result in loss of fire alarm protection with loss of the early fire warning system and potential loss of life. This provision does not apply to single station or multiple station smoke alarm devices with battery backup since these devices have batteries that will provide power for power for extended time but low battery charge will cause the smoke alarm to chirp, indicating low battery.
The panel recommends submission of this issue to the NFPA Fire Research Foundation for consideration as a possible study on the issue of AFCI and GFCI protection of the branch circuit supplying the fire alarm system.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.
Comment on Affirmative:
CLARY, S.: The NFPA 70 Correlating Committee should communicate with the NFPA 72® Correlating Committee so as to discuss and rectify the conflict between these two Codes. Both 70 and 72 state that one is to consult the other for additional requirements The two need to be in agreement in regards to the use or non use of AFCI protected branch circuits.
AFAA also supports the proposal for the NFPA Fire Protection Research Foundation to study this issue.

3-100 Log #307 NEC-P03 **Final Action: Accept in Principle**
(760.133 and 760.135 (New))

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 3-197
Recommendation: Revise and add new text to read as follows:
760.133 Installation of Conductors and Equipment in Cables, Compartments, Cable Trays, Enclosures, Manholes, Outlet Boxes, Device Boxes, and Raceways for Power-Limited Circuits. Conductors and equipment for power-limited fire alarm circuits shall be installed in accordance

with ~~760.136~~ 760.135 through 760.143.

760.135 (new) Installation of PLFA Cables In Buildings. Installation of power-limited fire alarm cables in buildings shall comply with 760.135(A) through (J).

(A) Listing. PLFA cables installed in buildings shall be listed.

(B) Other Spaces Used For Environmental Air (Plenums). The following cables shall be permitted in other spaces used for environmental air as described in 300.22(C):

(1) Type FPLP cables
(2) Type FPLP cables installed in plenum communications raceways
(3) Type FPLP and FPLP-CI cables supported by open metallic cable trays or cable tray systems
(4) Types FPLP, FPLR and FPL cables installed in raceways that are installed in compliance with 300.22(C)
(5) Types FPLP, FPLR and FPL cables supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)
(6) Types FPLP, FPLR and FPL cables installed in plenum communications raceways, riser communications raceways or general-purpose communications raceways supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

(C) Risers — Cables in Vertical Runs. The following cables shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

(1) Types FPLP and FPLR cables
(2) Types FPLP and FPLR cables installed in:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceway
d. Riser cable routing assemblies

Informational Note: See 300.21 for firestop requirements for floor penetrations.

(D) Risers — Cables in Metal Raceways. The following cables shall be permitted in metal raceways in a riser having firestops at each floor:

(1) Types FPLP, FPLR and FPL cables
(2) Types FPLP, FPLR and FPL cables installed in:
a. Plenum communications raceways
b. Riser communications raceways
c. General-purpose communications raceways

Informational Note: See 300.21 for firestop requirements for floor penetrations.

(E) Risers — Cables in Fireproof Shafts. The following cables shall be permitted to be installed in fireproof riser shafts having firestops at each floor:

(1) Types FPLP, FPLR and FPL cables
(2) Types FPLP, FPLR and FPL cables installed in:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceways
d. Riser cable routing assemblies
e. General-purpose communications raceways
f. General-purpose cable routing assemblies

Informational Note: See 300.21 for firestop requirements for floor penetrations.

(H) Risers — One- and Two-Family Dwellings. The following cables shall be permitted in one- and two-family dwellings:

(1) Types FPLP, FPLR FPL cables
(2) Types FPLP, FPLR and FPL cables installed in:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceways
d. Riser cable routing assemblies
e. General-purpose communications raceways
f. General-purpose cable routing assemblies

(I) Other Building Locations. The following cables shall be permitted to be installed in building locations other than the locations covered in 770.113(B) through (H):

(1) Types FPLP, FPLR and FPL cables
(2) Types FPLP, FPLR and FPL cables installed in:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceways
d. Riser cable routing assemblies
e. General-purpose communications raceways
f. General-purpose cable routing assemblies
(3) Types FPLP, FPLR and FPL cables installed in a raceway of a type recognized in Chapter 3

(L) Nonconcealed Spaces. Cables specified in Chapter 3 and meeting the requirements of 760.179 (A) and (B) shall be permitted to be installed in nonconcealed spaces where the exposed length of cable does not exceed 3 m (10 ft).

(M) Portable Fire Alarm System. A portable fire alarm system provided to protect a stage or set when not in use shall be permitted to use wiring methods in accordance with 530.12.

Substantiation: Proposals 3-197 and 3-202 were submitted as a package. Proposal 3-202 deals with 760.154, *Applications of Listed PLFA Cables*. Notwithstanding the title of 760.154, it contains a mixture of applications and installation rules. The primary objectives of proposals 3-197 and 3-202 are to separate the installation rules from the applications and to express the applications as simply as possible by using a table. If this concept is accepted in Articles 725 (proposals 3-144a & 3-154a) and 760 (proposals 3-197 & 3-202), then the cable applications and installation sections will be editorially consistent with Articles 770, 800, 820 and 830.

CMP-3 accepted 3-202 in principle in part by correcting the errors in the proposed Table 760.154 (accept in principle) and retaining the text in 760.154. Table 760.154 clearly prohibits the installation of plenum cable routing assemblies in plenums; permitting them to be used only in place of riser and general-purpose cable routing assemblies.

Proposal 3-197 was not correlated with (couldn't anticipate the panel action) the action on proposal 3-206 which required cables penetrating one or more floors to be riser or plenum rated. The comment recommends text for 760.135(C) that correlates with the panel action on proposal 3-206. The text accepted by CMP 3 on proposals 3-205 and 3-206 used the phrase "penetrating from floor to floor" instead of "penetrating one or more floors" as recommended by the submitters. The correlating committee directed that the CMP 3 action be correlated with CMP 16 existing text. CMP 16 uses "penetrating one or more floors" in 770.113(D), 800.113(D), 820.113(D) and 830.113(D). Since there were no proposals to change "penetrating one or more floors", the only way to correlate is to use "penetrating one or more floors" in CMP 3 text for Articles 725 and 760. If this comment and its companion comment on proposal 3-202 are accepted, the action on proposals 3-205 and 3-206 should be changed to accept in principle with reference to the acceptance of this comment on proposal 3-197 and our comment on proposal 3-202.

Proposal 3-197 included a recommendation for wiring in ducts specifically fabricated for environmental air. This comment has deletes that section in order to correlate with panel action on proposal 3-82 which prohibited wiring in ducts specifically fabricated for environmental air.

Panel Meeting Action: Accept in Principle

Panel Statement: Refer to panel action and statement for Comment 3-101 which meets the intent of the submitter.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13

Ballot Not Returned: 1 Sepulveda, M.

3-101 Log #987 NEC-P03 **Final Action: Accept in Principle**
(760.133 and 760.135 (New))

Submitter: Robert W. Jensen, dbi-Telecommunication Infrastructure Design

Comment on Proposal No: 3-197

Recommendation: Revise text to read as follows:

760.133 Installation of Conductors and Equipment in Cables, Compartments, Cable Trays, Enclosures, Manholes, Outlet Boxes, Device Boxes, and Raceways for Power-Limited Circuits. Conductors and equipment for power-limited fire alarm circuits shall be installed in accordance with ~~760.136~~ 760.135 through 760.143.

760.135 (new) Installation of PLFA Cables In Buildings. Installation of power-limited fire alarm cables in buildings shall comply with 760.135(A) through (J).

(A) Listing. PLFA cables installed in buildings shall be listed.

(B) Fabricated Ducts Used for Environmental Air. The following cables shall be permitted in ducts, as described in 300.22(B) if they are directly associated with the air distribution system:

(1) Up to 1.22 m (4 ft) of Types FPLP and FPLP-CI cables
(2) Types FPLP, FPLP-CI, FPLR, FPLR-CI, FPL and FPL-CI cables installed in raceways that are installed in compliance with 300.22(B)

Informational Note: For information on fire protection of wiring installed in fabricated ducts see 4.3.4.1 and 4.3.11.3.3 in NFPA 90A-2012, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

(C) Other Spaces Used For Environmental Air (Plenums). The following cables shall be permitted in other spaces used for environmental air as described in 300.22(C):

(1) Type FPLP cables
(2) Type FPLP cables installed in plenum communications raceways
(3) Type FPLP and FPLP-CI cables supported by open metallic cable trays or cable tray systems
(4) Types FPLP, FPLR and FPL cables installed in raceways that are installed in compliance with 300.22(C)
(5) Types FPLP, FPLR and FPL cables supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)
(6) Types FPLP, FPLR and FPL cables installed in plenum communications raceways, riser communications raceways or general-purpose communications raceways supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

(D) Risers — Cables in Vertical Runs. The following cables shall be permitted in vertical runs penetrating from floor to floor and in vertical runs in a shaft:

(1) Types FPLP and FPLR cables
(2) Types FPLP and FPLR cables installed in:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceway
d. Riser cable routing assemblies

Informational Note: See 300.21 for firestop requirements for floor penetrations.
(E) Risers — Cables in Metal Raceways. The following cables shall be permitted in metal raceways in a riser having firestops at each floor:
(1) Types FPLP, FPLR and FPL cables
(2) Types FPLP, FPLR and FPL cables installed in:
a. Plenum communications raceways
b. Riser communications raceways
c. General-purpose communications raceways
Informational Note: See 300.21 for firestop requirements for floor penetrations.
(F) Risers — Cables in Fireproof Shafts. The following cables shall be permitted to be installed in fireproof riser shafts having firestops at each floor:
(1) Types FPLP, FPLR and FPL cables
(2) Types FPLP, FPLR and FPL cables installed in:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceways
d. Riser cable routing assemblies
e. General-purpose communications raceways
f. General-purpose cable routing assemblies
Informational Note: See 300.21 for firestop requirements for floor penetrations.
(G) Risers — One- and Two-Family Dwellings. The following cables shall be permitted in one- and two-family dwellings:
(1) Types FPLP, FPLR FPL cables
(2) Types FPLP, FPLR and FPL cables installed in:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceways
d. Riser cable routing assemblies
e. General-purpose communications raceways
f. General-purpose cable routing assemblies
(H) Other Building Locations. The following cables shall be permitted to be installed in building locations other than the locations covered in 770.113(B) through (H):
(1) Types FPLP, FPLR and FPL cables
(2) Types FPLP, FPLR and FPL cables installed in:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceways
d. Riser cable routing assemblies
e. General-purpose communications raceways
f. General-purpose cable routing assemblies
(3) Types FPLP, FPLR and FPL cables installed in a raceway of a type recognized in Chapter 3
(I) Nonconcealed Spaces. Cables specified in Chapter 3 and meeting the requirements of 760.179 (A) and (B) shall be permitted to be installed in nonconcealed spaces where the exposed length of cable does not exceed 3 m (10 ft).
(J) Portable Fire Alarm System. A portable fire alarm system provided to protect a stage or set when not in use shall be permitted to use wiring methods in accordance with 530.12.

Substantiation: Proposals 3-197 and 3-202 were submitted as a package. Proposal 3-202 deals with 760.154, Applications of Listed PLFA Cables. Notwithstanding the title of 760.154, it contains a mixture of applications and installation rules. The primary objectives of proposals 3-197 and 3-202 are to separate the installation rules from the applications and to express the applications as simply as possible by using a table. If this concept is accepted in Articles 725 (proposals 3-144a & 3-154a) and 760 (proposals 3-197 & 3-202), then the cable applications and installation sections will be editorially consistent with Articles 770, 800, 820 and 830.

CMP-3 accepted 3-202 in principle in part by correcting the errors in the proposed Table 760.154 (accept in principle) and retaining the text in 760.154. Table 760.154 clearly prohibits the installation of plenum cable routing assemblies in plenums; permitting them to be used only in place of riser and general-purpose cable routing assemblies.

Proposal 3-197 was not correlated with (couldn't anticipate the panel action) the action on proposal 3-206 which required cables penetrating one or more floors to be riser or plenum rated. The comment recommends text for 760.135(C) that correlates with the panel action on proposal 3-206. If this comment and its companion comment on proposal 3-202 are accepted, the action on proposals 3-205 and 3-206 should be changed to accept in principle with reference to the acceptance of this comment on proposal 3-197 and our comment on proposal 3-202.

Panel Meeting Action: Accept in Principle
The panel accepts the comment with the following modifications:
(1) Modify (B)(1) to read: "(1) Types FPLP and FPLP-CI cables in lengths as short as practicable to perform the required function"
(2) Modify (D) to read as follows:
(D) Risers — Cables in Vertical Runs. The following cables shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft: (remainder unchanged.)

Panel Statement: The panel recognizes the requirements of NFPA 90A and modified (B)(1) to clarify the need to be consistent with NFPA 90A section 4.3.4.3.

The panel modified (D) to align with the correlating committee direction and the joint (CMP 3 and CMP 16) task team conclusions.

Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-102 Log #305 NEC-P03 **Final Action: Accept**
(760.139)

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 3-171
Recommendation: Continue to accept proposals 3-200 and 3-201 in principle based on the acceptance of the recommended text in proposal 3-171 for 760.139.
Substantiation: I submitted proposal 3-200 to permit the installation of power-limited fire alarm cables along with Class 2 and Class 3, optical fiber and communications cables in cable routing assemblies. The recommended text in proposals 3-200 and 3-211 and the text accepted for 760.139 in proposal 3-171 are identical.

CMP-3 action on these proposals will facilitate the use of cable routing assemblies in data centers where they are used to support and manage large installations of data cables.

Thank you. Y'all done good.

Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-103 Log #308 NEC-P03 **Final Action: Accept in Principle**
(760.154)

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 3-202
Recommendation: Revise 760.154 as follows:

760.154 Applications of Listed PLFA Cables. PLFA cables shall comply with the requirements described in ~~either 760.154(A), (B), or (C)~~ Table 760.154, or where cable substitutions are made as shown in 760.154(A ~~D~~). Where substitute cables are installed, the wiring requirements of Article 760, Parts I and III, shall apply. Types FPLP-CI, FPLR-CI and FPL-CI cables shall be permitted to be installed to provide 2-hour circuit integrity rated cables.

See Table 760.154 on Page 429

~~**(A) Plenum.** Cables installed in ducts, plenums, and other spaces used for environmental air shall be Type FPLP. Types FPLP, FPLR, and FPL cables installed in compliance with 300.22 shall be permitted. Type FPLP-CI cable shall be permitted to be installed to provide a 2-hour circuit integrity rated cable.~~
~~**(B) Riser.** Cables installed in risers shall be as described in either (1), (2), or (3):~~
~~(1) Cables installed in vertical runs and penetrating more than one floor, or cables installed in vertical runs in a shaft, shall be Type FPLR. Floor penetrations requiring Type FPLR shall contain only cables suitable for riser or plenum use. Type FPLR-CI cable shall be permitted to be installed to provide a 2-hour circuit integrity rated cable.~~
~~(2) Other cables shall be installed in metal raceways or located in a fireproof shaft having firestops at each floor.~~
~~(3) Type FPL cable shall be permitted in one- and two-family dwellings.~~
~~Informational Note: See **300.21** for firestop requirements for floor penetrations.~~
~~**(C) Other Wiring Within Buildings.** Cables installed in building locations other than those covered in **760.154(A)** or (B) shall be as described in either (C)(1), (C)(2), (C)(3), or (C)(4). Type FPL-CI cable shall be permitted to be installed as described in either (C)(1), (C)(2), (C)(3), or (C)(4) to provide a 2-hour circuit integrity rated cable.~~
~~**(1) General.** Type FPL shall be permitted.~~
~~**(2) In Raceways.** Cables shall be permitted to be installed in raceways.~~
~~**(3) Nonconcealed Spaces.** Cables specified in Chapter **3** and meeting the requirements of 760.179 **(A)** and (B) shall be permitted to be installed in nonconcealed spaces where the exposed length of cable does not exceed 3 m (10 ft).~~
~~**(4) Portable Fire Alarm System.** A portable fire alarm system provided to protect a stage or set when not in use shall be permitted to use wiring methods in accordance with 530.12.~~
(A ~~D~~) Fire Alarm Cable Substitutions. The substitutions for fire alarm cables listed in Table 760.154(A~~D~~) and illustrated in Figure 760.154(A ~~D~~) shall be permitted. Where substitute cables are installed, the wiring requirements of Article 760, Parts I and III, shall apply.
Informational Note: For information on communications cables (CMP, CMR, CMG, CM), see 800.179.
Renumber (re-letter) Figure 760.154(D) to 760.154(A). Delete the column "References" in Table 760.154(D) and renumber (re-letter) Table 760.154(D) to 760.154(A).

Insert Table 760.154(A) and Figure 760.154(A) here. (no changes, not submitted)

In 645.3(B) make the following changes:
(B) Plenums. The provisions of ~~Sections~~ 300.22(C)(1), 725.135(B) ~~725.154(A)~~, 760.53(B)(2), 760.135(B) ~~760.154(A)~~, 770.113(C), 800.113(C),

Table 760.154
Applications of Listed PLFA Cables in Buildings

Applications		**Cable Type**		
		FPLP	FPLR	FPL
In Fabricated Ducts as Described in 300.22(B)	In fabricated ducts	N	N	N
	In metal raceway that complies with 300.22(B)	Y*	Y*	Y*
In Other Spaces Used for Environmental Air as Described in 300.22(C)	In other spaces used for environmental air	Y*	N	N
	In metal raceway that complies with 300.22(C)	Y*	Y*	Y*
	In plenum communications raceways	Y*	N	N
	In plenum cable routing assemblies	NOT PERMITTED		
	Supported by open metal cable trays	Y*	N	N
	Supported by solid bottom metal cable trays with solid metal covers	Y*	Y*	Y*
In Risers	In vertical runs	Y*	Y*	N
	In metal raceways	Y*	Y*	Y*
	In fireproof shafts	Y*	Y*	Y*
	In plenum communications raceways	Y*	Y*	N
	In plenum cable routing assemblies	Y*	Y*	N
	In riser communications raceways	Y*	Y*	N
	In riser cable routing assemblies	Y*	Y*	N
	In one- and two-family dwellings	Y*	Y*	Y*
Within Buildings in other than Air-Handling Spaces and Risers	General	Y*	Y*	Y*
	Supported by cable trays	Y*	Y*	Y*
	In cross connect arrays	Y*	Y*	Y*
	In any raceway recognized in Chapter 3	Y*	Y*	Y*
	In plenum communications raceways	Y*	Y*	Y*
	In plenum cable routing assemblies	Y*	Y*	Y*
	In riser communications raceways	Y*	Y*	Y*
	In riser cable routing assemblies	Y*	Y*	Y*
	In general-purpose communications raceways	Y*	Y*	Y*
	In general-purpose cable routing assemblies	Y*	Y*	Y*

and 820.113(C) and Tables 725.154, 760.154, 770.154(A), 800.154(A) and 820.154(A) shall apply to wiring and cabling in a plenum (other space used for environmental air) above an information technology equipment room.

In 760.3(B) Exception, make the following change:

Exception: As permitted in 760.53(B)(1) and (B)(2) and Table 760.154 ~~(A).~~

Substantiation: Proposals 3-144a and 3-154a were submitted as a package. Proposal 3-154a deals with 725.154, *Applications of Listed Class 2, Class 3, and PLTC Cables*. Notwithstanding the title of 725.154, it contains a mixture of applications and installation rules. The primary objectives of proposals 3-144a and 3-154a are to separate the installation rules from the applications and to express the applications as simply as possible by using a table. If this concept is accepted in Articles 725 (proposals 3-144a & 3-154a) and 760 (proposals 3-197 & 3-202), then the cable applications and installation sections will be editorially consistent with Articles 770, 800, 820 and 830.

Note that a change has been made in Table 760.154 to correlate with the panel action on proposal 3-82 which rejected the use of any plenum cable in a duct specifically fabricated for environmental air.

Panel Meeting Action: Accept in Principle

Panel Statement: Refer to the panel action in comment 3-104. The primary difference between the two comments are differences in the table. The panel does not want to eliminate the use of FPLP in fabricated ducts as described in 300.22(B).

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13

Ballot Not Returned: 1 Sepulveda, M.

3-104 Log #988 NEC-P03 **Final Action: Accept in Part**
(760.154)

Submitter: Robert W. Jensen, dbi-Telecommunication Infrastructure Design

Comment on Proposal No: 3-202

Recommendation: Revise 760.154 as follows:

760.154 Applications of Listed PLFA Cables. PLFA cables shall comply with the requirements described in ~~either 760.154(A), (B), or (C)~~ Table 760.154, or where cable substitutions are made as shown in 760.154(A ~~D~~). Where substitute cables are installed, the wiring requirements of Article 760, Parts I and III, shall apply. Types FPLP-CI, FPLR-CI and FPL-CI cables shall be permitted to be installed to provide 2-hour circuit integrity rated cables.

*****Insert Table 760.154 Here*****

~~**(A) Plenum.** Cables installed in ducts, plenums, and other spaces used for environmental air shall be Type FPLP. Types FPLP, FPLR, and FPL cables installed in compliance with 300.22 shall be permitted. Type FPLP-CI cable shall be permitted to be installed to provide a 2-hour circuit integrity rated cable.~~

~~**(B) Riser.** Cables installed in risers shall be as described in either (1), (2), or (3):~~

~~(1) Cables installed in vertical runs and penetrating more than one floor, or cables installed in vertical runs in a shaft, shall be Type FPLR. Floor penetrations requiring Type FPLR shall contain only cables suitable for riser or plenum use. Type FPLR-CI cable shall be permitted to be installed to provide a 2-hour circuit integrity rated cable.~~

~~(2) Other cables shall be installed in metal raceways or located in a fireproof shaft having firestops at each floor.~~

~~(3) Type FPL cable shall be permitted in one- and two-family dwellings.~~

~~Informational Note: See **300.21** for firestop requirements for floor penetrations.~~

~~**(C) Other Wiring Within Buildings.** Cables installed in building locations other than those covered in **760.154(A)** or (B) shall be as described in either (C)(1), (C)(2), (C)(3), or (C)(4). Type FPL-CI cable shall be permitted to be installed as described in either (C)(1), (C)(2), (C)(3), or (C)(4) to provide a 2-hour circuit integrity rated cable.~~

~~**(1) General.** Type FPL shall be permitted.~~

~~**(2) In Raceways.** Cables shall be permitted to be installed in raceways.~~

~~**(3) Nonconcealed Spaces.** Cables specified in Chapter **3** and meeting the requirements of 760.179 **(A)** and (B) shall be permitted to be installed in nonconcealed spaces where the exposed length of cable does not exceed 3 m (10 ft).~~

~~**(4) Portable Fire Alarm System.** A portable fire alarm system provided to protect a stage or set when not in use shall be permitted to use wiring methods in accordance with 530.12.~~

(A ~~D~~) Fire Alarm Cable Substitutions. The substitutions for fire alarm cables listed in Table 760.154(A~~D~~) and illustrated in Figure 760.154(A ~~D~~) shall be permitted. Where substitute cables are installed, the wiring requirements of Article 760, Parts I and III, shall apply.

Informational Note: For information on communications cables (CMP, CMR, CMG, CM), see 800.179.

Renumber (re-letter) Figure 760.154(D) to 760.154(A). Delete the column "References" in Table 760.154(D) and renumber (re-letter) Table 760.154(D) to 760.154(A).

Insert Table 760.154(A) and Figure 760.154(A) here. (Not submitted)

In 645.3(B) make the following changes:

(B) Plenums. The provisions of ~~Sections~~ 300.22(C)(1), 725.135(B) ~~725.154(A),~~ 760.53(B)(2), 760.135(B) ~~760.154(A),~~ 770.113(C), 800.113(C), and 820.113(C) and Tables 725.154, 760.154, 770.154(A), 800.154(A) and 820.154(A) shall apply to wiring and cabling in a plenum (other space used for environmental air) above an information technology equipment room.

In 760.3(B) Exception, make the following change:

Exception: As permitted in 760.53(B)(1) and (B)(2) and Table 760.154 ~~(A).~~

Substantiation: Proposals 3-144a and 3-154a were submitted as a package. Proposal 3-154a deals with 725.154, Applications of Listed Class 2, Class 3, and PLTC Cables. Notwithstanding the title of 725.154, it contains a mixture of applications and installation rules. The primary objectives of proposals 3-144a and 3-154a are to separate the installation rules from the applications and to express the applications as simply as possible by using a table. If this concept is accepted in Articles 725 (proposals 3-144a & 3-154a) and 760 (proposals 3-197 & 3-202), then the cable applications and installation sections will be editorially consistent with Articles 770, 800, 820 and 830.

Panel Meeting Action: Accept in Part

Reject the proposed changes to 645.3(B).

The balance of the recommendation is accepted.

Panel Statement: The panel rejects the part of the comment that is outside the scope of the panel.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13

Ballot Not Returned: 1 Sepulveda, M.

3-105 Log #1367 NEC-P03 **Final Action: Reject**
(Table 760.154)

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)

Comment on Proposal No: 3-202

Recommendation: Delete plenum cable routing assemblies from the second column of Table 760.154.

Substantiation: Cable Routing assemblies are not permitted in Plenums or other spaces used for environmental air by either the NEC or by NFPA 90A that has jurisdiction over wiring in air handling plenum spaces. Inclusion of plenum cable routing assemblies is misleading and could cause it to be used where it is not permitted.

Panel Meeting Action: Reject

Panel Statement: The panel asserts that the table, as presented, states very clearly where the plenum rated cable routing assemblies are allowed to be installed.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13

Ballot Not Returned: 1 Sepulveda, M.

3-106 Log #697 NEC-P03 **Final Action: Accept in Principle in Part**
(760.154(B)(1))

Submitter: George Bish, Secure Watch Security

Comment on Proposal No: 3-206

Recommendation: Continue to "Accept in Principle".

Revise Panel Statement to: "See Panel Action and Panel Statement on Proposal 3-205."

Substantiation: It is the recommendation of the Task Group to correlate with the current language used in Chapter 8, Sections 800.113(D), 820.113(D) and 830.113(D), as well as 770.113(D). The Acceptance in Principle of Proposal 3-206 with reference to the Panel Action and Panel Statement on Proposal 3-205 as recommended by the Task Group will accomplish this. This action will fulfill the Correlating Committee's request to correlate the phrase "penetrating one or more floors" and "from floor to floor" in Proposals 3-159, 3-192, 3-193, 3-205, and 3-206.

This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to address the correlation of the term "floor to floor" vs. "more than one floor"

The Task Group members were:

George Bish, Chair, representing Satellite Broadcasting & Communication Association

Harry Ohde, representing IBEW

James Brunssen, representing Alliance for Telecommunications Industry Solutions

George Straniero, representing National Electrical Manufacturers Association

Robert Walsh, representing International Association of Electrical Inspectors

Wendell Whistler, representing Intertek Testing Services

Panel Meeting Action: Accept in Principle in Part

Revise panel action on Proposal 3-206 to read as follows:

(1) Cables installed in vertical runs and penetrating one or more floors, or cables installed in vertical runs in a shaft, shall be Type FPLR. Floor penetrations requiring Type FPLR shall contain only cables suitable for riser or plenum use. Type FPLR-CI cable shall be permitted to be installed to provide a 2-hour circuit integrity rated cable.

Panel Statement: The changes made by the panel to 760.154(B)(1) meet the intent of the submitter.

The panel cannot revise the panel statement in the ROP as suggested in the recommendation.

3-104 (Log #988)

Table 760.154 Applications of Listed PLFA Cables in Buildings

Applications		**Cable Type**		
		FPLP	FPLR	FPL
In Fabricated Ducts as Described in 300.22(B)	In fabricated ducts	Y*	N	N
	In metal raceway that complies with 300.22(B)	Y*	Y*	Y*
In Other Spaces Used for Environmental Air as Described in 300.22(C)	In other spaces used for environmental air	Y*	N	N
	In metal raceway that complies with 300.22(C)	Y*	Y*	Y*
	In plenum communications raceways	Y*	N	N
	In plenum cable routing assemblies	NOT PERMITTED		
	Supported by open metal cable trays	Y*	N	N
	Supported by solid bottom metal cable trays with solid metal covers	Y*	Y*	Y*
In Risers	In vertical runs	Y*	Y*	N
	In metal raceways	Y*	Y*	Y*
	In fireproof shafts	Y*	Y*	Y*
	In plenum communications raceways	Y*	Y*	N
	In plenum cable routing assemblies	Y*	Y*	N
	In riser communications raceways	Y*	Y*	N
	In riser cable routing assemblies	Y*	Y*	N
	In one- and two-family dwellings	Y*	Y*	Y*
Within Buildings in other than Air-Handling Spaces and Risers	General	Y*	Y*	Y*
	Supported by cable trays	Y*	Y*	Y*
	In cross connect arrays	Y*	Y*	Y*
	In any raceway recognized in Chapter 3	Y*	Y*	Y*
	In plenum communications raceways	Y*	Y*	Y*
	In plenum cable routing assemblies	Y*	Y*	Y*
	In riser communications raceways	Y*	Y*	Y*
	In riser cable routing assemblies	Y*	Y*	Y*
	In general-purpose communications raceways	Y*	Y*	Y*
	In general-purpose cable routing assemblies	Y*	Y*	Y*

Note: An 'N' in the table indicates that the cable type shall not be permitted to be installed in the application. A 'Y*' indicates that the cable shall be permitted to be installed in the application, subject to the limitations described in 760.130 through 760.145.

Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-107 Log #704 NEC-P03 **Final Action: Accept in Principle**
(760.154(B)(1))

Submitter: George Bish, Secure Watch Security
Comment on Proposal No: 3-205
Recommendation: Revise Panel Action to Accept Proposal 3-205.
Substantiation: It is the recommendation of the Task Group to Accept this proposal as this will correlate with the language used in Chapter 8, Sections 800.113(D), 820.113(D) and 830.113(D), as well as 770.113(D). This action will fulfill the TCC's request to correlate the phrase "penetrating one or more floors" and "from floor to floor" in Proposals 3-159, 3-192, 3-193, 3-205, and 3-206. The Task Group realizes that there are other sections of Articles 770 and Chapter 8 where this phrase is not consistent and recommends that a Task Group be appointed to work on the complete correlation for the 2017 edition

This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to address the correlation of the term "floor to floor" vs. "more than one floor"

The Task Group members were:

George Bish, Chair, representing Satellite Broadcasting & Communication Association

Harry Ohde, representing IBEW

James Brunssen, representing Alliance for Telecommunications Industry Solutions

George Straniero, representing National Electrical Manufacturers Association

Robert Walsh, representing International Association of Electrical Inspectors

Wendell Whistler, representing Intertek Testing Services

Panel Meeting Action: Accept in Principle
Panel Statement: Refer to the panel action and statement in Comment 3-106, which meets the intent of the submitter.
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-108 Log #658 NEC-P03 **Final Action: Accept**
(760.176(B))

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 3-207
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task group to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 & 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity. The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.

Panel Meeting Action: Accept
Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-109 Log #698 NEC-P03 **Final Action: Accept in Principle in Part**
(760.176(F))

Submitter: George Bish, Secure Watch Security
Comment on Proposal No: 3-208
Recommendation: Continue to Accept in Principle with the following changes

760.176(F)(1) "Circuit integrity (-CI) cables used in raceways shall ~~only~~ be ~~permitted to be installed in a raceway where specifically~~ listed and marked as part of an Electrical Circuit Protective System as covered in (F)(2)"

760.176(F)(2) "shall be identified with the protective system number and hourly rating printed on the outer jacket of the cable and ~~shall be~~ installed in accordance with the listing of the protective system"

760.176(F)(2) Informational Note 2 "UL 2196-200~~2~~1"

760.179(F)(2) Informational Note 3 "~~UL guide~~ The listing organization provides information for Electrical Circuit Protective Systems (FHIT) ~~contains information on proper~~ including installation requirements to maintain the fire rating."

Substantiation: The recommended changes to 760.176(F)(1) and (F)(2) will correlate these sections with 770.179(E)(1) & (E)(2) and 800.179(G)(1) & (G)(2) as contained in companion comments to Proposals 16-26a and 16-85a and similar changes recommended in companion comments to Proposals 3-165 and 3-210.

The correct date is provided for UL 2196 in Informational Note No 2.

Informational note No 3 is revised to indicate that the listing organization provides information, including installation requirements for FHIT systems.

This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to correlate the Panel Action on Proposals 16-26a, 16-79, 16-85a, 16-137, 3-165, 3-208, and 3-210

The Task Group members were:

George Bish, Chair, representing Satellite Broadcasting & Communication Association

Harry Ohde, representing IBEW

James Brunssen, representing Alliance for Telecommunications Industry Solutions

George Straniero, representing National Electrical Manufacturers Association

Robert Walsh, representing International Association of Electrical Inspectors

Wendell Whistler, representing Intertek Testing Services

Panel Meeting Action: Accept in Principle in Part

Accept the recommendation: 760.176(F)(2) printed on the outer jacket of the cable and shall be installed, and reject the remaining recommendations.

Modify 760.176(F)(2) Informational Note 1 to read:

One method of defining circuit integrity (CI) cable or an Electrical Circuit Protective System is by establishing a minimum 2-hour fire resistive rating when tested in accordance with UL 2196-2012, Standard for Tests of Fire Resistive Cables.

Panel Statement: The panel asserts that the original language of 760.176(F)(1) should remain.

The Panel agrees that the second "shall be" should be removed in 760.176(F)(2)

The reference to UL 2196 in 760.176(F)(2) Informational Note 2 was modified to reflect the current revision of the standard.

There is no need to modify 760.176(F)(2,) Informational Note 3.

Number Eligible to Vote: 14
Ballot Results: Affirmative: 13
Ballot Not Returned: 1 Sepulveda, M.

3-110 Log #1183 NEC-P03 **Final Action: Accept**
(760.176(F), Informational Note 2)

Submitter: Susan L. Stene, UL LLC
Comment on Proposal No: 3-141
Recommendation: Revise text to read as follows:

(F) Fire Alarm Circuit Integrity (CI) Cable or Electrical Circuit Protective System. Cables that are used for survivability of critical circuits under fire conditions shall meet either (F)(1) or (F)(2) as follows:

(1) Circuit Integrity (CI) Cables. Circuit Integrity (CI) cables, specified in 760.176(C), (D), and (E), and used for survivability of critical circuits shall have the additional classification using the suffix "-CI". Circuit integrity (CI) cables shall only be permitted to be installed in a raceway where specifically listed and marked as part of an electrical circuit protective system as covered in (F)(2).

(2) Electrical Circuit Protective System. Cables, specified in 760.176(C), (D), (E), and (F)(1), that are part of an electrical circuit protective system shall be identified with the protective system number and hourly rating printed on the outer jacket of the cable and shall be installed in accordance with the listing of the protective system.

Informational Note No. 1: Fire alarm circuit integrity (CI) cable and electrical circuit protective systems may be used for fire alarm circuits to comply with the survivability requirements of NFPA 72-2010, National Fire Alarm and Signaling Code, Sections 12.4.3 and 12.4.4, that the circuit maintain its electrical function during fire conditions for a defined period of time.

Informational Note No. 2: One method of defining circuit integrity (CI) cable or an Electrical Circuit Protective System is by establishing a minimum 2-hour fire resistive rating when tested in accordance with UL 2196-~~2001 (Rev. 2006)~~ 2012, Standard for Tests of Fire Resistive Cables.

Informational Note No. 3: UL guide information for electrical circuit protective systems (FHIT) contains information on proper installation requirements to maintain the fire rating.

Substantiation: UL 2196, the Standard for Tests for Fire Resistive Cables was revised in 2012. References to UL Standards in the NEC should reflect the current edition.

Panel Meeting Action: Accept

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13

Ballot Not Returned: 1 Sepulveda, M.

3-111 Log #699 NEC-P03 **Final Action: Accept in Principle in Part**

(760.179(G))

Submitter: George Bish, Secure Watch Security

Comment on Proposal No: 3-210

Recommendation: Continue to Accept in Principle with the following changes

760.179(G)(1) "Circuit integrity (-CI) cables used in raceways shall ~~only~~ be ~~permitted to be installed in a raceway where specifically~~ listed and marked as part of an Electrical Circuit Protective System as covered in (F)(2)"

760.179(G)(2) "shall be identified with the protective system number and hourly rating printed on the outer jacket of the cable and ~~shall be~~ installed in accordance with the listing of the protective system"

760.179(G)(2) Informational Note 2 "UL 2196-200~~2~~1"

760.179(G)(2) Informational Note 3 "~~UL guide~~ The listing organization provides information for Electrical Circuit Protective Systems (FHIT) ~~contains information on proper~~ including installation requirements to maintain the fire rating

Substantiation: The recommended changes to 760.179(G)(1) and (G)(2) will correlate these sections with 770.179(E)(1) & (E)(2) and 800.179(G)(1) & (G)(2) as contained in companion comments to Proposals 16-26a and 16-85a and similar changes recommended in companion comments to Proposals 3-165 and 3-208.

The correct date is provided for UL 2196 in Informational Note No 2. Informational note No 3 is revised to indicate that the listing organization provides information, including installation requirements for FHIT systems.

This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to correlate the Panel Action on Proposals 16-26a, 16-79, 16-85a, 16-137, 3-165, 3-208, and 3-210

The Task Group members were:

George Bish, Chair, representing Satellite Broadcasting & Communication Association

Harry Ohde, representing IBEW

James Brunssen, representing Alliance for Telecommunications Industry Solutions

George Straniero, representing National Electrical Manufacturers Association

Robert Walsh, representing International Association of Electrical Inspectors

Wendell Whistler, representing Intertek Testing Services

Panel Meeting Action: Accept in Principle in Part

The panel accepts the recommendation: 760.179(G)(2) printed on the outer jacket of the cable and shall be installed, and rejects the remaining recommendations.

Modify 760.179(G)(2) Informational Note 2 to read:

One method of defining circuit integrity (CI) cable or an Electrical Circuit Protective System is by establishing a minimum 2-hour fire resistive rating when tested in accordance with UL 2196-2012, Standard for Tests of Fire Resistive Cables.

Panel Statement: The panel asserts that the original language of 760.179(G)(1) should remain.

The panel agrees that the second "shall be" should be removed in 725.179(G)(2)

The reference to UL 2196 in 760.179(G)(2) Informational Note 2 was modified to reflect the current revision of the standard.

There is no need to modify 760.179(G)(2) Informational Note 3.

Number Eligible to Vote: 14

Ballot Results: Affirmative: 13

Ballot Not Returned: 1 Sepulveda, M.

ARTICLE 770 — OPTICAL FIBER CABLES AND RACEWAYS

16-4 Log #1039 NEC-P16 **Final Action: Reject**

(770, Informational Note)

Submitter: Mike Holt, Mike Holt Enterprises

Comment on Proposal No: 16-21

Recommendation: Accept this proposal in principal by removing the note altogether.

Substantiation: This note was (maybe) worth having in 2011, but its usefulness is over. How long are we going to have a note explaining changes that were made in previous Code editions?

Panel Meeting Action: Reject

Panel Statement: There has been confusion concerning the terms grounding and bonding, as well as the application of grounding conductors and bonding conductors. The panel added user-friendly Figures 800(a) and (b) to Article 800 to illustrate and clarify the application of grounding and bonding conductors. The existing note of 770, including the proposed added text of Proposal 16-21, continues to be helpful and explains the changes made during the 2011 NEC revision cycle.

Number Eligible to Vote: 18

Ballot Results: Affirmative: 17

Ballot Not Returned: 1 Ballast, D.

16-5 Log #700 NEC-P16 **Final Action: Accept in Principle**

(770.2. Cable Routing Assemblies)

TCC Action: After further consideration, the Correlating Committee directs that the definition of "cable routing assembly," as revised in the Panel Action on this comment, be relocated to Article 100, in accordance with the NEC Style Manual.

Submitter: George Bish, Secure Watch Security

Comment on Proposal No: 16-23

Recommendation: Continue to Accept in Principle with the following changes:

1) Move the definition of Cable Routing Assemblies from 770.2 to 800.2

2) Change the definition to be: A single channel or multiple channels, as well as associated fittings, forming a structural system that is used to support~~,~~ and route ~~and protect high densities of wires and cables, typically~~ communications wires and cables, optical fiber cables, ~~and~~ data ~~(Class 2 and Class3)~~ cables associated with information technology and communications equipment, Class 2 and Class 3 cables.

Substantiation: Placing the definition 'Cable Routing Assembly" in 800.2 enhances correlation as the listing requirements are contained in 800.182 and the Panel Action on Proposals 16-71 and 16-131 moved the application requirements from 770.154 to 800.154.. This action is in keeping with the correlating Committee Note to Proposal 3-118 to locate the definition in a single article in Chapter 8 and the April 23-27, 2012 Correlating Committee Meeting Minutes CMP 3 Minute Item suggesting "...that 800.2 may be the most appropriate location for the definition.

Continued Acceptance in Principle of this proposal is also in keeping with the Correlating Committee's directive to correlate the Panel Actions regarding cable routing assemblies throughout Articles 725, 760, 770, and Chapter 8

This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to locate a correlated definition of Cable Routing Assemblies in a single Article of Chapter 8 for use in Article 725, 760, 770, and Chapter 8.

The Task Group members were:

George Bish, Chair, representing Satellite Broadcasting & Communication Association

Harry Ohde, representing IBEW

James Brunssen, representing Alliance for Telecommunications Industry Solutions

George Straniero, representing National Electrical Manufacturers Association

Robert Walsh, representing International Association of Electrical Inspectors

Wendell Whistler, representing Intertek Testing Services

Panel Meeting Action: Accept in Principle

Add a new definition in 800.2 to read as follows:

Cable Routing Assembly. A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support and route communications wires and cables, optical fiber cables, data cables associated with information technology and communications equipment, Class 2 and Class 3 cables, and power-limited fire alarm cables.

Panel Statement: The panel accepts in principle the proposed recommendation but has included the phrase "and power-limited fire alarm cables" to the definition in support of CMP 3's request in the panel statement of Comment 3-41. The panel has also reinserted the word "connected" in front of "multiple" to correct an oversight in the recommendation since this word is contained in the current Code definition.

Acceptance in principle of Comment 16-5 as developed by the CMP 3/CMP

16 Joint Task Group locates the definition of "Cable Routing Assembly" in 800.2, a single section of Chapter 8, and provides a definition that is correlated for use in Articles 725, 760, 770 and Chapter 8 as directed by the Correlating Committee in their notes to Proposals 3-118 and 3-171.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.
Comment on Affirmative:
DORNA, G.: CMP 16 action on this Comment correlates with CMP 3 action on Comments 3-41 and 3-88.

16-6 Log #323 NEC-P16 **Final Action: Accept in Principle**
(770.2.Cable Routing Assembly)

TCC Action: See the Correlating Committee action on Comment 16-5 which relocates the definition of "Cable Routing Assembly" to Article 100.
Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 16-23
Recommendation: Accept proposal 16-23.
Substantiation: Proposal 16-23 recommended moving the definition of a cable routing assembly from 770.2 to 800.2. The panel accepted proposal 16-23 in principle in part because it decided to retain the definition of cable routing assemblies in 770.2 and repeat it in 800.2
The definition, listing requirements, applications and installation rules for cable routing assemblies do not need to be repeated in multiple articles. Having them all in Article 800 is sufficient.
The Correlating Committee, in its actions on proposal 3-118 and 3-171, directed that the definition of cable routing assembly be located in a single Article of Chapter 8. Acceptance of this comment will bring the panel action into conformance with the Correlating Committee directives.
Panel Meeting Action: Accept in Principle
Panel Statement: Refer to the panel action and statement on Comment 16-5 which meets the intent of the submitter.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-7 Log #989 NEC-P16 **Final Action: Accept in Principle**
(770.2.Cable Routing Assembly)

TCC Action: See the Correlating Committee action on Comment 16-5 which relocates the definition of "Cable Routing Assembly" to Article 100.
Submitter: Robert W. Jensen, dbi-Telecommunication Infrastructure Design
Comment on Proposal No: 16-23
Recommendation: Accept proposal 16-23.
Substantiation: Proposal 16-23 recommended moving the definition of a cable routing assembly from 770.2 to 800.2. The panel accepted proposal 16-23 in principle in part because it decided to retain the definition of cable routing assemblies in 770.2 and repeat it in 800.2
The definition, listing requirements, applications and installation rules for cable routing assemblies do not need to be repeated in multiple articles. Having them all in Article 800 is sufficient.
The Correlating Committee, in its actions on proposal 3-118 and 3-171, directed that the definition of cable routing assembly be located in a single Article of Chapter 8. Acceptance of this comment will bring the panel action into conformance with the Correlating Committee directives.
Panel Meeting Action: Accept in Principle
Panel Statement: Refer to the panel action and statement on Comment 16-5, which meets the intent of the submitter.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-8 Log #1036 NEC-P16 **Final Action: Reject**
(770.2.Cable Routing Assembly and 800.2)

TCC Action: See the Correlating Committee action on Comment 16-5 which relocates the definition of "Cable Routing Assembly" to Article 100.
Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 16-23
Recommendation: Reject this proposal, or move the definition to Article 100.
Substantiation: Having the same definition in Articles 770 and 800 makes no sense, and violates section 2.2.2.1 of the style manual.
Panel Meeting Action: Reject
Panel Statement: Refer to the panel action and statement on Comment 16-2, which addresses the same issue.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-9 Log #1037 NEC-P16 **Final Action: Reject**
(770.2.Innerduct)

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 16-28
Recommendation: Reject this proposal, or move the definition to Article 100.
Substantiation: Having the same definition in Articles 770 and 800 makes no sense, and violates section 2.2.2.1 of the style manual.
Panel Meeting Action: Reject
Panel Statement: Innerduct is frequently used in optical fiber cable installations and having the definition in 770.2 enhances NEC usability. Further, Section 2.2.2.1 of the NEC Style Manual is not a "hard-and-fast rule; it is a general statement. Where NEC usability may be enhanced by having a definition in more than one article, it is permitted.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-10 Log #324 NEC-P16 **Final Action: Accept**
(770.2.Optical Fiber Cable)

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 16-29
Recommendation: Revise (or confirm) the actions on proposals 16-29 and 16-30 so the definition of optical fiber cable reads:
Optical Fiber Cable. A factory assembly or field assembly of one or more optical fibers having an overall covering.
Substantiation: The Communications Cable and Connectivity Association supports the actions of CMP 16 to revise the definition of optical fiber cable to reflect actual field practice.
The recommended text is from Jim Brunssen's affirmative ballot statement.
Panel Meeting Action: Accept
Panel Statement: The panel affirms that the definition of "Optical Fiber Cable" is as stated in this comment.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-11 Log #990 NEC-P16 **Final Action: Accept**
(770.2. Optical fiber Cable)

Submitter: Robert W. Jensen, dbi-Telecommunication Infrastructure Design
Comment on Proposal No: 16-29
Recommendation: Revise the definition of optical fiber cable (no change to the informational note):
Optical Fiber Cable. A factory assembly or field assembly of one or more optical fibers having an overall covering.
Substantiation: BICSI supports the actions of CMP 16 to revise the definition of optical fiber cable to permit blown fiber cables.
The recommended text is from Jim Brunssen's affirmative ballot statement.
Panel Meeting Action: Accept
Panel Statement: Also refer to the panel statement on Comment 16-10.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-12 Log #325 NEC-P16 **Final Action: Reject**
(770.3)

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 16-35
Recommendation: Accept proposal 16-35 in principle in part by accepting the following text:
770.3 Other Articles. Installations of optical fiber cables and raceways shall comply with 770.3(A) and (B). Only those sections of Chapter 2, ~~and~~ Article 300 and Chapter 4 referenced in this article shall apply to optical fiber cables and raceways.
Substantiation: The panel reject statement stated "To ensure that this change will not impact this article will take a review of the Chapters 1, 3, and 4 to determine that all applicable sections have been referenced in Article 770."
A review has been conducted; see Gerald Dorna's ballot comment which showed that no part of Chapter 4 applies to optical fiber installations.
The Communications Cable and Connectivity Association believes it is unreasonably burdensome to expect installers of optical fiber cables to be familiar with the parts of the code that are exclusively electrical and have no relevance to optical fiber cable installations.
Panel Meeting Action: Reject
Panel Statement: The panel recognizes that there is nothing in Article 770 that references sections of Chapter 4.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-13 Log #690 NEC-P16 **Final Action: Hold**
(770.3(C))

TCC Action: The Correlating Committee directs this comment be reported as "Hold."
The Correlating Committee action on Comment 16-5 changed the location of the definition of Cable Routing Assemblies to Article 100.
The installation requirements for cable routing assemblies in 800.110 and 800.113 do not apply globally and negate some of the requirements in Article 770. The Correlating Committee will appoint a task group to address installation issues regarding Cable Routing Assemblies throughout the Code.
Submitter: George Bish, Secure Watch Security
Comment on Proposal No: 16-37
Recommendation: Accept this proposal in principle as follows:
"(D) **Cable Routing Assemblies.** The definition in 800.2, the applications in <u>Table</u> 800.154(c), and the installation rules in 800.110 and 800.113 shall apply to Article 770."
Substantiation: The reference to the definition in 800.2 is appropriate as the definition has been deleted in 770 and placed in a single location in 800.2 per Correlating Committee directive. The Panel Action on Proposals 16-116 and 16-119 included cable routing assemblies in 800.110 and 800.113. This is a companion comment to the Task Group comment on Proposal 16-23.
Continued Acceptance in Principle of this proposal is in keeping with the Correlating Committee's directive to correlate the Panel Actions regarding cable routing assemblies throughout Articles 725, 760, 770, and Chapter 8
This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to locate a correlated definition of Cable Routing Assemblies in a single Article of Chapter 8 for use in Article 725, 760, 770, and Chapter 8.
The Task Group members were:
George Bish, Chair, representing Satellite Broadcasting & Communication Association
Harry Ohde, representing IBEW
James Brunssen, representing Alliance for Telecommunications Industry Solutions
George Straniero, representing National Electrical Manufacturers Association
Robert Walsh, representing International Association of Electrical Inspectors
Wendell Whistler, representing Intertek Testing Services
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-14 Log #326 NEC-P16 **Final Action: Accept in Principle**
(770.3(D))

TCC Action: See Correlating Committee action on Comment 16-13.
Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 16-37
Recommendation: Accept proposals 16-37 in principle with the following text.
<u>**(D)**(new) **Cable Routing Assemblies.** The definition in 800.2, the applications in Table 800.154(c) and installation rules in 800.110 and 800.113 shall apply to Article 770.</u>
Substantiation: Proposal 16-23 recommended moving the definition of a cable routing assembly from 770.2 to 800.2. The panel accepted proposal 16-23 in principle in part because it decided to retain the definition of cable routing assemblies in 770.2 and repeat it in 800.2. As a consequence of its action on proposal 16-23 it accepted proposal 16-37 in principle in part.
The definition, listing requirements, applications and installation rules for cable routing assemblies do not need to be repeated in multiple articles. Having them all in Article 800 is sufficient. Hence this comment recommends referring to the definition of cable routing assembly in 800.2. A companion comment on proposal 16-23 recommends not repeating the definition in 770.2.
The Correlating Committee, in its actions on proposal 3-118 and 3-171, directed that the definition of cable routing assembly be located in a single Article of Chapter 8. Acceptance of this comment will bring the panel action into conformance with the Correlating Committee directives.
Panel Meeting Action: Accept in Principle
Panel Statement: Refer to the panel action on Comment 16-13, which meets the intent of the submitter.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-15 Log #991 NEC-P16 **Final Action: Accept in Principle**
(770.3(D) (New))

TCC Action: See Correlating Committee action on Comment 16-13.
Submitter: Robert W. Jensen, dbi-Telecommunication Infrastructure Design
Comment on Proposal No: 16-37
Recommendation: Accept proposals 16-37 in principle with the following text.
<u>**(D)**(new) **Cable Routing Assemblies.** The definition in 800.2, the applications in Table 800.154(c) and installation rules in 800.110 and 800.113 shall apply to Article 770.</u>
Substantiation: Proposal 16-23 recommended moving the definition of a cable routing assembly from 770.2 to 800.2. The panel accepted proposal 16-23 in principle in part because it decided to retain the definition of cable routing assemblies in 770.2 and repeat it in 800.2. As a consequence of its action on proposal 16-23 it accepted proposal 16-37 in principle in part.
The definition, listing requirements, applications and installation rules for cable routing assemblies do not need to be repeated in multiple articles. Having them all in Article 800 is sufficient. Hence this comment recommends referring to the definition of cable routing assembly in 800.2. A companion comment on proposal 16-23 recommends not repeating the definition in 770.2.
The Correlating Committee, in its actions on proposal 3-118 and 3-171, directed that the definition of cable routing assembly be located in a single Article of Chapter 8. Acceptance of this comment will bring the panel action into conformance with the Correlating Committee directives.
Panel Meeting Action: Accept in Principle
Panel Statement: Refer to the panel action on Comment 16-13, which meets the intent of the submitter.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-16 Log #327 NEC-P16 **Final Action: Reject**
(770.24)

TCC Action: The Correlating Committee directs that this Comment and Proposal 16-40 be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative.
Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 16-40
Recommendation: Continue to reject proposals 16-40 and 16-41.
Substantiation: The Communications Cable and Connectivity Association agrees with Gerald Dorna's ballot statement:
"The submitter's assertion that optical fiber cables need to be protected when installed other-then-parallel to framing members is totally unsubstantiated. Likewise the submitter's assertion that optical fiber cables require support when installed behind accessible panels is not substantiated. <u>These no-voltage cables</u> present no shock hazard and unlike electric power cables, they cannot initiate a fire. Article 770 already addresses the only hazard that optical fiber cables present, the hazard from the spread of fire."
Panel Meeting Action: Reject
Panel Statement: The panel reaffirms it original action (at the ROP meeting) to accept Proposal 16-40 and 16-41.
The substantiation that fire and shock are only things to consider is incorrect. Fiber optic cables is used for life safety applications such as for fire alarm systems, some building system controls and industrial process controls.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 11 Negative: 6
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:
BRUNSSEN, J.: This comment should be accepted. The purpose of the NEC, as stated in Article 90, Section 90.1(A): "... is the practical safeguarding of persons and property from hazards arising from the use of electricity." Optical fiber cables contain no electrical power and hence pose neither a fire nor electrical safety hazard. Section 90.1 (B) states: "Compliance... results in an installation that is essentially free from hazard but not necessarily efficient, convenient, or adequate for good service or for future expansion of electrical use." Since there is no electrical power present and hence, no associated electrical hazard, the acceptance of Proposals 16-40 and 16-41 imposes additional requirements solely to help ensure "good service". The Panel Action to reject this comment, as well as the text of the Panel Statement, essentially expands the purpose and adequacy of the NEC beyond that stated in Sections 90.1(A) and 90.1(B), respectively. Hence, the comment should be accepted.
DAWSON, F.: Acceptance of comments 16-20 and 16-21 and rejection of comments 16-16, 16-18, 16-19, and 16-23 all regarding Article 770.24 would mandate that optical fiber circuits have the same level of physical protection as power circuits even though there has been no data to demonstrate that optical fiber cable possesses any capability to start a fire or presents any electrical shock hazard as it carries no electrical current or voltage. To require optical fiber cable to have the same physical protection as power cable that does have the capability to start a fire and can present an electrical shock hazard if damaged is unwarranted.
In addition, proposals 3-126 regarding Article 725.24(Class 1, 2 and 3 circuits) and 3-177 regarding Article 760.23(fire alarm circuits) which are both identical to the optical fiber cable proposals were rejected by CMP 3 at the ROP and those rejections were confirmed at the ROC by acceptance of comments 3-48 and 3-93 which recommended confirmation of the ROP action. This will create an inconsistency in the NEC as optical fiber cable used in control and fire alarm applications would require a higher level of protection than is required in Article 725 for Class 2 and 3 circuits and Article 760 for fire alarm circuits.
DEIKE, JR., R.: Optical Fiber cables should not be held to the same requirements for installation as electrical cable. There was no substantiation provided to document the fiber optic cable presents the same level of hazard to

personnel or property that electrical cable does. The level of protection required for the fiber optic cable should be determined by the end user.

DORNA, G.: The submitter of Proposal 16-41 also submitted identical proposals for 725.24 (Proposal 3-126) and 760.24 (Proposal 3-177) that were rejected by CMP 3. That reject was reaffirmed by CMP 3 acceptance of Comments 3-48 & 3-93 which recommended continuing rejection of Proposals 3-126 and 3-177. The rejection of Comments 16-16, 16-18, 6-19 & 16-23 and the acceptance of Comments 16-20 & 21 because optical fiber cables are used for fire alarm and control applications, will require a higher level of physical protection for optical fiber cables used for fire alarm and control applications than Articles 725 and 760 require for class 2, class 3 and fire alarm cables. That does not correlate.

IVANS, R.: This comment should be Accepted. Optical fiber cables are not required to be protected the same as power, Class 1, or life safety circuits, therefore adding a reference to all of the subsections in 300.4 is unnecessary. Section 90.1(A) states the purpose of the NEC is practical safe guarding of persons and property from hazards arising from the use of electricity. The requirements of 300.4 are intended to protect cables containing voltage and available current that present the risk of fire or electrical shock. Where there is only signal power, limited power or no power at all (optical fiber) in the cable, there is no reason to add excessive requirements. If optical cable mechanical protection needs to be addressed, specific requirements should be developed, not just impose requirements originally developed for electric light and power circuits. Addressing life safety issues would require an expansion of the scope and more extensive requirements dealing with signal integrity would need to be developed.

JOHNSON, S.: The proposed additional requirements are appropriate for power cables, not optical fiber cables. Optical fiber cables contain no electrical power and hence, pose neither a fire nor electrical safety hazard.

Comment on Affirmative:

BISH, G.: I agree with both the panel action and the panel statement to accept Proposal 16-40 and 16-41. Expansion of the use of fiber optics cables in Life Safety Systems is becoming more common place.

OHDE, H.: We agree with both the panel action and the panel statement to accept Proposals 16-40 and 16-41. 770.24 – Mechanical Execution of Work sets the guidelines for the installer to install optical fiber cables in a neat and workmanlike manner. 300.4 (A) through (G) provide some of the rules to be in compliance with a neat and workmanlike manner installation. These rules rule should be consistent for all electrical installations and not just for some. Expansion of the use fiber optics cables in the electrical industry has changed and will keep changing, as they will be used in fire safety applications.

We agree with both the panel action and the panel statement to accept Proposals 16-40 and 16-41. 770.24 – Mechanical Execution of Work sets the guidelines for the installer to install optical fiber cables in a neat and workmanlike manner. 300.4 (A) through (G) provide some of the rules to be in compliance with a neat and workmanlike manner installation. These rules rule should be consistent for all electrical installations and not just for some. Expansion of the use fiber optics cables in the electrical industry has changed and will keep changing, as they will be used in fire safety applications.

16-17 Log #328 NEC-P16 **Final Action: Accept in Principle**
(770.24 800.24, 820.24, and 830.24)

TCC Action: The Correlating Committee directs that the last sentence of 770.24, 800.24, 820.24, and 830.24 be revised to correlate with 300.22(C)(1) as follows:

"Nonmetallic cables ties and other non-metallic cables accessories used to secure and support cables in other spaces used for environmental air (plenums) shall be listed as having low smoke and heat release properties."

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.

Comment on Proposal No: 16-42

Recommendation: Continue the panel actions (accept in part) on proposals 16-42, 16-100, 16-166 and 16-225.

Substantiation: The Communications Cable and Connectivity Association supports the panel actions to require plenum rated cables ties for use in plenums. These actions improve the correlation between NFPA 70 and NFPA 90A.

Panel Meeting Action: Accept in Principle

Revise the last sentence of 770.24 in the recommendation of Proposal 16-42, and the last sentence of 800.24 in the recommendation of Proposal 16-100, the last sentence of 820.24 in the recommendation of Proposal 16-166, and the last sentence of 830.24 in the recommendation of Proposal 16-225 to read as follows:

"Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables shall be listed as having low smoke and heat release properties."

Panel Statement: The panel action correlates with the CMP 3 action on Comment 3-24 that added "and other nonmetallic cable accessories" following "cable ties".

Number Eligible to Vote: 18

Ballot Results: Affirmative: 17

Ballot Not Returned: 1 Ballast, D.

16-18 Log #537 NEC-P16 **Final Action: Reject**
(770.24)

TCC Action: The Correlating Committee directs that this Comment and Proposal 16-40 be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative.

Submitter: James E. Brunssen, Telecordia Technologies Inc. / Rep. Alliance for Telecommunications Industry Solutions (ATIS)

Comment on Proposal No: 16-40

Recommendation: Continue to reject this proposal per Correlating Committee action.

Substantiation: The Correlating Committee acted correctly in reporting this proposal as "Reject". The proposal received less that the required two-thirds affirmative vote as the submitter failed to adequately substantiate the proposal as required by the "Regulations Governing Committee Projects" Section 4-3.3(d). This was noted by a number of the Committee members in their "Explanation of Negative" vote. The proposed additional requirements are appropriate for power cables, not optical fiber cables. Optical fiber cables contain no electrical power and hence, pose neither a fire nor electrical safety hazard.

Panel Meeting Action: Reject

Panel Statement: Refer to the panel action and statement on Comment 16-16.

Number Eligible to Vote: 18

Ballot Results: Affirmative: 11 Negative: 6

Ballot Not Returned: 1 Ballast, D.

Explanation of Negative:

BRUNSSEN, J.: See my statement associated with my negative ballot on Comment 16-16.

DAWSON, F.: See reason as for comment 16-16.

DEIKE, JR., R.: See my Explanation of Negative Vote on Comment 16-16.

DORNA, G.: See my negative statement on Comment 16-16.

IVANS, R.: This comment should be Accepted. Optical fiber cables are not required to be protected the same as power, Class 1, or life safety circuits, therefore adding a reference to all of the subsections in 300.4 is unnecessary. Section 90.1(A) states the purpose of the NEC is practical safe guarding of persons and property from hazards arising from the use of electricity. The requirements of 300.4 are intended to protect cables containing voltage and available current that present the risk of fire or electrical shock. Where there is only signal power, limited power or no power at all (optical fiber) in the cable, there is no reason to add excessive requirements. If optical cable mechanical protection needs to be addressed, specific requirements should be developed, not just impose requirements originally developed for electric light and power circuits. Addressing life safety issues would require an expansion of the scope and more extensive requirements dealing with signal integrity would need to be developed.

JOHNSON, S.: See my explanation of Negative on Comment 16-16.

Comment on Affirmative:

BISH, G.: See comment on Comment 16-16.

OHDE, H.: See our comment on Comment 16-16.

16-19 Log #538 NEC-P16 **Final Action: Reject**
(770.24)

TCC Action: The Correlating Committee directs that this Comment and Proposal 16-41 be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative.

Submitter: James E. Brunssen, Telecordia Technologies Inc. / Rep. Alliance for Telecommunications Industry Solutions (ATIS)

Comment on Proposal No: 16-41

Recommendation: Continue to reject this proposal per Correlating Committee action.

Substantiation: The Correlating Committee acted correctly in reporting this proposal as "Reject". The proposal received less that the required two-thirds affirmative vote as the submitter failed to adequately substantiate the proposal as required by the "Regulations Governing Committee Projects" Section 4-3.3(d). This was noted by a number of the Committee members in their "Explanation of Negative" vote. The proposed additional requirements are appropriate for power cables, not optical fiber cables. Optical fiber cables contain no electrical power and hence, pose neither a fire nor electrical safety hazard.

Panel Meeting Action: Reject

Panel Statement: Refer to the panel action and statement on Comment 16-16.

Number Eligible to Vote: 18

Ballot Results: Affirmative: 11 Negative: 6

Ballot Not Returned: 1 Ballast, D.

Explanation of Negative:

BRUNSSEN, J.: See my statement associated with my negative ballot on Comment 16-16.

DAWSON, F.: See reason as for comment 16-16.

DEIKE, JR., R.: See my Explanation of Negative Vote on Comment 16-16.

DORNA, G.: See my negative statement on Comment 16-16.

IVANS, R.: This comment should be Accepted. Optical fiber cables are not required to be protected the same as power, Class 1, or life safety circuits, therefore adding a reference to all of the subsections in 300.4 is unnecessary. Section 90.1(A) states the purpose of the NEC is practical safe guarding of persons and property from hazards arising from the use of electricity. The requirements of 300.4 are intended to protect cables containing voltage and available current that present the risk of fire or electrical shock. Where there is only signal power, limited power or no power at all (optical fiber) in the cable, there is no reason to add excessive requirements. If optical cable mechanical protection needs to be addressed, specific requirements should be developed, not just impose requirements originally developed for electric light and power circuits. Addressing life safety issues would require an expansion of the scope and more extensive requirements dealing with signal integrity would need to be developed.

JOHNSON, S.: See my explanation of Negative on Comment 16-16.

Comment on Affirmative:

BISH, G.: See comment on Comment 16-16.

OHDE, H.: See our comment on Comment 16-16.

16-20 Log #561 NEC-P16 **Final Action: Reject**
(770.24)

TCC Action: The Correlating Committee directs that this Comment and Proposal 16-40 be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative.
Note: When the ballot result does not confirm the TC action on a Proposal by a two-thirds affirmative vote, the Report on Proposals shall be published with a specific request for public comment on that Proposal. The Proposal is now being reconsidered by the TC as a public comment.
Submitter: David Clements, International Association of Electrical Inspectors
Comment on Proposal No: 16-40
Recommendation: Revise text to read as follows:

770.24 Mechanical Execution of Work.
Optical fiber cables shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be secured by hardware including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform with 300.4 ~~(D)~~ <u>(A) through (G)</u> and 300.11.

Substantiation: In addition to the physical protection required in 300.4(D) regarding distance from parallel framing members, optical fiber cable also needs to be protected when installed other-than-parallel, to framing members such as perpendicular through bored holes and notches in wood framing, holes in metallic framing, in shallow grooves, under roof decking, etc. Cables also require support when installed behind accessible panels.

The reference needs to be to 300.4(A) through (G) not just to (D).

Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 11 Negative: 6
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:

BRUNSSEN, J.: This comment should be rejected. The purpose of the NEC, as stated in Article 90, Section 90.1(A), "… is the practical safeguarding of persons and property from hazards arising from the use of electricity." Optical fiber cables contain no electrical power and hence, pose neither a fire nor electrical safety hazard. Section 90.1 (B) states: "Compliance... results in an installation that is essentially free from hazard but not necessarily efficient, convenient, or adequate for good service or for future expansion of electrical use." Since there is no electrical power present, the acceptance of Proposals 16-40 and 16-41 amounts to imposing additional requirements solely to help ensure "good service". The Panel Action to accept this comment essentially expands the purpose and adequacy of the NEC beyond that stated in Sections 90.1(A) and 90.1(B), respectively. Hence, the comment should be rejected.

DAWSON, F.: See reason as for comment 16-16.

DEIKE, JR., R.: Optical Fiber cables should not be held to the same requirements for installation as electrical cable. There was no substantiation provided to document the fiber optic cable presents the same level of hazard to personnel or property that electrical cable does. The level of protection required for the fiber optic cable should be determined by the end user.

DORNA, G.: See my negative statement on Comment 16-16.

IVANS, R.: This comment should be Rejected. Optical fiber cables are not required to be protected the same as power, Class 1, or life safety circuits, therefore adding a reference to all of the subsections in 300.4 is unnecessary. Section 90.1(A) states the purpose of the NEC is practical safe guarding of persons and property from hazards arising from the use of electricity. The requirements of 300.4 are intended to protect cables containing voltage and available current that present the risk of fire or electrical shock. Where there is only signal power, limited power or no power at all (optical fiber) in the cable, there is no reason to add excessive requirements. If optical cable mechanical protection needs to be addressed, specific requirements should be developed, not just impose requirements originally developed for electric light and power circuits. Addressing life safety issues would require an expansion of the scope and more extensive requirements dealing with signal integrity would need to be developed.

JOHNSON, S.: See my explanation of Negative on Comment 16-16.

Comment on Affirmative:

BISH, G.: I agree with the panel action and believe the submitters substantiation explaining the need.

OHDE, H.: We agree with the panel action and believe the submitter has done an excellent job explaining the need for the expansion of 300.4 to include 300.4 (A) through (G). The installer knows precisely how to install cable in accordance 300.4 (A) through (G). Consistent code rules is the key for well written code and enforceable code. We have one set installation rules for one cable but not another type of cable.

16-21 Log #569 NEC-P16 **Final Action: Reject**
(770.24)

TCC Action: The Correlating Committee directs that this Comment and Proposal 16-41 be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative.
Note: When the ballot result does not confirm the TC action on a Proposal by a two-thirds affirmative vote, the Report on Proposals shall be published with a specific request for public comment on that Proposal. The Proposal is now being reconsidered by the TC as a public comment.
Submitter: Marcus R. Sampson, Lysistrata Electric
Comment on Proposal No: 16-41
Recommendation: Revise text to read as follows:

770.24 Mechanical Execution of Work.
Optical fiber cables shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be secured by hardware including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform with300.4 ~~(D)~~ <u>(A) through (G)</u> and 300.11.

Substantiation: In addition to the physical protection required in 300.4(D) regarding distance from parallel framing members, optical fiber cable also needs to be protected when installed other-than-parallel, to framing members such as perpendicular through bored holes and notches in wood framing, holes in metallic framing, in shallow grooves, under roof decking, etc. Cables also require support when installed behind accessible panels.

The reference needs to be to 300.4(A) through (G) not just to (D).

Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 11 Negative: 6
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:

BRUNSSEN, J.: This comment should be rejected. See my statement associated with my negative ballot on Comment 16-20.

DAWSON, F.: See reason as for comment 16-16.

DEIKE, JR., R.: See my Explanation of Negative Vote on Comment 16-20.

DORNA, G.: See my negative statement on Comment 16-16.

IVANS, R.: This comment should be Rejected. Optical fiber cables are not required to be protected the same as power, Class 1, or life safety circuits, therefore adding a reference to all of the subsections in 300.4 is unnecessary. Section 90.1(A) states the purpose of the NEC is practical safe guarding of persons and property from hazards arising from the use of electricity. The requirements of 300.4 are intended to protect cables containing voltage and available current that present the risk of fire or electrical shock. Where there is only signal power, limited power or no power at all (optical fiber) in the cable, there is no reason to add excessive requirements. If optical cable mechanical protection needs to be addressed, specific requirements should be developed, not just impose requirements originally developed for electric light and power circuits. Addressing life safety issues would require an expansion of the scope and more extensive requirements dealing with signal integrity would need to be developed.

JOHNSON, S.: See my explanation of Negative on Comment 16-16.

Comment on Affirmative:

BISH, G.: See comment on Comment 16-20.

OHDE, H.: See our comment on Comment 16-20.

16-22 Log #906 NEC-P16 **Final Action: Reject**
(770.24)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 16-42
Recommendation: Revise text to read as follows:

770.24 Mechanical Execution of Work. Optical fiber cables shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be secured by hardware including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform with 300.4(D) and 300.11. <u>See also 300.22.</u> ~~Cable ties used to secure optical fiber plenum cables in other space used for environmental air (plenums) shall be listed as having low smoke and heat release properties.~~

Substantiation: CMP 3 accepted the requirements for cable ties in plenums and incorporate the language on requirements into 300.22 (C)(1). The addition of the language on cable ties here could create conflicts, especially if the language approved in 300.22(C)(1) is different from the language here. I have made a comment to CMP3 to request that the language addressing "smoke and heat release characteristics" be used in 300.22(C)(1).
Panel Meeting Action: Reject
Panel Statement: The reference to 300.22 in the submitter's recommendation is too broad. The panel action on Comment 16-17 is more appropriate because it refers to cable ties and other nonmetallic cable accessories. This panel action also maintains correlation with CMP 3 action on Comment 3-24 that is in agreement with the Correlating Committee's direction to correlate Articles 300, 770, 800, 820 and 830 on the subject of cable ties.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-23 Log #1221 NEC-P16 **Final Action: Reject**
(770.24)

TCC Action: The Correlating Committee directs that this Comment and Proposals 16-40 and 16-41 be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative.
Submitter: Fred C. Dawson, E. I. Du Pont Canada Company / Rep. American Chemistry Council
Comment on Proposal No: 16-40
Recommendation: Continue to reject proposals 16-40 and 16-41.
Substantiation: The ACC supports the panel action and agrees with comments from the panel members. Optical fiber cables present minimal no shock hazard and cannot initiate fires. There is no reason for them to be protected or supported in the same manner as power cables.
Panel Meeting Action: Reject
Panel Statement: Refer to the panel action and statement on Comment 16-16.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 11 Negative: 6
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:
BRUNSSEN, J.: See my statement associated with my negative ballot on Comment 16-16.
DAWSON, F.: See reason as for comment 16-16.
DEIKE, JR., R.: See my Explanation of Negative Vote on Comment 16-16.
DORNA, G.: See my negative statement on Comment 16-16.
IVANS, R.: This comment should be Accepted. Optical fiber cables are not required to be protected the same as power, Class 1, or life safety circuits, therefore adding a reference to all of the subsections in 300.4 is unnecessary. Section 90.1(A) states the purpose of the NEC is practical safe guarding of persons and property from hazards arising from the use of electricity. The requirements of 300.4 are intended to protect cables containing voltage and available current that present the risk of fire or electrical shock. Where there is only signal power, limited power or no power at all (optical fiber) in the cable, there is no reason to add excessive requirements. If optical cable mechanical protection needs to be addressed, specific requirements should be developed, not just impose requirements originally developed for electric light and power circuits. Addressing life safety issues would require an expansion of the scope and more extensive requirements dealing with signal integrity would need to be developed.
JOHNSON, S.: See my explanation of Negative on Comment 16-16.
Comment on Affirmative:
BISH, G.: See comment on Comment 16-16.
OHDE, H.: See our comment on Comment 16-16.

16-24 Log #329 NEC-P16 **Final Action: Accept**
(770.26)

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 16-45
Recommendation: Accept the proposal in principle with modified text as shown:
770.26 Spread of Fire or Products of Combustion.
Installations of optical fiber cables and <u>communications</u> raceways in hollow spaces, vertical shafts, and ventilation or air-handling ducts shall be made so that the possible spread of fire or products of combustion will not be substantially increased. Openings around penetrations of optical fiber cables and <u>communications</u> raceways through fire-resistant–rated walls, partitions, floors, or ceilings shall be firestopped using approved methods to maintain the fire resistance rating.
Informational Note: Directories of electrical construction materials published by qualified testing laboratories contain many listing installation restrictions necessary to maintain the fire-resistive rating of assemblies where penetrations or openings are made. Building codes also contain restrictions on membrane penetrations on opposite sides of a fire-resistance–rated wall assembly. An example is the 600-mm (24-in.) minimum horizontal separation that usually applies between boxes installed on opposite sides of the wall. Assistance in complying with 770.26 can be found in building codes, fire resistance directories, and product listings.
Substantiation: The panel rejected the proposal with the statement :
"Raceways are required to be fire stopped. The submitters substantiation to resolve the use of optical fiber raceway versus communications raceway is not reflected in the recommendation."
The recommended text reflects the panel actions to replace optical fiber raceways with communications raceways.
The firestopping of Chapter 3 raceways in covered in 300.21. Section 770.110(1) states:
(1) Raceways Recognized in Chapter 3. Optical fiber cables shall be permitted to be installed in any raceway included in Chapter 3. The raceways shall be installed in accordance with the requirements of Chapter 3.
If this comment is accepted, the text will correlate with 800.26, which requires the firestopping of communications cables and communications raceways, and with the panel action on proposal 16-169 which requires firestopping of CATV cables and communications raceways.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-25 Log #214 NEC-P16 **Final Action: Accept**
(770.47 (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 16-46
Recommendation: The Correlating Committee directs that the panel clarify the panel action by writing the Exceptions in complete sentences, based on 3.1.4.1 of the NEC Style Manual.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the direction of the Correlating Committee and the panel action on Comment 16-26 makes the necessary changes.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-26 Log #330 NEC-P16 **Final Action: Accept**
(770.47(B))

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 16-46
Recommendation: Revise text to read as follows:
(B) Direct-Buried Cables and Raceways. Direct-buried conductive optical fiber cables shall be separated by at least 300 mm (12 in.) from conductors of any electric light, power, or non–power-limited fire alarm circuit conductors or Class 1 circuit.
Exception No. 1: <u>Direct-buried conductive optical fiber cables shall not be required to be separated by at least 300 mm (12 in.) from electric service conductors where the</u> ~~Where~~ electric service conductors are installed in raceways or have metal cable armor.
Exception No. 2: <u>Direct-buried conductive optical fiber cables shall not be required to be separated by at least 300 mm (12 in.) from electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors where the</u> ~~Where~~ electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables.
Substantiation: The Correlating Committee directed that the action on this proposal be revised comply with 3.1.4.1 of the NEC Style manual which requires that exceptions shall be written in complete sentences.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-27 Log #1266 NEC-P16 **Final Action: Accept in Principle**
(770.48(B))

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 16-47
Recommendation: Proposal 16-47 should continue to be Accept in Principle with the following revision:
Replace the word "run" with "shall be installed."
Substantiation: Panel 16 should consider revising the current requirement to improve the language for this section.
Panel Meeting Action: Accept in Principle
In the panel action on Proposal 16-47 change the words "run in" to "shall be permitted to be installed in".
Panel Statement: The panel agrees that "installed in" is better code language than "run in." However, the recommended revision would change a permissive statement to a mandatory requirement without any substantiation for the

change. The panel modified the submitter's text to maintain permissive language.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-28 Log #215 NEC-P16 **Final Action: Accept**
(770.110)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 16-57
Recommendation: The Correlating Committee directs that the panel clarify the panel action pertaining to the last sentence which reads: "Remainder of the proposed text remains unchanged." with what additional text is to be inserted.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the Correlating Committee's direction to provide clarification. The panel intended to retain the balance of the submitter's recommendation. Comment 16-31 includes the entire text of 770.110 and resolves the question.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-29 Log #331 NEC-P16 **Final Action: Accept in Principle**
(770.110)

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 16-57
Recommendation: Revise the panel action on proposal 16-57 follows:
770.110 Raceways and Cable Routing Assemblies for Optical Fiber Cables.
(A) Types of Raceways. Optical fiber cables shall be permitted to be installed in any raceway that complies with either (A)(1) or (A)(2), and in cable routing assemblies installed in compliance with (C).
(1) Raceways Recognized in Chapter 3. Optical fiber cables shall be permitted to be installed in any raceway included in Chapter 3. The raceways shall be installed in accordance with the requirements of Chapter 3.
(2) Communications Raceways. Optical fiber cables shall be permitted to be installed in listed plenum communications raceways, listed riser communications raceways and listed general-purpose communications raceways selected in accordance with the provisions of 770.113, 800.110, and 800.113, and installed in accordance with 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing apply.
(B) Raceway Fill for Optical Fiber Cables. Raceway fill for optical fibers cables shall comply with either (B)(1) or (B)(2).
(1) Without Electric Light or Power Conductors. Where optical fiber cables are installed in raceway without electric light or power conductors, the raceway fill requirements of Chapters 3 and 9 shall not apply.
(2) Nonconductive Optical Fiber Cables with Electric Light or Power Conductors. Where nonconductive optical fiber cables are installed with electric light or power conductors in a raceway, the raceway fill requirements of Chapters 3 and 9 shall apply.
(C) Cable Routing Assemblies. Optical fiber ~~Communications wires~~ and cables shall be permitted to be installed in plenum cable routing assemblies, riser cable routing assemblies and general-purpose cable routing assemblies selected in accordance with the provisions of 800.113 and Table 800.154(c), and installed in accordance with (1) and (2).
(1) Horizontal Support. Cable routing assemblies shall be supported where run horizontally at intervals not to exceed 900 mm (3 ft), and at each end or joint, unless listed for other support intervals. In no case shall the distance between supports exceed 3 m (10 ft).
(2) Vertical Support. Vertical runs of cable routing assemblies shall be ~~securely~~ supported at intervals not exceeding 1.2 m (4 ft), unless listed for other support intervals, and shall not have more than one joint between supports.
Substantiation: "Communications wires and cables" is replaced by "Optical fiber cables" in the recommended text for 770.110(C) in order to correct an error.
The Correlating Committee directed that action on proposal 16-116 be rewritten to comply with 3.2.1 of the NEC Style Manual. "Securely" is on the list in Table 3.2.1, Possibly Unenforceable and Vague Terms. This proposal has the same style manual issue as proposal 16-116 so "securely" has been deleted from the recommended text.
The Correlating Committee directed that the panel clarify the statement "Remainder of proposed text remains unchanged." Panel action to accept this comment will provide the required clarification.
Panel Meeting Action: Accept in Principle
Panel Statement: Refer to the panel action on Comment 16-31, which meets the intent of the submitter.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 16 Negative: 1
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:
OHDE, H.: See our comment on Comment 16-31.

16-30 Log #514 NEC-P16 **Final Action: Accept**
(770.110)

Submitter: Thomas E. Moore, City of Beachwood
Comment on Proposal No: 16-57
Recommendation: Revise text to read as follows:
(C) Cable Routing Assemblies. ~~Communication wires~~ Optical fiber ~~and~~ cables shall be permitted to be installed in plenum cable routing assemblies, riser cable routing assemblies and general-purpose cable routing assemblies selected in accordance with the provisions of 800.113 and Table 800.IS4(c), and installed in accordance with (I) and (2).
Substantiation: During the meeting of Report on Proposals "communications wires" was inadvertently inserted in the panel action. Article 770 addresses optical fiber cables and
raceways and not communications cables. It was the panel's intention to address optical fiber cables. The acceptance of this comment will clarify that 770.110(C)
addresses optical fiber cables.
Panel Meeting Action: Accept
Panel Statement: The panel advises that there are two errors in the first paragraph. The phrase "Table 800.IS4(c), and installed in accordance with (I)" should be Table 800.I54(c), and installed in accordance with (1)". Refer to panel action on Comment 16-31, which is shown correctly.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-31 Log #992 NEC-P16 **Final Action: Accept**
(770.110)

Submitter: Robert W. Jensen, dbi-Telecommunication Infrastructure Design
Comment on Proposal No: 16-57
Recommendation: Revise the panel action on proposal 16-57 follows:
770.110 Raceways and Cable Routing Assemblies for Optical Fiber Cables.
(A) Types of Raceways. Optical fiber cables shall be permitted to be installed in any raceway that complies with either (A)(1) or (A)(2), and in cable routing assemblies installed in compliance with (C).
(1) Raceways Recognized in Chapter 3. Optical fiber cables shall be permitted to be installed in any raceway included in Chapter 3. The raceways shall be installed in accordance with the requirements of Chapter 3.
(2) Communications Raceways. Optical fiber cables shall be permitted to be installed in listed plenum communications raceways, listed riser communications raceways and listed general-purpose communications raceways selected in accordance with the provisions of 770.113, 800.110, and 800.113, and installed in accordance with 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing apply.
(B) Raceway Fill for Optical Fiber Cables. Raceway fill for optical fibers cables shall comply with either (B)(1) or (B)(2).
(1) Without Electric Light or Power Conductors. Where optical fiber cables are installed in raceway without electric light or power conductors, the raceway fill requirements of Chapters 3 and 9 shall not apply.
(2) Nonconductive Optical Fiber Cables with Electric Light or Power Conductors. Where nonconductive optical fiber cables are installed with electric light or power conductors in a raceway, the raceway fill requirements of Chapters 3 and 9 shall apply.
(C) Cable Routing Assemblies. Optical fiber ~~Communications wires and~~ cables shall be permitted to be installed in plenum cable routing assemblies, riser cable routing assemblies and general-purpose cable routing assemblies selected in accordance with the provisions of 800.113 and Table 800.154(c), and installed in accordance with (1) and (2).
(1) Horizontal Support. Cable routing assemblies shall be supported where run horizontally at intervals not to exceed 900 mm (3 ft), and at each end or joint, unless listed for other support intervals. In no case shall the distance between supports exceed 3 m (10 ft).
(2) Vertical Support. Vertical runs of cable routing assemblies shall be ~~securely~~ supported at intervals not exceeding 1.2 m (4 ft), unless listed for other support intervals, and shall not have more than one joint between supports.
Substantiation: "Communications wires and cables" is replaced by "Optical fiber cables" in the recommended text for 770.110(C) in order to correct an error.
The Correlating Committee directed that action on proposal 16-116 be rewritten to comply with 3.2.1 of the NEC Style Manual. "Securely" is on the list in Table 3.2.1, *Possibly Unenforceable and Vague Terms*. This proposal has the same style manual issue as proposal 16-116 so "securely" has been deleted from the recommended text.
The Correlating Committee directed that the panel clarify the statement "Remainder of proposed text remains unchanged." Panel action to accept this comment will provide the required clarification.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 16 Negative: 1
Ballot Not Returned: 1 Ballast, D.

Explanation of Negative:

OHDE, H.: We disagree with the panel action and believe that is should be Accept in Part. The deletion of the word "securely" in this case really is not a vague term but describes an action that will be required for the installer to securely support the optical fiber cable as opposed to just supporting the optical fiber cable. The deletion of the word "securely" provides no guidance and is now code rule is very generic.

16-32 Log #1038 NEC-P16 **Final Action: Accept in Principle**
(770.110)

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 16-57
Recommendation: Revise subsection (C) so that it applies to optical fiber cables instead of communications cables.
(C) Cable Routing Assemblies. ~~Communications wires and~~ Optical Fiber cables shall be permitted to be installed in plenum cable routing assemblies, riser cable routing assemblies and general-purpose cable routing assemblies selected in accordance with the provisions of 800.113 and Table 800.154(c), and installed in accordance with (1) and (2).
Substantiation: This seems to be a copy and paste error (a mistake that I am all too familiar with myself).
Panel Meeting Action: Accept in Principle
Panel Statement: Refer to the panel action on Comment 16-31, which meets the intent of the submitter.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-33 Log #881 NEC-P16 **Final Action: Accept**
(770.110(C)(3))

Submitter: Terry Peters, The Society of the Plastics Industry
Comment on Proposal No: 16-59
Recommendation: Continue to reject proposal 16-59.
Substantiation: The submitter's recommendation to prohibit the installation of plenum cables in plenum raceways is absurd. Plenum raceways are designed to be used with plenum cables. The Society of the Plastics Industry supports the panel action to reject this proposal.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-34 Log #332 NEC-P16 **Final Action: Hold**
(770.113(E))

TCC Action: The Correlating Committee directs that this panel action on this Comment be reported as "Hold" based on 4.4.4.6.2 of the NFPA Regulations Governing Committee Projects since the information accepted in this comment, to add an informational note, is new material that has not had public review.
Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 16-62
Recommendation: Revise text to read as follows:

Informational Note No.1: See 770.26 for firestop requirements for floor penetrations.

Informational Note No. 2: See 800.12 for information on using communications raceways as innerduct.

Substantiation: The new informational note adds clarity by guiding the reader to new section 800.12 which permits communications raceways to be used as innerduct in any type of Chapter 3 raceway.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 16 Negative: 1
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:

OHDE, H.: We disagree with the panel's action and believe that additional Information Note No. 2 is new material. In addition, the submitter's substantiation does not add clarity by guiding the reader to 800.12 but adds confusion. Too many informational notes defeat the true purpose of Informational Note. We believe the reader and the installer should have some knowledge of how to read and interpret the code.

16-35 Log #759 NEC-P16 **Final Action: Accept**
(770.133)

Submitter: James T. Dollard, Jr., IBEW Local 98
Comment on Proposal No: 16-66
Recommendation: Continue to Accept.
Substantiation: This comment is submitted on behalf of the high voltage task to provide additional substantiation as directed by the Correlating Committee.

The High Voltage Task Group (HVTG) was charged with developing recommendations throughout the NEC to provide the code user with prescriptive requirements for high voltage installations. The task group charge was to identify holes in the code with respect to installations operating at over 600-volts and address them with recommended requirements to allow for uniform installation and enforcement. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are currently being installed at DC voltages over 600V up to and including 1000V, 1200V, 1500V, and 2000V DC. These DC systems are expanding and have become a more integral part of many structures. Small Wind Electric Systems and Solar Photovoltaic (PV) Systems are employed regularly in, and on all types of structures from dwellings units, to large retail and high rise construction.

The first direction that the HVTG took was to simply suggest revisions in Chapter 6 for Special Equipment. It is extremely important to fully understand the outline form of the NEC. Section 90.3 mandates that Chapters 1 through 4 apply generally and Chapters 5, 6 and 7 are special and serve only to modify or supplement the rules in Chapters 1 through 4. The HVTG quickly realized that it was not feasible to address all of the installation requirements in Chapter 6. The work needs to be done throughout the NEC. The special systems in Chapter 6 are built primarily upon Chapters 1 through 4 with the Chapter 6 requirements providing only modifications or supplemental requirements. A quick review of the UL White-book for electrical products will uncover that UL has many products that are utilized in these systems rated at and above 600-volts including but not limited to, 600Vdc terminal blocks, 1000Vdc PV switches, 1500Vdc PV fuses, and 2000V PV wiring. Product listings provide permitted uses and restrictions on a given product. The NEC must recognize those products through installation requirements. Electrical safety in the home, workplace and in all venues depends upon installation requirements to ensure that all persons and property are not exposed to the hazards of electricity.
The success of this code hinges on three things (1) product standards, (2) installation requirements and (3) enforcement. The NEC needs to recognize emerging technologies that are operating at over 600-volts. Everyone needs to play a role in this transition. The present NEC requirements would literally require that a PV system operating at 750-volts DC utilize a disconnecting means rated at 5 kV. The manufacturers, research and testing laboratories and the NEC must work together to develop installation requirements and product standards to support these emerging technologies.

Moving the NEC threshold from 600 volts to 1000 volts will not, by itself, allow the immediate installation of systems at 1000-volts. Equipment must first be tested and found acceptable for use at the higher voltage(s). The testing and listing of equipment will not, by itself, allow for the installation of 1000 volt-systems. The NEC must include prescriptive requirements to permit the installation of these 1000-volt systems. It will take both tested/listed equipment and an installation code to meet the needs of these emerging technologies that society demands. The installation code should be the NEC.

Moving the NEC to 1000 volts is just the beginning. The desire to keep increasing efficiencies will continue to drive up the system voltages. We are beginning to see 1200, 1500, and 2000-volt systems. 2500 volts cannot be far down the road. Most equipment standards are still at 600 volts and will need to be upgraded also.

If the NEC does not adequately address systems over 600 volts, some other standard will. If we want to control the future safety of installations over 600 volts we need to address these issues today.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-36 Log #216 NEC-P16 **Final Action: Accept**
(770.179)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 16-75
Recommendation: The Correlating Committee directs that the panel clarify the panel action pertaining to the use of "(plenum)", (riser), and (general-purpose) in (F)(1) and "plenum" "riser" and "general-purpose" in (F)(4) without parenthesis in accordance with the NEC Style Manual.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accept the direction of the Correlating Committee and has clarified the action on Proposal 16-75 through the panel action on Comment 16-37.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-37 Log #333 NEC-P16 **Final Action: Accept in Principle**
(770.179)

TCC Action: The Correlating Committee directs that the proposed revision be revised as follows in accordance with the NEC Style Manual: 770.179(F) Field-Assembled Optical Fiber Cables. Field-assembled optical fiber cable shall comply with 770.179(F)(1) or (2).
(1) Marking and Listing of Combination of Jacket and Optical Fibers. The specific combination of jacket and optical fibers intended to be installed as a field-assembled optical fiber cable shall be listed in accordance with 770.179(A), (B), or (D) and shall be marked in accordance with table 770.179
(a) The jacket of a field-assembled optical fiber cable shall have a surface marking indicating the specific optical fibers with which it is listed for use.
(b) The optical fibers shall have a permanent marking, such as a marker tape, indicating the jacket with which they are listed for use.
(2) Listing of Jacket Without Fibers. The jacket without fibers shall meet the listing requirements for communications raceways in 800.182(A), (B), or (C) in accordance with the cable marking.
Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 16-75
Recommendation: Revise 770.179(F):
770.179(F) Field-Assembled Optical Fiber Cables. Field-assembled optical fiber cable shall comply with 770.179(F)(1) through (4).
(1) The specific combination of jacket and optical fibers intended to be installed as a field-assembled optical fiber cable shall be listed in accordance with 770.179(A) Types OFNP and OFCP ~~(plenum)~~, 770.179(B) Types OFNR and OFCR ~~(riser)~~ or 770.179(D) Types OFN and ORC ~~(general-purpose)~~ and shall be marked in accordance with Table 770.179.
(2) The jacket of a field-assembled optical fiber cable shall have a surface marking indicating the specific optical fibers with which it is listed for use.
(3) The optical fibers shall have a permanent marking, such as a marker tape, indicating the jacket with which they are listed for use.
(4) The jacket without fibers shall meet the listing requirements for communications raceways in 800.182(A) Plenum Communications Raceways and Plenum Cable Routing Assemblies ~~plenum~~, 800.182(B) Riser Communications Raceways and Plenum Cable Routing Assemblies ~~riser~~ or 800.182(C) General-Purpose Communications Raceways and General-purpose Cable Routing Assemblies ~~general-purpose~~ in accordance with the cable marking.
Substantiation: The Communications Cable and Connectivity Association supports the actions of CMP 16 to provide for the listing and installation of field-assembled optical fiber cables and thereby reflect actual field practice.
The recommended changes to the text are intended to add clarity and comply with the Correlating Committee directive on this proposal.
Panel Meeting Action: Accept in Principle
Revise 770.179(F)(1) as follows:
(1) The specific combination of jacket and optical fibers intended to be installed as a field-assembled optical fiber cable shall be listed in accordance with 770.179(A), (B) or (D) and shall be marked in accordance with Table 770.179.
Revise 770.179(F)(4) as follows: (4) The jacket without fibers shall meet the listing requirements for communications raceways in 800.182(A), (B) or (C) in accordance with the cable marking.
Panel Statement: The panel has simplified the requirements by removing the subsection titles.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-38 Log #701 NEC-P16 **Final Action: Accept in Principle**
(770.179(E))

Submitter: George Bish, Secure Watch Security
Comment on Proposal No: 16-26a
Recommendation: Accept in Principle with the following changes:
770.179(E)(1) "Circuit integrity (-CI) cables ~~suitable for use~~ used in raceways shall be listed and marked specifically as part of an Electrical Circuit Protective System as covered in (E)(2)"
Delete Informational Note associated with 770.179(E)(1)
770.179(E)(2) "shall be identified with the protective system number and hourly rating printed on the outer jacket of the cable and installed in accordance with the listing of the protective system"
Delete substantiation Item #4.
Substantiation: In 770.179(E)(1) Circuit integrity cables used in raceways are required to be listed and marked. Use of the phrase "suitable for use" neither enhances nor contributes to the understanding of the requirement. In 770.179(E)(2) the addition of the phrase "installed in accordance with the listing of the protective system" provides a reminder to the Code user and reinforces the requirement of 110.3(B). This is a companion comment to similar comments on Proposals 16-85a, 3-165, 3-208 and 3-210. Incorporation of these suggested revisions will provide correlation across Articles 725, 760, 770 & 800.
The Informational Note following 770.179(E)(1) is redundant as the mandatory text of 770.179(E)(1) already states that circuit integrity cables used in raceways shall be marked with the designation "CI". Substantiation # 4 is no longer necessary as the Informational note is removed
This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to correlate the Panel Action on Proposals 16-26a, 16-79, 16-85a, 16-137, 3-165, 3-208, and 3-210
The Task Group members were:
George Bish, Chair, representing Satellite Broadcasting & Communication Association
Harry Ohde, representing IBEW
James Brunssen, representing Alliance for Telecommunications Industry Solutions
George Straniero, representing National Electrical Manufacturers Association
Robert Walsh, representing International Association of Electrical Inspectors
Wendell Whistler, representing Intertek Testing Services
Panel Meeting Action: Accept in Principle
Revise 770.179(E) to read as follows:
770.179 (E) Circuit Integrity (-CI) Cable or Electrical Circuit Protective System. Cables that are used for survivability of critical circuits under fire conditions shall be listed and meet either (E)(1) or (E)(2) as follows:
Informational Note: The listing organization provides information for circuit integrity (-CI) cable and Electrical Circuit Protective Systems including installation requirements required to maintain the fire rating.
770.179(E)(1) Circuit Integrity (-CI) Cables. Circuit Integrity (-CI) cables, specified in 770.179(A) through (D), and used for survivability of critical circuits shall have the additional classification using the suffix "-CI. In order to maintain its listed fire rating, circuit integrity (-CI) cable shall only be installed in free air.
Informational Note : One method of defining circuit integrity (CI) cable is by establishing a minimum 2-hour fire resistance rating for the cable when tested in accordance with ANSI/UL 2196-2006, Standard for Tests of Fire-Resistive Cable.
770.179(E)(2) Fire-Resistive Cables. Cables, specified in 770.179(A) through (D) and 770.179(E)(1), that are part of an Electrical Circuit Protective System, shall be Fire-Resistive Cable, identified with the protective system number on the product or on the smallest unit container in which the product is packaged and installed in accordance with the listing of the protective system.
Informational Note: One method of defining an Electrical Circuit Protective System is by establishing a minimum 2-hour fire resistance rating for the system when tested in accordance with UL Subject 1724, Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems.
Panel Statement: The panel accepts the submitter's recommendation in principle but has revised the requirement to provide clarity on the listing of CI cable and cable used in electrical circuit protective systems (ECPS). The following modifications were made:
• The cable is required to be listed in all cases. The listing requirement has been placed in the main paragraph.
• As a condition of listing, -CI cable must be installed only in free air. This has been stated.
• Electrical circuit protective systems do not necessarily have to be conduit but can be enclosed in other materials. This has been reflected in the revisions to 770.179(E).
• The revisions have corrected all references.
• Marking requirements have been changed to align with listing requirement. It is not always practical to surface mark the cable in a system as the cable manufacturer may not be the one who has a system evaluated.
• Information Notes were added and revised for clarity
The panel advises the correlating committee that the panel actions in this comment do not fully correlate with the related actions of CMP 3 on Comments 3-74, 3-109 and 3-111. While there is not a technical conflict between these different panel actions, the revisions provided by Panel 16 include a greater level of precision and clarity that is needed for these provisions. It is recommended that the correlating committee review these changes to determine if any changes are needed for correlation.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-39 Log #691 NEC-P16 **Final Action: Accept in Principle**
(770.179(G))

Submitter: George Bish, Secure Watch Security
Comment on Proposal No: 16-79
Recommendation: Continue to Accept in Principle
Substantiation: Continued Acceptance in Principle correlates with the CMP3/CMP16 Joint Task Group recommendation on Proposal 16-26a
This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to correlate the Panel Action on Proposals 16-26a, 16-79, 16-85a, 16-137, 3-165, 3-208, and 3-210
The Task Group members were:
George Bish, Chair, representing Satellite Broadcasting & Communication Association
Harry Ohde, representing IBEW

James Brunssen, representing Alliance for Telecommunications Industry Solutions

George Straniero, representing National Electrical Manufacturers Association

Robert Walsh, representing International Association of Electrical Inspectors

Wendell Whistler, representing Intertek Testing Services

Panel Meeting Action: Accept in Principle

Panel Statement: Refer to the panel action and statement on Comment 16-38, which meets the intent of the submitter.

Number Eligible to Vote: 18

Ballot Results: Affirmative: 17

Ballot Not Returned: 1 Ballast, D.

ARTICLE 800 — COMMUNICATIONS CIRCUITS

16-40 Log #692 NEC-P16 **Final Action: Accept in Principle**

(800.2 and 800.179(G))

TCC Action: The Correlating Committee directs the proposed revision be revised as follows to be in accordance with the NEC Style Manual: "800.179(G)(2) Fire Resistive Cables. Cables, specified in 800.179(A) through (E) and 800.179(G)(1), that are part of an Electrical Circuit Protective System, shall be Fire-Resistive Cable, identified with the protective system number on the product or on the smallest unit container in which the product is packaged and shall be installed in accordance with the listing of the protective system."

Submitter: George Bish, Secure Watch Security

Comment on Proposal No: 16-85a

Recommendation: Accept in Principle with the following changes:

800.179(G)(1) "Circuit integrity (-CI) cables ~~suitable for use~~ used in raceways shall be listed and marked specifically as part of an Electrical Circuit Protective System as covered in (G)(2)"

Delete Informational Note associated with 800.179(G)(1)

800.179(G)(2) "shall be identified with the protective system number and hourly rating printed on the outer jacket of the cable and installed in accordance with the listing of the protective system"

Delete substantiation Item # 4.

Substantiation: In 800.179(G)(1) Circuit integrity cables used in raceways are required to be listed and marked. Use of the phrase "suitable for use" neither enhances nor contributes to the understanding of the requirement. In 800.179(G)(2) the addition of the phrase "installed in accordance with the listing of the protective system" provides a reminder to the Code user and reinforces the requirement of 110.3(B). This is a companion comment to similar comments on Proposals 16-26a, 3-165, 3-208 and 3-210. Incorporation of these suggested revisions will provide correlation across Articles 725, 760, 770 & 800.

The Informational Note following 800.179(G)(1) is redundant as the mandatory text of 800.179(G)(1) already states that circuit integrity cables used in raceways shall be marked with the designation "CI". Substantiation # 4 is no longer necessary as the Informational note is removed

This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to correlate the Panel Action on Proposals 16-26a, 16-79, 16-85a, 16-137, 3-165, 3-208, and 3-210

The Task Group members were:

George Bish, Chair, representing Satellite Broadcasting & Communication Association

Harry Ohde, representing IBEW

James Brunssen, representing Alliance for Telecommunications Industry Solutions

George Straniero, representing National Electrical Manufacturers Association

Robert Walsh, representing International Association of Electrical Inspectors

Wendell Whistler, representing Intertek Testing Services

The Task Group members were:

George Bish, Chair, representing Satellite Broadcasting & Communication Association

Harry Ohde, representing IBEW

James Brunssen, representing Alliance for Telecommunications Industry Solutions

George Straniero, representing National Electrical Manufacturers Association

Robert Walsh, representing International Association of Electrical Inspectors

Wendell Whistler, representing Intertek Testing Services

Panel Meeting Action: Accept in Principle

Revise 800.179(G) to read as follows:

800.179 (G) Circuit Integrity (-CI) Cable or Electrical Circuit Protective System. Cables that are used for survivability of critical circuits under fire conditions shall be listed and meet either (G)(1) or (G)(2) as follows:

Informational Note: The listing organization provides information for circuit integrity (-CI) cable and electrical circuit protective systems including installation requirements required to maintain the fire rating.

800.179(G)(1) Circuit Integrity (-CI) Cables. Circuit Integrity (-CI) cables, specified in 800.179(A) through (E), and used for survivability of critical circuits shall have the additional classification using the suffix "-CI. In order to maintain its listed fire rating, circuit integrity (-CI) cable shall only be installed in free air.

Informational Note : One method of defining circuit integrity (CI) cable is by establishing a minimum 2-hour fire resistance rating for the cable when tested in accordance with ANSI/UL 2196- 2006, Standard for Tests of Fire-Resistive Cable.

800.179(G)(2) Fire-Resistive Cables. Cables, specified in 800.179(A) through (E) and 800.179(G)(1), that are part of an Electrical Circuit Protective System, shall be Fire-Resistive Cable, identified with the protective system number on the product or on the smallest unit container in which the product is packaged and installed in accordance with the listing of the protective system.

Informational Note: One method of defining an electrical circuit protective system is by establishing a minimum 2-hour fire resistance rating for the system when tested in accordance with UL Subject 1724, Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems.

Panel Statement: The panel accepts the submitter's recommendation in principle but has revised the requirement to provide clarity on the listing of CI cable and cable used in electrical circuit protective systems (ECPS). The following modifications were made:

- The cable is required to be listed in all cases. The listing requirement has been placed in the main paragraph.
- As a condition of listing, -CI cable must be installed only in free air. This has been stated.
- Electrical circuit protective systems do not necessarily have to be conduit but can be enclosed in other materials. This has been reflected in the revisions to 800.179(G).
- The revisions have corrected all references.
- Marking requirements have been changed to align with listing requirement. It is not always practical to surface mark the cable in a system as the cable manufacturer may not be the one who has a system evaluated.
- Information Notes were added and revised for clarity

The panel advises the correlating committee that the panel actions in this comment do not fully correlate with the related actions of CMP 3 on Comments 3-74, 3-109 and 3-111. While there is not a technical conflict between these different panel actions, the revisions provided by Panel 16 include a greater level of precision and clarity that is needed for these provisions. It is recommended that the correlating committee review these changes to determine if any changes are needed for correlation.

Number Eligible to Vote: 18

Ballot Results: Affirmative: 17

Ballot Not Returned: 1 Ballast, D.

16-41 Log #1040 NEC-P16 **Final Action: Reject**

(800.2.Innerduct)

Submitter: Mike Holt, Mike Holt Enterprises

Comment on Proposal No: 16-87

Recommendation: Reject this proposal, or move the definition to Article 100.

Substantiation: Having the same definition in Articles 770 and 800 makes no sense, and violates section 2.2.2.1 of the style manual.

Panel Meeting Action: Reject

Panel Statement: Communications raceways are permitted to be used as innerducts. NEC usability is enhanced by having the definition in 800.2 as the item is closely associated with communications. Further, Section 2.2.2.1 of the NEC Style Manual is not a hard-and-fast rule; it is a general statement. Where NEC usability may be enhanced by having a definition in more than one article, it is permitted.

Number Eligible to Vote: 18

Ballot Results: Affirmative: 17

Ballot Not Returned: 1 Ballast, D.

16-42 Log #334 NEC-P16 **Final Action: Accept**

(800.12)

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.

Comment on Proposal No: 16-97

Recommendation: Accept proposal 16-97 in principle by revising the text accepted for 800.12 as shown:

800.12 Innerduct Listed plenum communications raceway, listed riser communications raceway, and listed general-purpose communications raceway selected in accordance with the provisions of Table 800.154(b) shall be permitted to be installed as innerduct in any type of listed raceway permitted in Chapter 3.

Substantiation: Panel action on proposal 16-131 established Table 800.154(b), Applications of Listed Communications Raceways in Buildings.

Panel Meeting Action: Accept

Number Eligible to Vote: 18

Ballot Results: Affirmative: 17

Ballot Not Returned: 1 Ballast, D.

16-43 Log #335 NEC-P16 **Final Action: Accept**
(800.24)

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 16-98
Recommendation: Continue to reject proposal 16-98.
Substantiation: The Communications Cable and Connectivity Association agrees with the panel's reject statement. The Communications Cable and Connectivity Association opposes the adoption of onerous installation rules for communications cables unless they are required to mitigate a recognized hazard.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-44 Log #336 NEC-P16 **Final Action: Accept in Part**
(800.24, 820.24, and 830.24)

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 16-99
Recommendation: Continue to reject proposals 16-99, 16-101, 16-165, 16-167, 16-224 & 16-226.
Substantiation: The Communications Cable and Connectivity Association agrees with Gerald Dorna's ballot statement:

"The submitter's assertion that communications cables need to be protected when installed other-then-parallel to framing members is totally unsubstantiated. Likewise the submitter's assertion that communications cables require support when installed behind accessible panels is not substantiated. Communications cables present minimal shock hazard and unlike electric power cables, they cannot initiate a fire. The uniqueness of communications circuits is recognized by 90.3 which exempts Chapter 8 from the general wiring requirements unless specifically referenced from Chapter 8. The submitter is trying to apply a uniform set of installation rules to power, communications and fiber optics without considering the inherent safety features of communications installations."
Panel Meeting Action: Accept in Part

Accept the recommendation for 800.24 (Proposals 16-99 and 16-101), and 820.24 (Proposals 16-165 and 16-167).

Reject the recommendation for 830.24 (Proposal 16-224 and 16-226).
Panel Statement: The panel took action on 830.24 to delete the reference to 300.4 because it is already contained in 830.3(E). See the panel action and statement on Comment 16-89.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 15 Negative: 2
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:

BISH, G.: I disagree with both the panel action and panel statement. I believe there should be a uniform set of installation requirements for cables referenced in 300.4.

OHDE, H.: We disagree with the panel action. We believe that the panel should have accepted Proposals 16-99, 16-101, 16-165, and 16- 167 on the ROP written ballot. We believe that there should be a uniform set of installation requirements for all cables as referenced in 300.4.

16-45 Log #539 NEC-P16 **Final Action: Accept**
(800.24)

Submitter: James E. Brunssen, Telecordia Technologies Inc. / Rep. Alliance for Telecommunications Industry Solutions (ATIS)
Comment on Proposal No: 16-99
Recommendation: Continue to reject this proposal per Correlating Committee action.
Substantiation: The Correlating Committee acted correctly in reporting this proposal as "Reject". The proposal received less that the required two-thirds affirmative vote as the submitter failed to adequately substantiate the proposal as required by the "Regulations Governing Committee Projects" Section 4-3.3(d). This was noted by a number of the Committee members in their "Explanation of Negative" vote. The proposed additional requirements are appropriate for power cables, not communications cables. Communications cables and wires are much smaller than power conductors (typically 26 AWG copper), are powered from a power-limited source of 100 volt-amperes, and pose neither a fire nor electrical safety hazard.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 3
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:

BISH, G.: See comment on Comment 16-44.

OHDE, H.: See our comment on Comment 16-44.

PIRKLE, W.: Submitter's comment only addressed additional installation requirements. Panel statement rejected comment on power and current, not on installation requirements.
Comment on Affirmative:

BRUNSSEN, J.: The Panel Action to accept is correct. The submitter of Proposal 16-99 has identified neither a fire nor electrical safety hazard to warrant expanding the requirements of 800.24. Communications wires and cables are typically smaller than power cables (26 AWG copper conductors), operate at power levels of 100 volt-amperes or less derived from a power-limited source, and pose neither a fire nor electrical safety hazard.

16-46 Log #540 NEC-P16 **Final Action: Accept**
(800.24)

Submitter: James E. Brunssen, Telecordia Technologies Inc. / Rep. Alliance for Telecommunications Industry Solutions (ATIS)
Comment on Proposal No: 16-101
Recommendation: Continue to reject this proposal per Correlating Committee action.
Substantiation: The Correlating Committee acted correctly in reporting this proposal as "Reject". The proposal received less that the required two-thirds affirmative vote as the submitter failed to adequately substantiate the proposal as required by the "Regulations Governing Committee Projects" Section 4-3.3(d). This was noted by a number of the Committee members in their "Explanation of Negative" vote. The proposed additional requirements are appropriate for power cables, not communications cables. Communications cables and wires are much smaller than power conductors (typically 26 AWG copper), are powered from a power-limited source of 100 volt-amperes, and pose neither a fire nor electrical safety hazard.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 3
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:

BISH, G.: See comment on Comment 16-44.

OHDE, H.: See our comment on Comment 16-44.

PIRKLE, W.: Submitter's comment only addressed additional installation requirements. Panel statement rejected comment on power and current, not on installation requirements.
Comment on Affirmative:

BRUNSSEN, J.: See my statement associated with my affirmative ballot on Comment 16-45 that also applies to Proposal 16-101.

16-47 Log #562 NEC-P16 **Final Action: Reject**
(800.24)

Note: When the ballot result does not confirm the TC action on a Proposal by a two-thirds affirmative vote, the Report on Proposals shall be published with a specific request for public comment on that Proposal. The Proposal is now being reconsidered by the TC as a public comment.
Submitter: David Clements, International Association of Electrical Inspectors
Comment on Proposal No: 16-99
Recommendation: Revise text to read as follows:

800.24 Mechanical Execution of Work.
Communications circuits and equipment shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be secured by hardware, including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform to 300.4 ~~(D)~~ <u>(A) through (G)</u> and 300.11.
Substantiation: In addition to the physical protection required in 300.4(D) regarding distance from parallel framing members, communication cable also needs to be protected when installed other-than-parallel to framing members such as perpendicular through bored holes and notches in wood framing, holes in metallic framing, in shallow grooves, under roof decking, etc. Cables also require support behind accessible panels.

The reference needs to be to 300.4(A) through (G) not just to (D).
Panel Meeting Action: Reject
Panel Statement: The submitter has identified neither a fire nor an electrical safety hazard to warrant expanding the requirements of 800.24. Communications wires and cables are typically smaller than power cables (26 AWG copper conductors), operate at power levels of 100 volt-amperes or less derived from a power-limited source, and pose neither a fire nor electrical safety hazard.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 13 Negative: 4
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:

BISH, G.: I disagree with both the panel action and panel statement and believe that the expansion of 300.4 to include (A) through (G) is appropriate.

CHAN, L.: Cables should be protected against physical damage by methods other than parallel to framing members and furring strips. As an inspector, I see all types of improper installed cables and 300.4 (A) through (G) gives the inspector more leverage when he performs an inspection.

OHDE, H.: We disagree with both the panel action and panel statement. We believe the submitter has done an excellent job explaining the need for the expansion of 300.4 to include 300.4 (A) through (G). The installer knows precisely how to install cable in accordance 300.4 (A) through (G). Consistent code rules is the key for well written code and enforceable code. We have one set installation rules for one cable but not the other.

PIRKLE, W.: Submitter's comment only addressed additional installation requirements. Panel statement rejected comment on power and current, not on installation requirements.

Comment on Affirmative:

BRUNSSEN, J.: See my statement associated with my affirmative ballot on Comment 16-45.

16-48 Log #568 NEC-P16 **Final Action: Reject**
(800.24)

Note: When the ballot result does not confirm the TC action on a Proposal by a two-thirds affirmative vote, the Report on Proposals shall be published with a specific request for public comment on that Proposal. The Proposal is now being reconsidered by the TC as a public comment.

Submitter: Marcus R. Sampson, Lysistrata Electric
Comment on Proposal No: 16-101
Recommendation: Revise text to read as follows:

800.24 Mechanical Execution of Work.
Communications circuits and equipment shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be secured by hardware, including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform to 300.4 ~~(D)~~ (A) through (G) and 300.11.

Substantiation: In addition to the physical protection required in 300.4(D) regarding distance from parallel framing members, communication cable also needs to be protected when installed other-than-parallel to framing members such as perpendicular through bored holes and notches in wood framing, holes in metallic framing, in shallow grooves, under roof decking, etc. Cables also require support behind accessible panels.

The reference needs to be to 300.4(A) through (G) not just to (D).

Panel Meeting Action: Reject
Panel Statement: Refer to panel action and statement on Comment 16-47, which addresses the same issue.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 13 Negative: 4
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:

BISH, G.: See comment on Comment 16-47.
CHAN, L.: See my explanation of negative vote on Comment 16-47.
OHDE, H.: See our comment on Comment 16-47.
PIRKLE, W.: Submitter's comment only addressed additional installation requirements. Panel statement rejected comment on power and current, not on installation requirements.

Comment on Affirmative:

BRUNSSEN, J.: See my statement associated with my affirmative ballot on Comment 16-46.

16-49 Log #907 NEC-P16 **Final Action: Reject**
(800.24)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 16-100
Recommendation: Revise text to read as follows:

800.24 Mechanical Execution of Work. Communications circuits and equipment shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be secured by hardware including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform with 300.4(D) and 300.11. See also 300.22. ~~Cable ties used to secure communications plenum cables in other space used for environmental air (plenums) shall be listed as having low smoke and heat release properties.~~

Substantiation: CMP 3 accepted the requirements for cable ties in plenums and incorporate the language on requirements into 300.22 (C)(1). The addition of the language on cable ties here could create conflicts, especially if the language approved in 300.22(C)(1) is different from the language here. I have made a comment to CMP3 to request that the language addressing "smoke and heat release characteristics" be used in 300.22(C)(1).

Panel Meeting Action: Reject
Panel Statement: The reference to 300.22 in the submitter's recommendation is too broad. The panel action on Comment 16-17 is more appropriate because it refers to cable ties and other nonmetallic cable accessories. This panel action also maintains correlation with CMP 3 action on Comment 3-24 that is in agreement with the Correlating Committee's direction to correlate Articles 300, 770, 800, 820 and 830 on the subject of cable ties.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-50 Log #1222 NEC-P16 **Final Action: Accept**
(800.24)

Submitter: Fred C. Dawson, E. I. Du Pont Canada Company / Rep. American Chemistry Council
Comment on Proposal No: 16-98
Recommendation: Continue to reject proposal 16-98.
Substantiation: The ACC supports the panel action. The proponent has not provided any data to support the recommendation.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-51 Log #1223 NEC-P16 **Final Action: Accept in Part**
(800.24, 820.24, and 830.24)

Submitter: Fred C. Dawson, E. I. Du Pont Canada Company / Rep. American Chemistry Council
Comment on Proposal No: 16-99
Recommendation: Continue to reject proposals 16-99, 16-101, 16-165, 16-167, 16-224, 16-226.
Substantiation: The ACC supports the panel action and agrees with comments from the panel members. Communications cables present minimal shock hazard and do not initiate fires. There is no reason for them to be protected or supported in the same manner as power cables.
Panel Meeting Action: Accept in Part

Accept the recommendation for 800.24 (Proposals 16-99 and 16-101), and 820.24 (Proposals 16-165 and 16-167).

Reject the recommendation for 830.24 (Proposal 16-224 and 16-226).

Panel Statement: The panel took action on 830.24 to delete the reference to 300.4 because it is already contained in 830.3(E). See the panel action and statement on Comment 16-89.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 15 Negative: 2
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:

BISH, G.: See comment on Comment 16-44.
OHDE, H.: See our comment on Comment 16-44.

16-52 Log #1067 NEC-P16 **Final Action: Reject**
(800.49 (New))

Submitter: Michael J. Johnston, National Electrical Contractors Association
Comment on Proposal No: 16-104
Recommendation: Continue to accept the proposal in principle and revise as follows:

800.49 Metallic Entrance ~~Conduit~~ Raceway Grounding. ~~Rigid metal conduit (RMC) or intermediate metal conduit (IMC)~~ Metallic raceways containing communications entrance wire or cable shall be connected by a bonding conductor or grounding electrode conductor to a grounding electrode in accordance with 800.100(B).

Substantiation: The proposal only provides a requirement for grounding RMC and IMC. There appear to be other metallic raceways that would also require grounding such as metallic wireways, EMT, FMC, LFMC and so forth, if those raceways are suitable for enclosing communications service entrance cables. The last sentence of Section 800.50(B) appears to indicate that metal conduits or other metal raceways could be installed for service-entrance communications wire or cables. The comment intends to build on the concepts introduced in the proposal and provides the same proposed grounding requirements for all metallic raceways installed for service entrance communications cable or wire. Note: For correlation, the same change should be made to proposals 16-46, 16-176, 16-234, 16-280.

Panel Meeting Action: Reject
Panel Statement: Metallic entrance conduit for communications entrance wire and cable is restricted to rigid metal conduit (RMC) or intermediate metal conduit (IMC). The point of entrance is so defined in 800.2 (see Proposal 16-88). The section identified by the submitter [800.50(B)] as appearing to indicate that metal conduits or other metal raceways could be installed for service-entrance communications wire or cables is incorrect. Section 800.50(B) addresses possible contact with electrical conductors and does not address entrance conduit.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-53 Log #1041 NEC-P16 **Final Action: Reject**
(800.100(B)(2)(3))

Submitter: Mike Holt, Mike Holt Enterprises
Comment on Proposal No: 16-110
Recommendation: Remove item (3) in its entirety.
Substantiation: 800.100(B)(2) tells me what do when I have no intersystem bonding terminal. Item 3 tells me that using the intersystem bonding terminal is an option if I don't have an intersystem bonding terminal. This is circular logic.
Panel Meeting Action: Reject
Panel Statement: An intersystem bonding terminal (IBT) may not exist; but one can be established and if the IBT is established by the user, then the rules in 250.94 must be followed as referenced in 800.100(B)(2)(3). For example, a telecommunications technician can use a meter-box clamp listed as an IBT to create a bonding connection.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-54 Log #217 NEC-P16 **Final Action: Accept**
(800.110)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 16-116
Recommendation: The Correlating Committee directs the action on this proposal be rewritten to comply with 3.2.1 of the NEC Style Manual.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the correlating committee's direction to rewrite this paragraph. Refer to the panel action on Comment 16-56.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-55 Log #337 NEC-P16 **Final Action: Accept**
(800.110(C)(2), 820.110(C)(2), and 830.110(C)(2))

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 16-116
Recommendation: Revise text to read as follows:
(2) Vertical Support. Vertical runs of cable routing assemblies shall be ~~securely~~ supported at intervals not exceeding 1.2 m (4 ft), unless listed for other support intervals, and shall not have more than one joint between supports.
Substantiation: The Correlating Committee directed that the action on proposals 16-116 be rewritten to comply with 3.2.1 of the NEC Style Manual. "Securely" is on the list in Table 3.2.1, Possibly Unenforceable and Vague Terms. Actions on proposals 16-57, 191 and 245 adopted identical text to the action on proposal 16-116.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 16 Negative: 1
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:
OHDE, H.: We disagree with the panel action and believe that is should be Accept in Part. The deletion of the word "securely" in this case really is not a vague term but describes an action that will be required for the installer to securely support the cable routing assemblies as opposed to just supporting the cable routing assemblies. The deletion of the word "securely" provides no guidance and is now code rule is very generic.

16-56 Log #993 NEC-P16 **Final Action: Accept**
(800.110(C)(2), 820.110(C)(2), and 830.110(C)(2))

Submitter: Robert W. Jensen, dbi-Telecommunication Infrastructure Design
Comment on Proposal No: 16-116
Recommendation: Revise text to read as follows:
(2) Vertical Support. Vertical runs of cable routing assemblies shall be ~~securely~~ supported at intervals not exceeding 1.2 m (4 ft), unless listed for other support intervals, and shall not have more than one joint between supports.
Substantiation: The Correlating Committee directed that the action on proposals 16-116 be rewritten to comply with 3.2.1 of the NEC Style Manual. "Securely" is on the list in Table 3.2.1, Possibly Unenforceable and Vague Terms. Actions on proposals 16-57, 191 and 245 adopted identical text to the action on proposal 16-116.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 16 Negative: 1
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:
OHDE, H.: See our comment on Comment 16-55.

16-57 Log #882 NEC-P16 **Final Action: Accept**
(800.110(C)(3))

Submitter: Terry Peters, The Society of the Plastics Industry
Comment on Proposal No: 16-122
Recommendation: Continue to reject proposal 16-122.
Substantiation: The submitter's recommendation to prohibit the installation of plenum cables in plenum raceways is absurd. Plenum raceways are designed to be used with plenum cables. The Society of the Plastics Industry supports the panel action to reject this proposal.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-58 Log #338 NEC-P16 **Final Action: Hold**
(800.113(E))

TCC Action: The Correlating Committee directs that this panel action on this Comment be reported as "Hold" based on 4.4.4.6.2 of the NFPA Regulations Governing Committee Projects since the information accepted in this comment, to add an informational note, is new material that has not had public review.
Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 16-119
Recommendation: Revise text to read as follows:
Informational Note <u>No.1</u>: See 800.26 for firestop requirements for floor penetrations.
<u>Informational Note No. 2: See 800.12 for information on using communications raceways as innerduct.</u>
Substantiation: The new informational note adds clarity by guiding the reader to new section 800.12 which permits communications raceways to be used as innerduct in any type of Chapter 3 raceway.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 16 Negative: 1
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:
OHDE, H.: We disagree with the panel's action and believe that additional Information Note No. 2 is new material. In addition, the submitter's substantiation does not add clarity by guiding the reader to 800.12 but adds confusion. Too many informational notes defeat the true purpose of Informational Note. We believe the reader and the installer should have some knowledge of how to read and interpret the code.

16-59 Log #410 NEC-P16 **Final Action: Accept in Principle**
(800.133)

Submitter: Stanley Kaufman, CableSafe Inc.
Comment on Proposal No: 16-124
Recommendation: Revise text to read:
800.133 Installation of Communications Wires, Cables, and Equipment. Communications wires and cables from the protector to the equipment or, where no protector is required, communications wires and cables attached to the outside or inside of the building shall comply with 800.133(A) through (~~C~~<u>B</u>).
Substantiation: CMP 16 accepted proposal 16-170 for the 2011 NEC. The proposal recommended moving 800.133(C) to 800.3(E). At that time the initial sentence in 800.133 should have been revised to recognize that 800.133(C) no longer existed. This comment fixes that error.
Panel Meeting Action: Accept in Principle
Change the word "through" to "and" at the end of the recommendation.
Panel Statement: The change is made as an editorial correction.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-60 Log #693 NEC-P16 **Final Action: Accept**
(800.133(A)(1)(b))

Submitter: George Bish, Secure Watch Security
Comment on Proposal No: 16-125
Recommendation: Continue to Accept this proposal.
Substantiation: Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with Parts I and III of Article 725 and power-limited fire alarm systems in compliance with Parts I and III of Article 760 are presently permitted in the same raceway, cable tray or enclosure with communications circuits. It is therefore logical that they also be permitted to occupy the same cable routing assembly.
Continued acceptance of this proposal is in keeping with the Correlating Committee's directive to correlate the Panel Actions regarding cable routing assemblies throughout Articles 725, 760, 770, and Chapter 8
This is one of a group of comments developed by the CMP3/CMP16 Joint

Task Group formed at the direction of the Correlating Committee to locate a correlated definition of Cable Routing Assemblies in a single Article of Chapter 8 for use in Article 725, 760, 770, and Chapter 8.

The Task Group members were:

George Bish, Chair, representing Satellite Broadcasting & Communication Association

Harry Ohde, representing IBEW

James Brunssen, representing Alliance for Telecommunications Industry Solutions

George Straniero, representing National Electrical Manufacturers Association

Robert Walsh, representing International Association of Electrical Inspectors

Wendell Whistler, representing Intertek Testing Services

Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-61 Log #522 NEC-P16 **Final Action: Reject**
(Table 800.154(a))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 16-131
Recommendation: Table 800.154(a) Applications of Listed Communications Wires and Cables in Buildings [ROP 16–131, ROP 16–105, ROP 16–106]
Column heading: Hybrid power and Communications cables
Column heading: Communications wires
Substantiation: The headings smear together. Hyphenate and break communications. <nl> means new line.
Panel Meeting Action: Reject
Panel Statement: The proposed change is not needed because Table 800.154(a) in the committee action on Proposal 16-131 is correct as shown. In addition, the text of the recommendation appears to introduce hyphens which are not intended.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.
Comment on Affirmative:
DORNA, G.: This comment appears to be based on the ROP draft.

16-62 Log #523 NEC-P16 **Final Action: Reject**
(Table 800.154(b))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 16-131
Recommendation: Table 800.154(b) Applications of Listed Communications Raceways in Buildings [ROP 16–131]
Column heading: Plenum communications raceways
Column heading: Riser communications raceways
Substantiation: The headings smear together. Hyphenate and break communications. <nl> means new line.
Panel Meeting Action: Reject
Panel Statement: No change is needed. Refer to the panel action and statement on Comment 16-61, which addressed the same type of issue on Table 800.154(a).
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.
Comment on Affirmative:
DORNA, G.: This comment appears to be based on the ROP draft.

16-63 Log #524 NEC-P16 **Final Action: Reject**
(Table 800.154(c))

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 16-131
Recommendation: Table 800.154(c) Applications of Listed Cable Routing Assemblies in Buildings [ROP 16–131]
Column heading: General-purpose Cable Routing Assembly
Substantiation: The headings smear together. Hyphenate and break general-purpose. <nl> means new line.
Panel Meeting Action: Reject
Panel Statement: No change is needed. Refer to the panel action and statement on Comment 16-61 that addressed the same type of issue on Table 800.154(a).
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.
Comment on Affirmative:
DORNA, G.: This comment appears to be based on the ROP draft.

16-64 Log #579 NEC-P16 **Final Action: Hold**
(800.170, Informational Note)

TCC Action: The Correlating Committee directs that this panel action on this Comment be reported as "Hold" based on 4.4.4.6.2 of the NFPA Regulations Governing Committee Projects since the information accepted in this comment, to add an informational note, is new material that has not had public review.
Submitter: Thomas M. Burke, UL LLC
Comment on Proposal No: 16-134
Recommendation: Revise the Informational Note for 800.170 to add a reference to new standard UL 62368-1. Also, update the reference to UL 60950-1 to the latest edition.

Informational Note: One way to determine applicable requirements is to refer to UL 60950-1-200~~3~~ 7, *Standard for Safety of Information Technology Equipment*; UL 1459-1999, *Standard for Safety, Telephone Equipment*; ~~or~~ UL 1863-2004, *Standard for Safety, Communications Circuit Accessories*; or UL 62368-1-2012, *Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements.* For information on listing requirements for cable routing assemblies and communications raceways, see UL 2024-2011, *Standard for Optical Fiber and Communication Cable Raceways and Cable Routing Assemblies*.
Substantiation: This is one in a series of proposals to update NFPA 70 to add a reference to UL 62368-1.

ANSI/UL 62368-1, Audio/video, information and communication technology equipment – Part 1: Safety requirements, was published on February 17, 2012. This new standard will eventually replace (later this decade) both, UL 60065, Audio, Video, and Similar Electronic Apparatus-Safety Requirements, and UL 60950-1, Information Technology Equipment Safety - Part 1: General Requirements. In the meantime, multiple references to UL 60950-1 in the body of the Code should be supplemented by a reference to UL 62368-1 since similar equipment complying with, and Listed to both standards will be installed per the Code. In fact, equipment already is being Listed to UL 62368-1.

Additionally, UL 60950-1-2007 is the latest edition of that standard.
Panel Meeting Action: Accept in Principle
Accept the recommendation but revise title of UL 2024 to reflect "Communications", plural.
Panel Statement: The panel accepts the additional text in the informational note and has made a correction to the title of UL 2024.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-65 Log #694 NEC-P16 **Final Action: Accept**
(800.179(G))

Submitter: George Bish, Secure Watch Security
Comment on Proposal No: 16-137
Recommendation: Continue to Accept in Principle.
Substantiation: Continued Acceptance in Principle correlates with the CMP3/CMP16 Joint Task Group recommendation on Proposal 16-85a

This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to correlate the Panel Action on Proposals 16-26a, 16-79, 16-85a, 16-137, 3-165, 3-208, and 3-210

The Task Group members were:

George Bish, Chair, representing Satellite Broadcasting & Communication Association

Harry Ohde, representing IBEW

James Brunssen, representing Alliance for Telecommunications Industry Solutions

George Straniero, representing National Electrical Manufacturers Association

Robert Walsh, representing International Association of Electrical Inspectors

Wendell Whistler, representing Intertek Testing Services

Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

ARTICLE 810 — RADIO AND TELEVISION EQUIPMENT

16-66 Log #218 NEC-P16 **Final Action: Accept**
(810.1)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 16-141
Recommendation: The Correlating Committee advises that Article Scope statements are the responsibility of the Correlating Committee and the Correlating Committee Rejects the panel action.

The Correlating Committee further directs that consideration be given to the comments expressed in the voting.
Substantiation: This is a direction from the National Electrical Code Technical

Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the direction to reconsider the comments expressed in voting. Refer to the panel action on Comment 16-68.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-67 Log #541 NEC-P16 **Final Action: Accept in Principle**
(810.1)

Submitter: James E. Brunssen, Telecordia Technologies Inc. / Rep. Alliance for Telecommunications Industry Solutions (ATIS)
Comment on Proposal No: 16-141
Recommendation: Continue to reject this proposal per Correlating Committee action.
Substantiation: The Correlating Committee acted correctly in rejecting the panel action. The submitter failed to adequately substantiate the proposal as required by the "Regulations Governing Committee Projects" Section 4-3.3(d). This was noted by a number of the Committee members in their "Explanation of Negative" vote. The submitter's statement that "…flat or parabolic antennas 1 m (39.37 in) or less in diameter or across and their associated coaxial cabling are better suited …" to Article 840 is an opinionative statement that is technically unsupported.
Panel Meeting Action: Accept in Principle
Panel Statement: Refer to the panel action on Comment 16-68, which meets the intent of the submitter.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-68 Log #1100 NEC-P16 **Final Action: Accept**
(810.1)

TCC Action: The Correlating Committee advises that article scope statements are the responsibility of the Correlating Committee and the Correlating Committee Accepts the panel action.
Submitter: Randy Ivans, Underwriters Laboratories Inc.
Comment on Proposal No: 16-141
Recommendation: Newly added text from the proposal "exceeding 1 m (39.37 in) in diameter or across" should be deleted.

This article covers antenna systems for radio and television receiving equipment, amateur and citizen band radio transmitting and receiving equipment, and certain features of transmitter safety. This article covers antennas such as wire-strung type, multi-element, vertical rod, flat, ~~and~~ or ~~dish~~ parabolic ~~exceeding 1 m (39.37 in) in diameter or across~~ and also covers the wiring and cabling that connects them to equipment. This article does not cover equipment and antennas used for coupling carrier current to power line conductors.

Substantiation: This proposal should be "Accepted In Part". Including flat antennas and correcting the term "dish" to "parabolic" should be accepted. However, there is no technical substantiation provided why parabolic antennas 1 m or less in diameter should be excluded from Article 810 or why these should be treated differently than parabolic antennas greater than 1 m in diameter. They are all subject to lightning transients. In addition, although Article 840 covers premises powered broadband systems that deliver broadband services that an antenna might provide, the requirements were specifically developed to cover only fiber to the premises systems where there is no metallic wiring or cable members conductively connected to cabling or devices outside of the building. In order for small parabolic antennas to be included in article 840, appropriate requirements would need to be developed to cover outside cabling and antennas that may be subject to lightning transients. Finally, installation criteria and requirements would need to be developed that somehow differentiate these small parabolic antennas from other antenna systems still covered under article 810.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-69 Log #1531 NEC-P16 **Final Action: Accept in Part**
(810.1 Scope)

TCC Action: The Correlating Committee advises that article scope statements are the responsibility of the Correlating Committee and the Correlating Committee Accepts the panel action.
Submitter: David M. Lettkeman, DISH
Comment on Proposal No: 16-141
Recommendation: Revise text to read as follows:
This article covers antenna systems for radio and television receiving equipment, amateur and citizen band radio transmitting and receiving equipment, and certain features of transmitter safety. This article covers antennas such as wire-strung type, multi-element, vertical rod, flat, ~~and~~ or a ~~dish~~ parabolic exceeding 1 m (39.37 in) in diameter or across and also covers the wiring and cabling that connects them to equipment. This article does not cover equipment and antennas used for coupling carrier current to power line conductors.
Substantiation: When grounded in accordance with this article small parabolic antennas could become, by simple definition, lightning rods. As they are not installed to the standards for lightning rods they pose a proven hazard to life and property. Many instances of injury and property damages can be directly attributed to grounding these antennas and providing a path for a surge to seek out this path to ground. Each year millions of dollars are spent to repair damages caused by such surges seeking out the ground mandated in this article. While recognizing the inherent danger from lightning and other possible high voltage surges, when there is no ground to the antenna the surge has no path to take. Most of these antenna installations are not mounted in high exposure situations which make them unlikely to become energized. Small parabolic antennas generally for personal use are defined by FCC 47CFR1.4000 as a dish which is less than one meter (39.37") or less in diameter. More than 50 million small parabolic antennas have been installed in the US alone with minimal substantiated cases of injury or damage when the installations were not grounded in accordance with Article 810. For over 25 years these antennas have a proven safety record when not connected to ground in accordance with Article 810 of the code.

Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Accept in Part
Panel Statement: Refer to the panel action on Comment 16-68. The panel accepts the change adding the words "flat" and "parabolic" and rejects the remainder of the recommendation. The requirements of Article 810 need to include all parabolic antennas. The rejected part would leave smaller parabolic antennas uncovered.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-70 Log #1532 NEC-P16 **Final Action: Reject**
(810.1 Exception)

Submitter: David M. Lettkeman, DISH
Comment on Proposal No: 16-141
Recommendation: Add text to read:

Exception: Parabolic antennas 1 m (39.37 in) or less in diameter or across, for personal use.

Substantiation: When grounded in accordance Article 810 small parabolic antennas may become, by simple definition, lightning rods. As they are not installed to the standards for lightning rods they pose a proven hazard to life and property.

Many instances of injury and property damages can be directly attributed to grounding these antennas and providing a path for a surge to seek out this path to ground. Each year millions of dollars are spent to repair damages caused by such surges seeking out the ground mandated in this article. While recognizing the inherent danger from lightning and other possible high voltage surges, when there is no ground to the antenna the surge has no path. Most of these antenna installations are not mounted in high exposure situations which make them unlikely to become energized. Small parabolic antennas generally for personal use as defined by the FCC 47CFR1.4000 as a dish which is one meter (39.37") or less in diameter. More than 50 million small parabolic antennas have been installed in the US alone with minimal substantiated cases of injury or damage when the installations were not grounded in accordance with Article 810. For over 25 years these antennas have a proven safety record when not connected to ground in accordance with Article 810 of the code. With this proven safety record parabolic antennas for personal use should be exempted from this Article.

Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: Refer to the panel action on Comment 16-69, which addresses the same issue.

The addition of this exception to the scope of the article is considered as new material.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-71 Log #219 NEC-P16 **Final Action: Accept**
(810.3)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 16-143
Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the Correlating Committee action taken on Proposal 16-141.

It was the further action of the Correlating Committee that further consideration be given to the comments expressed in the voting.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the Correlating Committee direction to

reconsider and the action taken on Comment 16-72 resolves the concern.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-72 Log #542 NEC-P16 **Final Action: Accept**
(810.3)

Submitter: James E. Brunssen, Telecordia Technologies Inc. / Rep. Alliance for Telecommunications Industry Solutions (ATIS)
Comment on Proposal No: 16-143
Recommendation: Reject this proposal.
Substantiation: The Panel Action on this proposal was based upon the Panel Action on Proposals 16-141, -259 and -260 which the Correlating Committee rejected. Hence, parabolic (dish) antennas will not be covered in Article 840 and the proposed revision to 810.3 is inappropriate and unnecessary. Additionally, the Proposal should be rejected based upon the comments expressed in the voting.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-73 Log #1101 NEC-P16 **Final Action: Accept**
(810.3)

Submitter: Randy Ivans, Underwriters Laboratories Inc.
Comment on Proposal No: 16-143
Recommendation: Newly added text from the proposal should be deleted and the paragraph returned to the original wording.

810.3 Other Articles. Wiring from the source of power to and between devices connected to the interior wiring system shall comply with Chapters I through 4 other than as modified by Parts I and II of Article 640. Wiring for audio signal processing, amplification, and reproduction equipment shall comply with Article 640. ~~For antennas exceeding 1m 139.37 in) in diameter or across c~~Coaxial cables that connect antennas to equipment shall comply with Article 820. ~~For antennas 1m (39.37 in) or less in diameter or across, coaxial cables that connect antennas to equipment shall comply with Article 840.~~
Substantiation: This proposal should be Rejected. There is no technical substantiation provided why parabolic antennas 1 m or less in diameter should be excluded from the requirements in Article 810 or why these should be treated differently than parabolic antennas greater than 1 m in diameter. They are all subject to lightning transients. It is not appropriate for any antennas to be installed in accordance with article 820 as a blanket requirement. For example, 820.93 (C) describes the use of a listed primary protector. This type of protector is not appropriate for antenna systems which, when protectors are used, would require an antenna lead-in protector specifically designed for antenna systems with surge current ratings.

In addition, although Article 840 covers premises powered broadband systems that deliver broadband services that an antenna might provide, the requirements were specifically developed to cover only fiber to the premises systems where there is no metallic wiring or cable members conductively connected to cabling or devices outside of the building. In order for small parabolic antennas to be included in article 840, appropriate requirements would need to be developed to cover outside cabling and antennas that may be subject to lightning transients. Finally, installation criteria and requirements would need to be developed that somehow differentiate these small parabolic antennas from other antenna systems still covered under article 810.
Panel Meeting Action: Accept
Panel Statement: The panel advises that the revisions made in the recommendation return the text to that of the 2011 NEC. This action agrees with that on Comment 16-72.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-74 Log #220 NEC-P16 **Final Action: Accept**
(810.6 (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 16-144
Recommendation: The Correlating Committee directs that the panel clarify the panel action on this proposal by revising the last sentence of the requirement to use proper terminology such as "bonding conductor" or "grounding electrode conductor."
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise the last sentence of 810.6 (New) as follows:

The antenna lead-in protector shall be grounded using a bonding conductor or grounding electrode conductor installed in accordance with 810.21(F).
Panel Statement: The panel accepts the direction of the Correlating Committee. The panel has clarified the panel action on this proposal by adding the terms "bonding conductor" and "grounding electrode conductor", as well as identifying the appropriate reference within 810.21.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

ARTICLE 820 — COMMUNITY ANTENNA TELEVISION AND RADIO DISTRIBUTION SYSTEMS

16-75 Log #221 NEC-P16 **Final Action: Accept**
(820.3(B) and 820.3(C) (New))

TCC Action: The Correlating Committee directs that the text of (J) be revised as follows:
"(J) Cable Routing Assemblies. The definition in Article 100, the applications in Table 800.154(c), and installation rules in 800.110 and 800.113 shall apply to Article 820."
See the Correlating Committee action on Comment 16-5 that relocated the definition of cable routing assembly to Article 100.
Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 16-161
Recommendation: The Correlating Committee directs the panel to reconsider and clarify the action on this proposal.

The Correlating Committee notes that the order of sections noted in the panel statement does not correspond with the titles of all of the available subdivisions within 820.3.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Revise 820.3 to read as follows:
820.3 Other Articles. Circuits and equipment shall comply with 820.3(A) through (J).
(A) Hazardous (Classified) Locations. CATV equipment installed in a location that is classified in accordance with 500.5 and 505.5 shall comply with the applicable requirements of Chapter 5.
(B) Wiring in Ducts for Dust, Loose Stock, or Vapor Removal. The requirements of 300.22(A) shall apply.
(C) Equipment in Other Space Used for Environmental Air. The requirements of 300.22(C)(3) shall apply.
(D) Installation and Use. The requirements of 110.3 shall apply.
(E) Installations of Conductive and Nonconductive Optical Fiber Cables. The requirements of Article 770 shall apply.
(F) Communications Circuits. The requirements of Article 800 shall apply.
(G) Network-Powered Broadband Communications Systems. The requirements of Article 830 shall apply.
(H) Premises-Powered Broadband Communications Systems. The requirements of Article 840 shall apply.
(I) Alternate Wiring Methods. The wiring methods of Article 830 shall be permitted to substitute for the wiring methods of Article 820.

Informational Note: Use of Article 830 wiring methods will facilitate the upgrading of Article 820 installations to network-powered broadband applications.
(J) Cable Routing Assemblies. The definition in 800.2, the applications in Table 800.154(c), and installation rules in 800.110 and 800.113 shall apply to Article 820.
Panel Statement: The panel accepts direction of the Correlating Committee and has provided the entire text of 820.3 for correlation with the actions on Proposal 16-161, 16-162 and 16-163. The panel notes the list of items in the panel statements of these proposals were incorrect and the panel action of this comment is shown correctly.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-76 Log #695 NEC-P16 **Final Action: Accept**
(820.3(H))

TCC Action: See Correlating Committee action on Comment 16-75.
Submitter: George Bish, Secure Watch Security
Comment on Proposal No: 16-163
Recommendation: Continue to Accept in Principle this proposal.
Substantiation: The Continued Acceptance in Principle of this proposal is appropriate as the definition "Cable Routing Assembly" now resides in 800.2, the listing requirements are contained in 800.182 and the applications are contained in Table 800.154(c).

Continued Acceptance in Principle of this proposal is also in keeping with the Correlating Committee's directive to correlate the Panel Actions regarding cable routing assemblies throughout Articles 725, 760, 770, and Chapter 8

This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to locate a correlated definition of Cable Routing Assemblies in a single Article of Chapter 8 for use in Article 725, 760, 770, and Chapter 8.

The Task Group members were:
George Bish, Chair, representing Satellite Broadcasting & Communication Association
Harry Ohde, representing IBEW
James Brunssen, representing Alliance for Telecommunications Industry Solutions
George Straniero, representing National Electrical Manufacturers Association
Robert Walsh, representing International Association of Electrical Inspectors
Wendell Whistler, representing Intertek Testing Services
Panel Meeting Action: Accept
Panel Statement: The panel notes that the panel action on Proposal 16-163 is reflected in the panel action on Comment 16-75 as item (J).
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-77 Log #543 NEC-P16 **Final Action: Accept**
(820.24)

Submitter: James E. Brunssen, Telecordia Technologies Inc. / Rep. Alliance for Telecommunications Industry Solutions (ATIS)
Comment on Proposal No: 16-165
Recommendation: Continue to reject this proposal per Correlating Committee action.
Substantiation: The Correlating Committee acted correctly in reporting this proposal as "Reject". The proposal received less that the required two-thirds affirmative vote as the submitter failed to adequately substantiate the proposal as required by the "Regulations Governing Committee Projects" Section 4-3.3(d). This was noted by a number of the Committee members in their "Explanation of Negative" vote. The proposed additional requirements are appropriate for power cables, not coaxial cables. Coaxial cables are much smaller than power cables (typically ¼ inch in diameter), contain no power and hence, pose neither a fire nor electrical safety hazard.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 3
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:
BISH, G.: See comment on Comment 16-44.
OHDE, H.: See our comment on Comment 16-44.
PIRKLE, W.: Submitter's comment only addressed additional installation requirements. Panel statement rejected comment on power and current, not on installation requirements.
Comment on Affirmative:
BRUNSSEN, J.: The Panel Action to accept is correct. The submitter of Proposal 16-165 has identified neither a fire nor electrical safety hazard to warrant expanding the requirements of 820.24. Coaxial cables are typically smaller than power cables, operate at very small signal voltages (i.e., they contain no appreciable power), and pose neither a fire nor electrical safety hazard.

16-78 Log #544 NEC-P16 **Final Action: Accept**
(820.24)

Submitter: James E. Brunssen, Telecordia Technologies Inc. / Rep. Alliance for Telecommunications Industry Solutions (ATIS)
Comment on Proposal No: 16-167
Recommendation: Continue to reject this proposal per Correlating Committee action.
Substantiation: The Correlating Committee acted correctly in reporting this proposal as "Reject". The proposal received less that the required two-thirds affirmative vote as the submitter failed to adequately substantiate the proposal as required by the "Regulations Governing Committee Projects" Section 4-3.3(d). This was noted by a number of the Committee members in their "Explanation of Negative" vote. The proposed additional requirements are appropriate for power cables, not coaxial cables. Coaxial cables are much smaller than power cables (typically ¼ inch in diameter), contain no power and hence, pose neither a fire nor electrical safety hazard.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 3
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:
BISH, G.: See comment on Comment 16-44.
OHDE, H.: See our comment on Comment 16-44.
PIRKLE, W.: Submitter's comment only addressed additional installation requirements. Panel statement rejected comment on power and current, not on installation requirements.
Comment on Affirmative:
BRUNSSEN, J.: See my statement associated with my affirmative ballot on Comment 16-77 that also applies to Proposal 16-167.

16-79 Log #563 NEC-P16 **Final Action: Reject**
(820.24)

Note: When the ballot result does not confirm the TC action on a Proposal by a two-thirds affirmative vote, the Report on Proposals shall be published with a specific request for public comment on that Proposal. The Proposal is now being reconsidered by the TC as a public comment.
Submitter: David Clements, International Association of Electrical Inspectors
Comment on Proposal No: 16-165
Recommendation: Revise text to read as follows:
820.24 Mechanical Execution of Work.
Community television and radio distribution systems shall be installed in a neat and workmanlike manner. Coaxial cables installed exposed on the surface of ceiling and sidewalls shall be supported by the building structure in such a manner that the cables will not be damaged by normal building use. Such cables shall be secured by hardware including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform to 300.4 ~~(D)~~ <u>(A) through (G)</u> and 300.11.
Substantiation: In addition to the physical protection required in 300.4(D) regarding distance from parallel framing members, community television and radio cable also needs to be protected when installed other-than-parallel to framing members such as perpendicular through bored holes and notches in wood framing, holes in metallic framing, in shallow grooves, under roof decking, etc. Cables also require support behind accessible panels.
The reference needs to be to 300.4(A) through (G) not just to (D).
Panel Meeting Action: Reject
Panel Statement: The submitter has identified neither a fire nor an electrical safety hazard to warrant expanding the requirements of 820.24. Coaxial cables used in 820 operate in a power-limited environment with a much lower electrical hazard than electrical branch circuits requiring compliance with 300.4 A-G. Also refer to the panel action and statement on Comment 16-47.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 13 Negative: 4
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:
BISH, G.: See comment on Comment 16-47.
CHAN, L.: Coaxial cables should be protected against physical damage by methods other than parallel to framing members and furring strips. As an inspector, I see all types of improper installed cables and 300.4 (A) through (G) gives the inspector more leverage when he performs an inspection.
OHDE, H.: See our comment on Comment 16-47.
PIRKLE, W.: Submitter's comment only addressed additional installation requirements. Panel statement rejected comment on power and current, not on installation requirements.
Comment on Affirmative:
BRUNSSEN, J.: See my statement associated with my affirmative ballot on Comment 16-77.

16-80 Log #567 NEC-P16 **Final Action: Reject**
(820.24)

Note: When the ballot result does not confirm the TC action on a Proposal by a two-thirds affirmative vote, the Report on Proposals shall be published with a specific request for public comment on that Proposal. The Proposal is now being reconsidered by the TC as a public comment.
Submitter: Marcus R. Sampson, Lysistrata Electric
Comment on Proposal No: 16-167
Recommendation: Revise text to read as follows:
820.24 Mechanical Execution of Work.
Community television and radio distribution systems shall be installed in a neat and workmanlike manner. Coaxial cables installed exposed on the surface of ceiling and sidewalls shall be supported by the building structure in such a manner that the cables will not be damaged by normal building use. Such cables shall be secured by hardware including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform to 300.4 ~~(D)~~ <u>(A) through (G)</u> and 300.11.
Substantiation: In addition to the physical protection required in 300.4(D) regarding distance from parallel framing members, community television and radio cable also needs to be protected when installed other-than-parallel, to framing members such as perpendicular through bored holes and notches in wood framing, holes in metallic framing, in shallow grooves, under roof decking, etc. Cables also require support behind accessible panels.
The reference needs to be to 300.4(A) through (G) not just to (D).
Panel Meeting Action: Reject
Panel Statement: Refer to the panel action and statement on Comment 16-79, which is the same issue.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 3
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:
BISH, G.: See comment on Comment 16-47.

CHAN, L.: See my explanation of negative vote on Comment 16-79.
OHDE, H.: See our comment on Comment 16-47.
Comment on Affirmative:
BRUNSSEN, J.: See my statement associated with my affirmative ballot on Comment 16-78.

16-81 Log #908 NEC-P16 **Final Action: Reject**
(820.24)

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 16-166
Recommendation: Revise text to read as follows:
820.24 Mechanical Execution of Work. Community television and radio distribution systems shall be installed in a neat and workmanlike manner. Coaxial cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be secured by hardware including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform with 300.4(D) and 300.11. <u>See also 300.22.</u> ~~Cable ties used to secure coaxial plenum cables in other space used for environmental air (plenums) shall be listed as having low smoke and heat release properties.~~
Substantiation: CMP 3 accepted the requirements for cable ties in plenums and incorporate the language on requirements into 300.22 (C)(1). The addition of the language on cable ties here could create conflicts, especially if the language approved in 300.22(C)(1) is different from the language here. I have made a comment to CMP3 to request that the language addressing "smoke and heat release characteristics" be used in 300.22(C)(1).
Panel Meeting Action: Reject
Panel Statement: The reference to 300.22 in the submitter's recommendation is too broad. The panel action on Comment 16-17 is more appropriate because it refers to cable ties and other nonmetallic cable accessories. This panel action also maintains correlation with CMP 3 action on Comment 3-24 that is in agreement with the Correlating Committee's direction to correlate Articles 300, 770, 800, 820 and 830 on the subject of cable ties.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-82 Log #1533 NEC-P16 **Final Action: Reject**
(820.100 Exception)

Submitter: David M. Lettkeman, DISH
Comment on Proposal No: 16-181
Recommendation: Add text to read:
Exception: For communications systems using coaxial cable ~~confined~~ <u>attached to or</u> within <u>a single building on</u> the premises and isolated from outside cable plant, the shield shall be permitted to be grounded by a connection to an equipment grounding conductor as described in 250.118. Connecting to an equipment grounding conductor through a grounded receptacle using a dedicated <u>bonding jumper or equipment</u> grounding conductor and permanently connected listed device shall be permitted. Use of a cord and plug for the connection to an equipment grounding conductor shall not be permitted.
Substantiation: Substantiation from 16-181: The term "grounding conductor" in this section should be changed to correlate with the other changes that were made.
While supporting proposal 16-181 there needs to be further clarification limiting the use of this type of connection. By adding the limitation of allowing this type of connection to a single building on the premises will help clarify its use.
Note: Supporting material is available for review at NFPA Headquarters.
Panel Meeting Action: Reject
Panel Statement: The panel, in accepting in principle proposal 16-181, intended to permit coaxial cable that is entirely confined within the building or structure (premises) to be grounded within the building or structure to an equipment grounding conductor. Such coaxial cable is considered unexposed to contact with power of 300 volts or greater and lightning. The submitter's suggested revision extends this permission to coaxial cable located on the exterior of the building or structure that is potentially exposed to power contact and lighting events. Such exposure can bring power or lightning currents within the building or structure, creating and electrical shock or fire hazard. Additionally, the phrase "or equipment grounding conductor" in the second sentence is incorrect as the panel has previously identified "bonding jumper" as the correct terminology.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-83 Log #883 NEC-P16 **Final Action: Accept**
(820.113(C)(3))

Submitter: Terry Peters, The Society of the Plastics Industry
Comment on Proposal No: 16-198
Recommendation: Continue to reject proposal 16-198.
Substantiation: The submitter's recommendation to prohibit the installation of plenum cables in plenum raceways is absurd. Plenum raceways are designed to be used with plenum cables. The Society of the Plastics Industry supports the panel action to reject this proposal.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-84 Log #339 NEC-P16 **Final Action: Hold**
(820.113(E), Informational Note)

TCC Action: The Correlating Committee directs that this panel action on this Comment be reported as "Hold" based on 4.4.4.6.2 of the NFPA Regulations Governing Committee Projects since the information accepted in this comment, to add an informational note, is new material that has not had public review.
Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 16-194
Recommendation: Revise text to read as follows:
Informational Note <u>No.1</u>: See 820.26 for firestop requirements for floor penetrations.
<u>Informational Note No. 2: See 800.12 for information on using communications raceways as innerduct.</u>
Substantiation: The new informational note adds clarity by guiding the reader to new section 800.12 which permits communications raceways to be used as innerduct in any type of Chapter 3 raceway.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 16 Negative: 1
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:
OHDE, H.: See our comment on Comment 16-58.

ARTICLE 830 — NETWORK-POWERED BROADBAND COMMUNICATIONS SYSTEMS

16-85 Log #499 NEC-P16 **Final Action: Accept in Principle**
(830.2.Network Interface Unit (NIU))

Submitter: Marcelo M. Hirschler, GBH International
Comment on Proposal No: 16-216
Recommendation: Revise text to read as follows:
Network Interface Unit (NIU). A device that converts a broadband signal into component voice, audio, video, data, and interactive services signals<u> and that provides isolation between the network power and the premises signal circuits</u>. ~~The NIU provides isolation between the network power and the premises signal circuits. The NIU~~ <u>These devices</u> may also contain primary and secondary protectors.~~.~~
Substantiation: I accept the concept that NEC definitions are not required to be in single sentences. However this definition contains the defined term "NIU" and the NEC manual of style does not permit the definition to contain the defined term. The proposed information will make the definition comply with the Manual of Style. If CMP16 believes that this information is a requirement it should place it somewhere else in Article 830, for example as a new section 760.4 or a similar new location, since NEC definitions shall not contain requirements.
Two examples of alternate approaches are:
Network Interface Unit (NIU). A device that converts a broadband signal into component voice, audio, video, data, and interactive services signals.
<u>**830.4 Network Interface Unit**.</u>
<u>**830.4.1** Network interface units provide isolation between the network power and the premises signal circuits.</u>
<u>**820.4.2** Network interface units are permitted to contain primary and secondary protectors.</u>
Network Interface Unit (NIU). A device that converts a broadband signal into component voice, audio, video, data, and interactive services signals. ~~The NIU provides isolation between the network power and the premises signal circuits. The NIU may also contain primary and secondary protectors.~~
<u>**Informational Note:** The NIU provides isolation between the network power and the premises signal circuits. The NIU may also contain primary and secondary protectors.</u>
The NEC Manual of Style states as follows:
2.2.2 Definitions. Definitions shall be in alphabetical order and shall not contain the term that is being defined. Definitions shall not contain requirements or recommendations.
Panel Meeting Action: Accept in Principle

Revise the recommendation to read as follows:
Network Interface Unit (NIU). A device that converts a broadband signal into component voice, audio, video, data and interactive services signals and provides isolation between the network power and the premises signal circuits. These devices often contain primary and secondary protectors.
Panel Statement: The panel agrees with the recommendation but the words "may also" are permissive and have been changed to "often".
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-86 Log #696 NEC-P16 **Final Action: Accept**
(830.3(F))

TCC Action: The Correlating Committee directs that the text of (F) be revised as follows:
"(F) Cable Routing Assemblies. The definition in Article 100, the applications in Table 800.154(c), and installation rules in 800.110 and 800.113 shall apply to Article 830."
See the Correlating Committee action on Comment 16-5 that relocated the definition of cable routing assembly to Article 100.
Submitter: George Bish, Secure Watch Security
Comment on Proposal No: 16-222
Recommendation: Continue to Accept in Principle this Proposal.
Substantiation: The Panel Action to Accept in Principle is appropriate as the definition "Cable Routing Assembly now resides in 800.2 and the applications are contained in Table 800.154(c).
Continued Acceptance in Principal of this proposal is in keeping with the Correlating Committee's directive to correlate the Panel Actions regarding cable routing assemblies throughout Articles 725, 760, 770, and Chapter 8
This is one of a group of comments developed by the CMP3/CMP16 Joint Task Group formed at the direction of the Correlating Committee to locate a correlated definition of Cable Routing Assemblies in a single Article of Chapter 8 for use in Article 725, 760, 770, and Chapter 8.
The Task Group members were:
George Bish, Chair, representing Satellite Broadcasting & Communication Association
Harry Ohde, representing IBEW
James Brunssen, representing Alliance for Telecommunications Industry Solutions
George Straniero, representing National Electrical Manufacturers Association
Robert Walsh, representing International Association of Electrical Inspectors
Wendell Whistler, representing Intertek Testing Services
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-87 Log #545 NEC-P16 **Final Action: Reject**
(830.24)

Submitter: James E. Brunssen, Telecordia Technologies Inc. / Rep. Alliance for Telecommunications Industry Solutions (ATIS)
Comment on Proposal No: 16-224
Recommendation: Continue to reject this proposal per Correlating Committee action.
Substantiation: The Correlating Committee acted correctly in reporting this proposal as "Reject". The proposal received less that the required two-thirds affirmative vote as the submitter failed to adequately substantiate the proposal as required by the "Regulations Governing Committee Projects" Section 4-3.3(d). This was noted by a number of the Committee members in their "Explanation of Negative" vote. The proposed additional requirements are appropriate for power cables, not network-powered broadband communications cables. Network-powered broadband communications systems consist of a cable to bring the signal and any needed power from the communications network to the Network Interface Unit, typically located on the exterior of the building or structure. From that point on within the building or structure, the premises wiring and cabling is identical to that for optical fiber cables, communications cables, and coaxial CATV cables of Articles 770, 800 and 820, respectively. The Network-powered broadband communications systems cable serving the Network Interface Unit is power-limited to 100 volt-amperes, and is considered neither an electrical safety nor fire hazard.
Panel Meeting Action: Reject
Panel Statement: The panel has concluded that reference to 300.4 within Article 830 is needed and is already provided in 830.3(E). Refer to the panel action and statement on Comment 16-89.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-88 Log #546 NEC-P16 **Final Action: Reject**
(830.24)

Submitter: James E. Brunssen, Telecordia Technologies Inc. / Rep. Alliance for Telecommunications Industry Solutions (ATIS)
Comment on Proposal No: 16-226
Recommendation: Continue to reject this proposal per Correlating Committee action.
Substantiation: The Correlating Committee acted correctly in reporting this proposal as "Reject". The proposal received less that the required two-thirds affirmative vote as the submitter failed to adequately substantiate the proposal as required by the "Regulations Governing Committee Projects" Section 4-3.3(d). This was noted by a number of the Committee members in their "Explanation of Negative" vote. The proposed additional requirements are appropriate for power cables, not network-powered broadband communications cables. Network-powered broadband communications systems consist of a cable to bring the signal and any needed power from the communications network to the Network Interface Unit, typically located on the exterior of the building or structure. From that point on within the building or structure, the premises wiring and cabling is identical to that for optical fiber cables, communications cables, and coaxial CATV cables of Articles 770, 800 and 820, respectively. The Network-powered broadband communications systems cable serving the Network Interface Unit is power-limited to 100 volt-amperes, and is considered neither an electrical safety nor fire hazard.
Panel Meeting Action: Reject
Panel Statement: The panel has concluded that reference to 300.4 within Article 830 is needed and is already provided in 830.3(E). Refer to the panel action and statement on Comment 16-89.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-89 Log #564 NEC-P16 **Final Action: Accept in Principle**
(830.24)

Note: When the ballot result does not confirm the TC action on a Proposal by a two-thirds affirmative vote, the Report on Proposals shall be published with a specific request for public comment on that Proposal. The Proposal is now being reconsidered by the TC as a public comment.
Submitter: David Clements, International Association of Electrical Inspectors
Comment on Proposal No: 16-224
Recommendation: Revise text to read as follows:
830.24 Mechanical Execution of Work.
Network-powered broadband communications circuits and equipment shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be secured by hardware including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform to 300.4 ~~(D)~~ <u>(A) through (G)</u> and 300.11.
Substantiation: In addition to the physical protection required in 300.4(D) regarding distance from parallel framing members, network-powered broadband communications cable also needs to be protected when installed other-than-parallel to framing members such as perpendicular through bored holes and notches in wood framing, holes in metallic framing, in shallow grooves, under roof decking, etc. Cables also require support when installed behind accessible panels.
The reference needs to be to 300.4(A) through (G) not just to (D).
Panel Meeting Action: Accept in Principle
Revise the last sentence of the recommendation to read as follows:
The installation shall also conform to 300.11.
Panel Statement: The panel accepts the recommendation in principle but recognizes that 830.3(E) already includes a requirement to follow 300.4. The panel has deleted the reference to 300.4 in its entirety from 830.24.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-90 Log #570 NEC-P16 **Final Action: Accept in Principle**
(830.24)

Note: When the ballot result does not confirm the TC action on a Proposal by a two-thirds affirmative vote, the Report on Proposals shall be published with a specific request for public comment on that Proposal. The Proposal is now being reconsidered by the TC as a public comment.
Submitter: Marcus R. Sampson, Lysistrata Electric
Comment on Proposal No: 16-226
Recommendation: Revise text to read as follows:
830.24 Mechanical Execution of Work.
Network-powered broadband communications circuits and equipment shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such

cables shall be secured by hardware including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform to 300.4 ~~(D)~~ (A) through (G) and 300.11.

Substantiation: In addition to the physical protection required in 300.4(D) regarding distance from parallel framing members, network-powered broadband communications cable also needs to be protected when installed other-than-parallel, to framing members such as perpendicular through bored holes and notches in wood framing, holes in metallic framing, in shallow grooves, under roof decking, etc. Cables also require support when installed behind accessible panels.

The reference needs to be to 300.4(A) through (G) not just to (D).

Panel Meeting Action: Accept in Principle

Panel Statement: Refer to the panel action and statement on Comment 16-89, which is the same issue.

Number Eligible to Vote: 18

Ballot Results: Affirmative: 17

Ballot Not Returned: 1 Ballast, D.

16-91 Log #909 NEC-P16 **Final Action: Reject**

(830.24)

Submitter: Marcelo M. Hirschler, GBH International

Comment on Proposal No: 16-225

Recommendation: Revise text to read as follows:

830.24 Mechanical Execution of Work. Network-powered broadband communications circuits and equipment shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be secured by hardware including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform with 300.4(D) and 300.11. See also 300.22. ~~Cable ties used to secure network-powered broadband communications plenum cables in other space used for environmental air (plenums) shall be listed as having low smoke and heat release properties.~~

Substantiation: CMP 3 accepted the requirements for cable ties in plenums and incorporate the language on requirements into 300.22 (C)(1). The addition of the language on cable ties here could create conflicts, especially if the language approved in 300.22(C)(1) is different from the language here. I have made a comment to CMP3 to request that the language addressing "smoke and heat release characteristics" be used in 300.22(C)(1).

Panel Meeting Action: Reject

Panel Statement: The reference to 300.22 in the submitter's recommendation is too broad. The panel action on Comment 16-17 is more appropriate because it refers to cable ties and other nonmetallic cable accessories. This panel action also maintains correlation with CMP 3 action on Comment 3-24 that is in agreement with the Correlating Committee's direction to correlate Articles 300, 770, 800, 820 and 830 on the subject of cable ties.

Number Eligible to Vote: 18

Ballot Results: Affirmative: 17

Ballot Not Returned: 1 Ballast, D.

16-92 Log #525 NEC-P16 **Final Action: Reject**

(830.100(B)(3)(2))

Submitter: James F. Williams, Fairmont, WV

Comment on Proposal No: 16-242

Recommendation: Revise text to read as follows:

830.100 Cable, Network Interface Unit, and Primary Protector Bonding and Grounding.

(B) Electrode.

(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.

(2) If the building or structure served has no intersystem bonding termination or has no grounding means, as described in 830.100(B)(2) or (B)(3)(1), to any one of the individual grounding electrodes described in 250.52(A)(7) and (A)(8), ~~or to~~ then a ground rod or pipe not less than 1.5 m (5 ft) in length and 12.7 mm (1/2 in.) in diameter, driven, where practicable, into permanently damp earth and separated from lightning conductors as covered in 800.53 and at least 1.8 m (6 ft) from electrodes of other systems shall be used. Steam or hot water pipes or lightning-rod conductors shall not be employed as grounding electrodes for protectors, NIUs with integral protection, grounded metallic members, NIUs with metallic enclosures, and other equipment.

Substantiation: I believe the intent is to require a "communications ground rod" if no other ground is available.

Panel Meeting Action: Reject

Panel Statement: When taken in context with the full Section 830.100(B), the order of preference is implicit in the order the alternatives are listed in the article.

Number Eligible to Vote: 18

Ballot Results: Affirmative: 17

Ballot Not Returned: 1 Ballast, D.

16-93 Log #884 NEC-P16 **Final Action: Accept**

(830.110(C)(3))

Submitter: Terry Peters, The Society of the Plastics Industry

Comment on Proposal No: 16-249

Recommendation: Continue to reject proposal 16-249.

Substantiation: The submitter's recommendation to prohibit the installation of plenum cables in plenum raceways is absurd. Plenum raceways are designed to be used with plenum cables. The Society of the Plastics Industry supports the panel action to reject this proposal.

Panel Meeting Action: Accept

Number Eligible to Vote: 18

Ballot Results: Affirmative: 17

Ballot Not Returned: 1 Ballast, D.

16-94 Log #222 NEC-P16 **Final Action: Accept**

(830.113)

Submitter: Technical Correlating Committee on National Electrical Code®

Comment on Proposal No: 16-247

Recommendation: The Correlating Committee directs the panel to review the proposed text relative to incomplete sentences.

The Correlating Committee also directs the panel to clarify the outline of this proposal with respect to first and second level subdivisions and list items.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

Panel Meeting Action: Accept

Panel Statement: The panel accepts the direction of the Correlating Committee and has addressed their concerns in the panel action and statement of Comment 16-95.

Number Eligible to Vote: 18

Ballot Results: Affirmative: 17

Ballot Not Returned: 1 Ballast, D.

16-95 Log #340 NEC-P16 **Final Action: Accept in Principle**

(830.113)

Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.

Comment on Proposal No: 16-247

Recommendation: Revise the text of 830.113 to read as follows:

830.113 Installation of Network-Powered Broadband Communications Cables. Installation of network-powered broadband communications cables shall comply with 830.113(A) through (H).

(A) Listing. Network-powered broadband communications cables installed in buildings shall be listed.

(B) Fabricated Ducts Used for Environmental Air. The following cables shall be permitted in ducts as described in 300.22(B) if they are directly associated with the air distribution system:

(1) Up to 1.22 m (4 ft) of Type BLP cable

(2) Types BLP, BMR, BLR, BM, BL, and BLX cables installed in raceways that are installed in compliance with 300.22(B)

Informational Note: For information on fire protection of wiring installed in fabricated ducts see 4.3.4.1 and 4.3.11.3.3 in NFPA 90A-2009, S*tandard for the Installation of Air-Conditioning and Ventilating Systems*.

(C) Other Spaces Used For Environmental Air (Plenums). The following cables shall be permitted in other spaces used for environmental air as described in 300.22(C):

(1) Type BLP cable

(2) Type BLP cable installed in plenum communications raceways

(3) Type BLP cable supported by open metallic cable trays or cable tray systems

(4) Types BLP, BMR, BLR, BM, BL, and BLX cables installed in raceways that are installed in compliance with 300.22(C)

(5) Types BLP, BMR, BLR, BM, BL, and BLX cables supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

(6) Types BLP, BMR, BLR, BM, BL, and BLX cables installed in plenum communications raceways, riser communications raceways or general-purpose communications raceways supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

Informational Note: For information on fire protection of wiring installed in other spaces used for environmental air see 4.3.11.2, 4.3.11.4 and 4.3.11.5 of NFPA 90A-2009, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

(D) Risers — Cables in Vertical Runs. The following cables shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

(1) Types BLP, BMR, and BLR cables

(2) Types BLP and BLR cables installed in:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

Informational Note: See 830.26 for firestop requirements for floor penetrations.

(E) Risers — Cables in Metal Raceways. The following cables shall be permitted in a metal raceway in a riser with firestops at each floor:

(1) Types BLP, BMR, BLR, BM, BL, and BLX cables

(2) Types BLP, BLR, and BL cables installed in:

a. Plenum communications raceways

b. Riser communications raceways

c. General-purpose communications raceways

Informational Note: See 830.26 for firestop requirements for floor penetrations.

(F) Risers — Cables in Fireproof Shafts. The following cables shall be permitted to be installed in fireproof riser shafts with firestops at each floor:

(1) Types BLP, BMR, BLR, BM, BL, and BLX cables

(2) Types BLP, BLR, and BL cables installed in:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

Informational Note: See 830.26 for firestop requirements for floor penetrations.

(G) Risers — One- and Two-Family Dwellings. The following cables shall be permitted in one-and two-family dwellings:

(1) Types BLP, BMR, BLR, BM, and BL cables and BLX cables less than 10 mm (0.375 in.) in diameter

(2) Types BLP, BLR, and BL cables installed in:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

Informational Note: See 830.26 for firestop requirements for floor penetrations.

(H) Other Building Locations. The following cables and raceways shall be permitted to be installed in building locations other than those covered in 830.113(B) through (G):

(1) Types BLP, BMR, BLR, BM, and BL cables

(2) Types BLP, BMR, BLR, BM, BL, and BLX cables installed in a raceway

(3) Types BLP, BLR, and BL cables installed in:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

(4) Types BLX cables less than 10 mm (0.375 in.) in diameter in one- and two-family dwellings

(5) Types BMU and BLU cables entering the building from outside and run in rigid metal conduit or intermediate metal conduit where the conduit is connected by a bonding conductor or grounding electrode conductor in accordance with 830.100(B)

Informational Note: This provision limits the length of Type BLX cable to 15 m (50 ft), while 830.90(B) requires that the primary protector, or NIU with integral protection, be located as close as practicable to the point at which the cable enters the building. Therefore, in installations requiring a primary protector, or NIU with integral protection, Type BLX cable may not be permitted to extend 15 m (50 ft) into the building if it is practicable to place the primary protector closer than 15 m (50 ft) to the entrance point.

(6) A maximum length of 15 m (50 ft), within the building, of Type BLX cable entering the building from outside and terminating at an NIU or a primary protection location

Substantiation: The proposal, as submitted, had a copy and paste error. Part of (B) Fabricated Ducts Used for Environmental Air was inadvertently omitted.

The missing text has been inserted. The panel action to reject the use of cable routing assemblies in plenums is included in the revised text by deleting 830.113(C)(3) in the original proposal.

Acceptance of this comment will bring the panel action into conformance with the Correlating Committee directives on this proposal.

Panel Meeting Action: Accept in Principle

Revise 830.113 to read as follows:

830.113 Installation of Network-Powered Broadband Communications Cables. Installation of network-powered broadband communications cables shall comply with 830.113(A) through (H).

(A) Listing. Network-powered broadband communications cables installed in buildings shall be listed.

(B) Fabricated Ducts Used for Environmental Air. The following cables shall be permitted in ducts as described in 300.22(B) if they are directly associated with the air distribution system:

(1) Up to 1.22 m (4 ft) of Type BLP cable

(2) Types BLP, BMR, BLR, BM, BL, and BLX cables installed in raceways that are installed in compliance with 300.22(B)

Informational Note: For information on fire protection of wiring installed in fabricated ducts see 4.3.4.1 and 4.3.11.3.3 in NFPA 90A-2012 Standard for the Installation of Air-Conditioning and Ventilating Systems.

(C) Other Spaces Used For Environmental Air (Plenums). The following cables shall be permitted in other spaces used for environmental air as described in 300.22(C):

(1) Type BLP cable

(2) Type BLP cable installed in plenum communications raceways

(3) Type BLP cable supported by open metallic cable trays or cable tray systems

(4) Types BLP, BMR, BLR, BM, BL, and BLX cables installed in raceways that are installed in compliance with 300.22(C)

(5) Types BLP, BMR, BLR, BM, BL, and BLX cables supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

(6) Types BLP, BMR, BLR, BM, BL, and BLX cables installed in plenum communications raceways, riser communications raceways or general-purpose communications raceways supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

Informational Note: For information on fire protection of wiring installed in other spaces used for environmental air see 4.3.11.2, 4.3.11.4 and 4.3.11.5 of NFPA 90A-2012, Standard for the Installation of Air-Conditioning and Ventilating Systems.

(D) Risers — Cables in Vertical Runs. The following cables shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

(1) Types BLP, BMR, and BLR cables

(2) Types BLP and BLR cables installed in:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

Informational Note: See 830.26 for firestop requirements for floor penetrations.

(E) Risers — Cables in Metal Raceways. The following cables shall be permitted in a metal raceway in a riser with firestops at each floor:

(1) Types BLP, BMR, BLR, BM, BL, and BLX cables

(2) Types BLP, BLR, and BL cables installed in:

a. Plenum communications raceways

b. Riser communications raceways

c. General-purpose communications raceways

Informational Note: See 830.26 for firestop requirements for floor penetrations.

(F) Risers — Cables in Fireproof Shafts. The following cables shall be permitted to be installed in fireproof riser shafts with firestops at each floor:

(1) Types BLP, BMR, BLR, BM, BL, and BLX cables

(2) Types BLP, BLR, and BL cables installed in:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

Informational Note: See 830.26 for firestop requirements for floor penetrations.

(G) Risers — One- and Two-Family Dwellings. The following cables shall be permitted in one-and two-family dwellings:

(1) Types BLP, BMR, BLR, BM, BL and BLX cables less than 10 mm (0.375 in.) in diameter

(2) Types BLP, BLR, and BL cables installed in:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

Informational Note: See 830.26 for firestop requirements for floor penetrations.

(H) Other Building Locations. The following cables and raceways shall be permitted to be installed in building locations other than those covered in 830.113(B) through (G):

(1) Types BLP, BMR, BLR, BM, and BL cables

(2) Types BLP, BMR, BLR, BM, BL, and BLX cables installed in a raceway

(3) Types BLP, BLR, and BL cables installed in:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

(4) Types BLX cables less than 10 mm (0.375 in.) in diameter in one- and two-family dwellings

(5) Types BMU and BLU cables entering the building from outside and run in rigid metal conduit or intermediate metal conduit where the conduit is connected by a bonding conductor or grounding electrode conductor in accordance with 830.100(B)

Informational Note: This provision limits the length of Type BLX cable to 15 m (50 ft), while 830.90(B) requires that the primary protector, or NIU with integral protection, be located as close as practicable to the point at which the

cable enters the building. Therefore, in installations requiring a primary protector, or NIU with integral protection, Type BLX cable may not be permitted to extend 15 m (50 ft) into the building if it is practicable to place the primary protector closer than 15 m (50 ft) to the entrance point.
(6) A maximum length of 15 m (50 ft), within the building, of Type BLX cable entering the building from outside and terminating at an NIU or a primary protection location
Panel Statement: The panel agrees with the recommendation but has made grammatical corrections to the text as provided in the panel action. As a part of these changes the panel has updated the reference to NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-96 Log #341 NEC-P16 **Final Action: Hold**
(830.113(E), Informational Note)

TCC Action: The Correlating Committee directs that this panel action on this Comment be reported as "Hold" based on 4.4.4.6.2 of the NFPA Regulations Governing Committee Projects since the information accepted in this comment, to add an informational note, is new material that has not had public review.
Submitter: Frank W. Peri, Communications Cable & Connectivity Assoc.
Comment on Proposal No: 16-247
Recommendation: Revise text to read as follows:
Informational Note <u>No.1</u>: See 830.26 for firestop requirements for floor penetrations.
<u>Informational Note No. 2: See 800.12 for information on using communications raceways as innerduct.</u>
Substantiation: The new informational note adds clarity by guiding the reader to new section 800.12 which permits communications raceways to be used as innerduct in any type of Chapter 3 raceway.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 16 Negative: 1
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:
OHDE, H.: See our comment on Comment 16-58.

ARTICLE 840 —PREMISES-POWERED BROADBAND COMMUNICATIONS SYSTEMS

16-97 Log #223 NEC-P16 **Final Action: Accept**
(840.1)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 16-259
Recommendation: The Correlating Committee advises that Article Scope statements are the responsibility of the Correlating Committee and the Correlating Committee Rejects the panel action.
The Correlating Committee further directs that consideration be given to the comments expressed in the voting.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the direction of the Correlating Committee to give further consideration to the comments expressed in voting. The panel has acted to reject the proposed changes to 840.1 thereby resolving the concerns. Refer to the panel action on Comment 16-100.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-98 Log #224 NEC-P16 **Final Action: Accept**
(840.1)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 16-260
Recommendation: The Correlating Committee advises that Article Scope statements are the responsibility of the Correlating Committee and the Correlating Committee Rejects the panel action.
The Correlating Committee further directs that consideration be given to the comments expressed in the voting.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the direction of the Correlating Committee to give further consideration to the comments expressed in voting. The panel has acted to reject the proposed changes to 840.1 thereby resolving the concerns. Refer to the panel action on Comment 16-101.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-99 Log #225 NEC-P16 **Final Action: Accept**
(840.1)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 16-261
Recommendation: The Correlating Committee directs the panel to reconsider the panel action with respect to the Correlating Committee action taken on Proposal 16-260.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the direction of the Correlating Committee to reconsider based on the action taken on Proposal 16-260. The panel has acted to reject the proposed changes to 840.1 thereby resolving the concerns. Refer to the panel action on Comment 16-105.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-100 Log #547 NEC-P16 **Final Action: Accept**
(840.1)

Submitter: James E. Brunssen, Telecordia Technologies Inc. / Rep. Alliance for Telecommunications Industry Solutions (ATIS)
Comment on Proposal No: 16-259
Recommendation: Continue to reject this proposal per Correlating Committee action.
Substantiation: The Correlating Committee acted correctly in rejecting the panel action. Article 840 was specifically written to address premises-powered, optical fiber based broadband communications systems and contains requirements specific to those systems throughout the Article. The article scope cannot be generalized to include "…other Premises-Powered Broadband Communications Systems that are not delivered via an optical network" without adding the appropriate system-specific requirements for the "other" system throughout the Article.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 16 Negative: 1
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:
BISH, G.: The original intent of Article 840 was to be able to address all premises-powered Broadband Communication Systems not just optical fiber type.

16-101 Log #548 NEC-P16 **Final Action: Accept**
(840.1)

Submitter: James E. Brunssen, Telecordia Technologies Inc. / Rep. Alliance for Telecommunications Industry Solutions (ATIS)
Comment on Proposal No: 16-260
Recommendation: Continue to reject this proposal per Correlating Committee action.
Substantiation: The Correlating Committee acted correctly in rejecting the panel action. Article 840 was specifically written to address premises-powered, optical fiber based broadband communications systems and contains requirements specific to those systems throughout the Article. Parabolic antenna systems cannot be included simply by adding the words "parabolic antenna system" to the scope of Article 840 without including the necessary system-specific requirements throughout the Article, as was done for the optical fiber based systems. These include considerations such as protection, bonding, grounding, installation and listing.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 16 Negative: 1
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:
BISH, G.: The original intent of Article 840 was to be able to address all premises-powered Broadband Communication Systems not just optical fiber type.

16-102 Log #1102 NEC-P16 **Final Action: Accept**
(840.1)

Submitter: Randy Ivans, Underwriters Laboratories Inc.
Comment on Proposal No: 16-259
Recommendation: Reject.
Wording in the 2011 NEC should be retained.
Substantiation: This proposal should be Rejected. The requirements in article 840 were specifically developed to cover only fiber to the premises systems where there is no metallic wiring or cable members conductively connected to cabling or devices outside of the building. In order to include other systems

that might deliver broadband services and are premises powered, appropriate requirements would need to be developed to cover those systems. For example, systems using parabolic antennas with cabling outside of the building may be subject to lightning transients that are not anticipated in the current article 840.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 16 Negative: 1
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:
BISH, G.: The original intent of Article 840 was to be able to address all premises-powered Broadband Communication Systems not just optical fiber type.

16-103 Log #1103 NEC-P16 **Final Action: Accept**
(840.1)

Submitter: Randy Ivans, Underwriters Laboratories Inc.
Comment on Proposal No: 16-260
Recommendation: Reject.
Wording in the 2011 NEC should be retained.
Substantiation: This proposal should be Rejected. There is no technical substantiation provided why parabolic antennas should be included as an example when there are no requirements in the article dealing with antennas or cabling installed outdoors that may be subject to lightning transients.
The requirements in article 840 were specifically developed to cover only fiber to the premises systems where there is no metallic wiring or cable members conductively connected to cabling or devices outside of the building. Although antenna systems might provide broadband services and be premises powered, in order for parabolic antennas to be included in article 840, appropriate requirements would need to be developed to cover outside cabling and antennas that may be subject to lightning transients. No such requirements have been proposed.
Finally, installation criteria and requirements would need to be developed that somehow differentiate these small parabolic antennas from other antenna systems still covered under article 810. Without such criteria and requirements, these antennas could be mounted on a 10 ft. mast on a roof top or on a 100 ft. tower next to a building and be subject to different requirements than antennas covered under article 810 that are in the same environment. No such requirements have been proposed.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 16 Negative: 1
Ballot Not Returned: 1 Ballast, D.
Explanation of Negative:
BISH, G.: The original intent of Article 840 was to be able to address all premises-powered Broadband Communication Systems not just optical fiber type.

16-104 Log #1104 NEC-P16 **Final Action: Accept in Principle**
(840.1, Informational Note)

Submitter: Randy Ivans, Underwriters Laboratories Inc.
Comment on Proposal No: 16-261
Recommendation: Informational Note No. 1 ~~2~~: A typical basic optical fiber system configuration consists of an optical fiber cable to the premises (FTTP) supplying a broadband signal to an ONT
that converts the broadband optical signal into component electrical signals, such as traditional telephone, video, highspeed internet, and interactive services. Powering of the ONT is typically accomplished through an ONT power supply unit (OPSU) and battery backup unit (BBU) that derive their power input from the available ac at the premises.
The optical fiber cable is unpowered and may be nonconductive or conductive.
Substantiation: If proposal 16-260 is rejected as suggested in another comment, this note should be changed back to Note No. 1.
Panel Meeting Action: Accept in Principle
Retain the wording of 840.1 Informational Notes as it appears in the 2011 NEC.
Panel Statement: The panel accepts the recommendation in principle because the recommendation in the comments mistakenly included text from the recommendation of Proposal 16-261 instead of the intended wording from the 2011 NEC.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-105 Log #549 NEC-P16 **Final Action: Accept**
(840.1, Informational Note 1)

Submitter: James E. Brunssen, Telecordia Technologies Inc. / Rep. Alliance for Telecommunications Industry Solutions (ATIS)
Comment on Proposal No: 16-261
Recommendation: Reject this proposal per Correlating Committee action on Proposals 16-259 and 16-260.
Substantiation: The Correlating Committee acted correctly in rejecting the Panel Action on Proposals 16-259 and 16-260. Article 840 was specifically written to address premises-powered optical fiber based broadband communications systems and contains requirements specific to those systems. There are no parabolic antenna system-specific requirements in Article 840. As proposals 16-259 and 16-260 have been rejected, the proposed revisions to Informational Note No. 1 are unnecessary.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-106 Log #226 NEC-P16 **Final Action: Accept**
(840.1, Informational Note 2)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 16-263
Recommendation: The Correlating Committee directs the panel to reconsider the panel action with respect to the Correlating Committee action taken on Proposal 16-260.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the Correlating Committee direction to reconsider and revised the panel action on Proposal 16-263 to Reject. There is no need for Informational Note 2 as the addition of parabolic antenna systems to Article 840 has been rejected. See panel action on Comments 16-98, 16-108 and 16-111.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-107 Log #227 NEC-P16 **Final Action: Accept**
(840.1, Informational Note 2)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 16-264
Recommendation: The Correlating Committee directs the panel to reconsider the panel action with respect to the Correlating Committee action taken on Proposal 16-260.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the direction of the Correlating Committee to reconsider and the panel revised the panel action on Proposal 16-264 to Reject. There is no need for Informational Note 2 as the addition of parabolic antenna systems to Article 840 has been rejected. See panel action on Comment 16-110.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-108 Log #550 NEC-P16 **Final Action: Accept**
(840.1, Informational Note 2)

Submitter: James E. Brunssen, Telecordia Technologies Inc. / Rep. Alliance for Telecommunications Industry Solutions (ATIS)
Comment on Proposal No: 16-263
Recommendation: Reject this proposal per Correlating Committee action on Proposals 16-259 and 16-260.
Substantiation: The Correlating Committee acted correctly in rejecting the Panel Action on Proposals 16-259 and 16-260. Article 840 was specifically written to address premises-powered optical fiber based broadband communications systems and contains requirements specific to those systems. There are no parabolic antenna system-specific requirements in Article 840. As proposals 16-259 and 16-260 have been rejected, an additional Informational Note No. 2 is unnecessary.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-109 Log #551 NEC-P16 **Final Action: Accept**
(840.1, Informational Note 2)

Submitter: James E. Brunssen, Telecordia Technologies Inc. / Rep. Alliance for Telecommunications Industry Solutions (ATIS)
Comment on Proposal No: 16-264
Recommendation: Reject this proposal per Correlating Committee action on Proposals 16-259 and 16-260.
Substantiation: The Correlating Committee acted correctly in rejecting the Panel Action on Proposals 16-259 and 16-260. As proposals 16-259 and 16-260 have been rejected, there is no need for renumbering Informational Note No. 2.
Panel Meeting Action: Accept

Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-110 Log #1106 NEC-P16 **Final Action: Accept**
(840.1, Informational Note 2)

Submitter: Randy Ivans, Underwriters Laboratories Inc.
Comment on Proposal No: 16-264
Recommendation: Informational Note No. 2 ~~4~~ : See 90.2(B)(4) for installations of premises-powered broadband communications systems that are not covered.
Substantiation: This proposal should be Rejected. It is not required to renumber the note if 16-260 and 16-263 are rejected.
There here is no technical substantiation provided why parabolic antennas should be included as proposed in proposals 16-260 and 16-263 when there are no requirements in the article dealing with antennas or cabling installed outdoors that may be subject to lightning transients.
The requirements in article 840 were specifically developed to cover only fiber to the premises systems where there is no metallic wiring or cable members conductively connected to cabling or devices outside of the building. Although antenna systems might provide broadband services and be premises powered, in order for parabolic antennas to be included in article 840, appropriate requirements would need to be developed to cover outside cabling and antennas that may be subject to lightning transients. No such requirements have been proposed.
Finally, installation criteria and requirements would need to be developed that somehow differentiate these small parabolic antennas from other antenna systems still covered under article 810. Without such criteria and requirements, these antennas could be mounted on a 10 ft. mast on a roof top or on a 100 ft. tower next to a building and be subject to different requirements than antennas covered under article 810 that are in the same environment. No such requirements have been proposed.
Panel Meeting Action: Accept
Panel Statement: The panel notes that the action of the recommendation returns the informational note numbering to that in the 2011 NEC.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-111 Log #1105 NEC-P16 **Final Action: Accept**
(840.1, Informational Note 3)

Submitter: Randy Ivans, Underwriters Laboratories Inc.
Comment on Proposal No: 16-263
Recommendation: Reject.
Wording in the 2011 NEC should be retained.
Substantiation: This proposal to add an informational note on parabolic antenna systems should be Rejected. There is no technical substantiation provided why parabolic antennas should be included as an example when there are no requirements in the article dealing with antennas or cabling installed outdoors that may be subject to lightning transients.
The requirements in article 840 were specifically developed to cover only fiber to the premises systems where there is no metallic wiring or cable members conductively connected to cabling or devices outside of the building. Although antenna systems might provide broadband services and be premises powered, in order for parabolic antennas to be included in article 840, appropriate requirements would need to be developed to cover outside cabling and antennas that may be subject to lightning transients. No such requirements have been proposed.
Finally, installation criteria and requirements would need to be developed that somehow differentiate these small parabolic antennas from other antenna systems still covered under article 810. Without such criteria and requirements, these antennas could be mounted on a 10 ft. mast on a roof top or on a 100 ft. tower next to a building and be subject to different requirements than antennas covered under article 810 that are in the same environment. No such requirements have been proposed.
Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-112 Log #552 NEC-P16 **Final Action: Accept in Principle**
(840.2.Fiber-to-the-Premises)

Submitter: James E. Brunssen, Telecordia Technologies Inc. / Rep. Alliance for Telecommunications Industry Solutions (ATIS)
Comment on Proposal No: 16-266
Recommendation: Continue to accept this proposal.
Substantiation: The Correlating Committee correctly identified conflicting Panel Action on this proposal and Proposal 16-267 where the term "non-conducting" (hyphenated) and "nonconducting" were both accepted. The term "nonconducting" (unhyphenated) is used throughout the NEC and should be used here for consistency as well.
Panel Meeting Action: Accept in Principle
Panel Statement: Refer to the panel action and statement on Comment 16-113, where the entire paragraph is shown for clarity.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-113 Log #553 NEC-P16 **Final Action: Accept in Principle**
(840.2.Fiber-to-the-Premises)

Submitter: James E. Brunssen, Telecordia Technologies Inc. / Rep. Alliance for Telecommunications Industry Solutions (ATIS)
Comment on Proposal No: 16-267
Recommendation: Accept this proposal in principle. Revise submitter's text "non-conductive" to "nonconductive (unhyphenated).
Substantiation: The Panel Action should have been to Accept in Principle, where the Panel accepts the submitter's text but revises the term "non-conductive" (hyphenated) to "nonconductive" for correlation with the Panel Action on Proposal 16-266 and consistent use of the term "nonconductive" throughout the Code. This addresses the Correlating Committee directive to correlate the Panel Action on Proposals 16-266 and 16-267.
Panel Meeting Action: Accept in Principle
Revise 840.2 to read as follows:
840.2 Fiber-to-the-Premises (FTTP). Conductive or nonconductive optical fiber cable that is brought to the premises, is terminated at an optical network terminal (ONT), and establishes a connection to a communications network.
Panel Statement: The panel accepts the recommendation in principle but has shown the entire paragraph for clarity. The panel has retained the changes shown in the panel action on Proposal 16-267 but has corrected the improper hyphenation as suggested by the comment submitter.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-114 Log #228 NEC-P16 **Final Action: Accept**
(840.2. Fiber-to-the-Premises (FTTP))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 16-266
Recommendation: It was the recommendation of the Correlating Committee that this proposal be reconsidered and correlated with the "Accept" action taken on Proposal 16-267.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the direction of the Correlating Committee and has resolved the concern through action on Comment 16-113.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-115 Log #229 NEC-P16 **Final Action: Accept**
(840.2. Fiber-to-the-Premises (FTTP))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 16-267
Recommendation: It was the recommendation of the Correlating Committee that this proposal be reconsidered and correlated with the "Accept" action taken on Proposal 16-266.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept
Panel Statement: The panel accepts the direction of the Correlating Committee and has resolved the concern through action on Comment 16-113.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

16-116 Log #580 NEC-P16 **Final Action: Hold**
(840.170(A), Informational Note)

TCC Action: The Correlating Committee directs that this panel action on this Comment be reported as "Hold" based on 4.4.4.6.2 of the NFPA Regulations Governing Committee Projects since the information accepted in this comment, to add an informational note, is new material that has not had public review.
Submitter: Thomas M. Burke, UL LLC
Comment on Proposal No: 16-76
Recommendation: Revise the Informational Note for 840.170(A) to add a reference to new standard UL 62368-1.
Informational Note No. 1: One way to determine applicable requirements is to refer to UL 60950-1-2007, *Standard for Safety of Information Technology Equipment*, UL 498A-2008, *Current Taps and Adapters*, ~~or~~ UL 467-2007, *Grounding and Bonding Equipment*; or UL 62368-1-2012, *Audio/Video,*

Information and Communication Technology Equipment – Part 1: Safety Requirements.

Substantiation: This is one in a series of proposals to update NFPA 70 to add a reference to UL 62368-1.

ANSI/UL 62368-1, Audio/video, information and communication technology equipment – Part 1: Safety requirements, was published on February 17, 2012. This new standard will eventually replace (later this decade) both, UL 60065, Audio, Video, and Similar Electronic Apparatus-Safety Requirements, and UL 60950-1, Information Technology Equipment Safety - Part 1: General Requirements. In the meantime, multiple references to UL 60950-1 in the body of the Code should be supplemented by a reference to UL 62368-1 since similar equipment complying with, and Listed to both standards will be installed per the Code. In fact, equipment already is being Listed to UL 62368-1.

Panel Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 17
Ballot Not Returned: 1 Ballast, D.

CHAPTER 9 TABLES

6-77 Log #103 NEC-P06 **Final Action: Accept**
(Chapter 9, Notes to Tables, Note (10) (New))

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 6-112
Recommendation: The Correlating Committee directs that the accepted text comply with Section 3.1.1 of the NEC Style Manual relative to the use of mandatory text since these notes are part of the mandatory requirements for use of the table.

Use of the symbol "&" is not acceptable in Code text.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept

Revise text to read as follows:

(10) The values for approximate conductor diameter and area shown in Table 5 are based on worst case scenario and indicate Round Concentric-Lay-Stranded Conductors. Solid and Round Concentric-Lay-Stranded and are grouped together for the purpose of Table 5. Round Compact-Stranded Conductors values are shown in Table 5a. If the actual values of the conductor diameter and area are known, they shall be permitted to be used.

Panel Statement: CMP-6 accepts the direction of the Correlating Committee to review Proposal 6-112 in accordance with Section 3.1.1 of the NEC Style Manual.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

6-78 Log #104 NEC-P06 **Final Action: Accept**
(Chapter 9, Table 5)

Submitter: Technical Correlating Committee on National Electrical Code®
Comment on Proposal No: 6-113
Recommendation: The Correlating Committee directs that the panel clarify their action on this proposal as to whether the repositioning of the column applies to the new or existing table.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
Panel Meeting Action: Accept

The approximate area columns are to appear to the left of approximate diameter columns.

Panel Statement: CMP-6 accepts the direction of the Correlating Committee to clarify the panel action. CMP-6 notes that the A2013 Draft is correct.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

6-79 Log #996 NEC-P06 **Final Action: Accept in Principle in Part**
(Chapter 9, Table 5)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 6-114
Recommendation: Revise text to read as follows:

Chapter 9 Tables

Table 5 Dimensions of Insulated Conductors and Fixture Wires

Type: FFH-2, RFH-1, RFH-2, RFHH-2, RHH, RHH*, RHW, RHW*, RHW-2, RHW-2*, RHH, RHW, RHW-2, SF-1, SF-2, SFF-1, SFF-2, TF, TFF, THHW, THW, THW-2, TW, XF, XFF

Type: RHH*, RHW*, RHW-2*, THHN, THHW, THW, THW-2, TFN, TFFN, THWN, THWN-2, XF, XFF

Type: FEP, FEPB, PAF, PAFF, PF, PFA, PFAH, PFF, PGF, PGFF, PTF, PTFF, TFE, THHN, THWN, THWN-2, Z, ZF, ZFF, ZHF

Type: KF-1, KF-2, KFF-1, KFF-2, XHH, XHHW, XHHW-2, ZW

Substantiation: First group Type: missing RFHH-2, RHH (w/o *), RHW (w/o *), RHW-2 (w/o *)

Second group Type: OK
Third group Type: missing ZHF
Fourth group Type: OK

Panel Meeting Action: Accept in Principle in Part

Revise heading to read as follows:

Type: FFH-2, RFH-1, RFH-2, RFHH-2, RHH*, RHW*, RHW-2*, RHH, RHW, RHW-2, SF-1, SF-2, SFF-1, SFF-2, TF, TFF, THHW, THW, THW-2, TW, XF, XFF

Type: FEP, FEPB, PAF, PAFF, PF, PFA, PFAH, PFF, PGF, PGFF, PTF, PTFF, TFE, THHN, THWN, THWN-2, Z, ZF, ZFF, ZHF

Panel Statement: CMP-6 notes that the submitter intended to refer to Proposal 6-114.

CMP-6 does not accept the submitter's text to add RHH, RHW, or RHW-2 as these are already in the table title.

CMP-6 accepts the submitter's addition of RFHH-2 and ZHF as indicated in his recommendation.

CMP-6 revises two titles of Table 5.

Number Eligible to Vote: 10
Ballot Results: Affirmative: 10

8-59 Log #1597 NEC-P08 **Final Action: Reject**
(Chapter 9, Notes to Tables, Note (4))

Submitter: Scott Cline, Monterey Park, CA
Comment on Proposal No: 8-197
Recommendation: In Chapter 9 Table 1, Note (4) change the term "nipples" to "raceways."
Substantiation: We need to use the fully NEC defined term "raceways" to avoid any unintended omissions.

I somehow failed to communicate that the common industrial term "nipples" does not cover the full range of raceways to which this Note should apply.

The 2011 change of the term in 310.15(B)(3)(a)(2) from "nipples" to "raceways" was made to correct the unintended omission of certain raceways.

I cannot order an 18" EMT "nipple" and yet it should certainly fit this Note. Terms in the NEC may not define themselves, and so we cannot say that the 18" EMT is a "nipple" just because it is no more than 24 inches long. Also a 24 inch or shorter piece of any non-tubular (and therefore also non-"nipple") raceway (such as an 18" long piece of 4" by 4" wireway) should still be included.

Panel Meeting Action: Reject
Panel Statement: CMP-8 reaffirms its position to reject Proposal 8-197. Making this revision does not provide clarity. "Nipples" is a commonly used industry term, and appears multiple times in the NEC.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ANNEX A—PRODUCT SAFETY STANDARDS

1-110 Log #450 NEC-P01 **Final Action: Reject**
(Annex A)

Submitter: William Fiske, Intertek
Comment on Proposal No: 1-186
Recommendation: Delete the following text:

~~Batteries for Use in Light Electric Rail (LER) Applications and Stationary Applications, Subject 1973~~
~~Concentrator Photovoltaic Modules and Assemblies, Subject 8703~~
~~Connectors for Use in Photovoltaic Systems, Subject 6703~~
~~Distributed Wiring Harnesses, Subject 9703~~
~~Electric Vehicle Supply Equipment, Subject 2594~~
~~Enclosed and Dead-Front Switches for Use in Photovoltaic Systems, Subject 98B~~
~~Low-Voltage Fuses – Fuses for Photovoltaic Systems, Subject 2579~~
~~Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures for Use With Photovoltaic Systems, Subject 489B~~
~~Multi-Pole Connectors for Use in Photovoltaic Systems, Subject 6703A~~
~~Photovoltaic Junction Boxes, Subject 3739~~
~~Photovoltaic Wire, Subject 4703~~
~~Rack Mounting Systems and Clamping Devices for Flat-Plate Photovoltaic Modules and Panels, Subject 2703~~
~~Solar Trackers, Subject 3703~~
~~Wind Turbine Generating Systems, Subject 6140~~
~~Wind Turbine Generating Systems – Small; Subject 6142~~
~~Circuit integrity (CI) Cable – UL Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems, Subject 1724~~

Substantiation: An American National Standard, such as ANSI/NFPA 70, should not include references to publications that are not consensus standards. UL "Subjects," identified as "Outlines of Investigation" on the documents themselves, are not consensus standards. Moreover, it is by no means certain that any given Outline of Investigation will become a consensus standard in the near future. That is evidenced by the fact that Circuit Integrity (CI) Cable – UL Outline of Investigations for Fire Tests for Electrical Circuit Protective Systems, Subject 1724, that was added to Annex A in the 2008 NEC, is not yet a published UL Standard, more than four years after NEC 2008 was approved

by the NFPA Standards Council. That is the reason we recommend Subject 1724 be withdrawn from the NEC, in addition to recommending that the other Outlines of Investigation be withheld from Annex A and any Informational Notes within Code Articles until such time as they have attained consensus and been published as ANSI/UL standards.
Panel Meeting Action: Reject
Panel Statement: There is no requirement that the NEC or other model codes contain only references to consensus standards, and in fact the NEC and other model codes have referenced outlines of investigation for many years. The specified content provides relevant information for users of the Code.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-111 Log #581 NEC-P01 **Final Action: Accept**
(Annex A)

Submitter: Thomas M. Burke, UL LLC
Comment on Proposal No: 1-186
Recommendation: Add the following additional UL standard to Annex A.
Aboveground Reinforced Thermosetting Resin conduit (RTRC) and Fittings UL 2515
Antenna-Discharge Units UL 452
Arc-Fault Circuit-Interrupters UL 1699
Armored Cable UL 4
Attachment Plugs and Receptacles UL 498
Audio, Video and Similar Electronic Apparatus — Safety Requirements UL 60065
<u>Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements UL 62368-1</u>
Batteries for Use in Electric Vehicles UL 2580
Substantiation: This is one in a series of proposals to update NFPA 70 to add a reference to UL 62368-1.
ANSI/UL 62368-1, Audio/video, information and communication technology equipment – Part 1: Safety requirements, was published on February 17, 2012. This new standard will eventually replace (later this decade) both, UL 60065, Audio, Video, and Similar Electronic Apparatus-Safety Requirements, and UL 60950-1, Information Technology Equipment Safety - Part 1: General Requirements. In the meantime, a reference to UL 62368-1 should be added to Annex A since similar equipment complying with, and Listed to these standards will be installed per the Code. In fact, equipment already is being Listed to UL 62368-1.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-112 Log #794 NEC-P01 **Final Action: Accept**
(Annex A)

Submitter: George Mauro, Underwriters Laboratories Inc.
Comment on Proposal No: 2-232
Recommendation: Revise text to read as follows:
~~Transient Voltage~~ Surge <u>Protective Devices</u> ~~Suppressors~~ UL 1449
Substantiation: Correct name of UL Standard UL 1449 referenced in the Informative Annex A.
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

1-113 Log #801 NEC-P01 **Final Action: Accept**
(Annex A)

Submitter: Camille Alma, Underwriters Laboratories Inc.
Comment on Proposal No: 1-186
Recommendation: The following is to be added to Informative Annex A Product Safety Standards:
Product Standard Name Product Standard Number
<u>Household and Similar Electrical Appliances Part 2: Particular Requirements for Heating and Cooling UL 60335-2-40</u>
Substantiation: An update to the proposed revisions to the UL standards listed in Informative Annex A Product Safety Standards of NFPA 70, is required to reflect the addition of the following new UL standard:
• Household and Similar Electrical Appliances, Part 2: Particular Requirements for Heating and Cooling Equipment, UL 60335-2-40
Panel Meeting Action: Accept
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

ANNEX D—EXAMPLES

6-80 Log #875 NEC-P06 **Final Action: Reject**
(Example D.1(d))

Submitter: C. Douglas White, Center Point Energy / Rep. Edison Electric Institute/Electric Light & Power Group
Comment on Proposal No: 6-117a
Recommendation: The panel should have accepted this in principle and relocate Table 310.15(B)(7) to this new example to Example D7
Retain Table 310.15(B)(7) deleted by proposal 6-49a:
Example for Sizing of Service Conductors for Dwelling(s): Service conductors and feeders for certain dwellings are allowed to be sized per 310.15(B)(7). If a 175 ampere Service Rating is determined as the service disconnect rating per 230.79, the required service conductor ampacity is: 83% x 175 amperes = 145.25 amperes. If no other adjustments or corrections are required for the installation, then per Table 310.15(B)(16), a 1/0 AWG Cu or a 3/0 AWG Al 75 degree C conductor would have the required ampacity. Similarly, the following table of conductor values were determined using 310.15(B)(7). However, these tabulated values would not apply if other adjustments or correction factors apply.

Table 310.15(B)(7) Conductor Types and Sizes for 120/240-Volt, 3-Wire, Single-Phase Dwelling Services and Feeders. Conductor Types RHH, RHW, RHW-2, THHN, THHW, THW, THW-2, THWN, THWN-2, XHHW, XHHW-2, SE, USE, USE-2

	Conductor (AWG or kcmil)	
Service or Feeder Rating (Amperes)	Copper	Aluminum or Copper-Clad Aluminum
100	4	2
110	3	1
125	2	1/0
150	1	2/0
175	1/0	3/0
200	2/0	4/0
225	3/0	250
250	4/0	300
300	250	350
350	350	500
400	400	600

Substantiation: Removal of Table 310.15(B)(7)does not add clarity or usability of the NEC. Relocating it into example D7 retains the established trade practice that has proven useful to the installers.
Note: the ROP Draft shows this as Example D7 but the ROP shows it as D.1(d).
Panel Meeting Action: Reject
Panel Statement: The addition of the table will add more confusion than clarity.
Number Eligible to Vote: 10
Ballot Results: Affirmative: 9 Negative: 1
Explanation of Negative:
WALL, C.: See my explanation on comment 6-57

2-122 Log #1479 NEC-P02 **Final Action: Accept**
(Example D.4(b))

Submitter: Charles R. Miller, Charles R. Miller Electrical Education and Training
Comment on Proposal No: 2-265
Recommendation: Revise text to read as follows:
Each dwelling unit is equipped with an electric range of 8-kW nameplate rating, four 1.5-kW separately controlled 240-V electric space heaters, and a 2.5-kW, 240-V electric water heater. Assume range, space heater, and water heater kW ratings equivalent to kVA. <u>Calculate the load for the individual dwelling unit by the standard calculation (Part III of Article 220).</u> A common laundry facility is available to all tenants *[see 210.52(F), Exception No. 1]*. Area of each dwelling unit is 840 ft^2.
Calculated Load for Each Dwelling Unit *(see <u>Part II and Part III of</u> Article 220)*

Substantiation: This example is confusing because the title of this example references the optional calculation but the calculation for the individual dwelling units is by the standard calculation (Part III of Article 220). Text is needed to clarify that the individual dwelling units are not calculated by the optional calculation, but by the standard calculation.
Panel Meeting Action: Accept
Number Eligible to Vote: 13
Ballot Results: Affirmative: 13

ANNEX H—ADMINISTRATION AND ENFORCEMENT

1-114 Log #1204 NEC-P01 **Final Action: Reject**
(H.80.15(B)(4))

Submitter: Michael L. Last, Na'Alehu, HI
Comment on Proposal No: 1-187
Recommendation: Add new text to read as follows:
H.80.15(B)(4)i. A member of an organization that represents the non-union electrical workforce.
Substantiation: In order to equally and fairly represent all segments of the electrical workforce, representatives of both the union and the non-union workforce should be considered for membership on the Electrical Board. This is not to imply that either one of the organization's representative is more qualified for membership, but only to provide for a mechanism whereby, if the major workforce is not represented by a labor (union) organization, these members of the workforce will be equally represented. Circumstances can arise where the entire electrical workforce (not just the primary one) are not affiliated with any labor organization. The way the proposal is presently written can appear to offer a distinct advantage to the labor (union represented) electrical workforce.
Panel Meeting Action: Reject
Panel Statement: The panel reaffirms its action on Proposal 1-187.
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

Errata

NFPA 70®

National Electrical Code® (Report on Proposals)

Proposed 2014 Edition

Reference: **12-109 (Log #1618) Panel Meeting Action**

The National Electrical Code Technical Correlating Committee notes the following error in the ROP on NFPA 70®, *National Electrical Code®*.

1. Proposal 12-109 starting on page 675 of the ROP has missing text in the panel action. Shown below is the proposal with the panel action as it should have been published.

Report on Proposals – June 2013 **NFPA 70**

12-109 Log #1618 NEC-P12 **Final Action: Accept in Principle**
(645)

Panel Meeting Action: Combining the following panel actions:
12-111, 12-111a, 12-112, 12-114, 12-127, 12-128, 12-131,12-134, 12-137, 12-138, 12-139 and, 12-142.
yields a revised Article 645 that reads as follows:

ARTICLE 645
Information Technology Equipment

Informational Note: Text that is followed by a reference in brackets has been extracted from NFPA 75-2009, *Standard for the Protection of Information Technology Equipment*. Only editorial changes were made to the extracted text to make it consistent with this *Code*.

I. General

645.1 Scope. This article covers equipment, power-supply wiring, equipment interconnecting wiring, and grounding of information technology equipment and systems in an information technology equipment room.

> Informational Note: For further information, see NFPA 75-2009, *Standard for the Protection of Information Technology Equipment*, which covers the requirements for the protection of information technology equipment and information technology equipment areas.

645.2 Definitions.
Abandoned Supply Circuits and Interconnecting Cables. Installed supply circuits and interconnecting cables that are not terminated at equipment and not identified for future use with a tag.

Critical Operations Data System. An information technology equipment system that requires continuous operation for reasons of public safety, emergency management, national security, or business continuity.

Information Technology Equipment (ITE). Equipment and systems rated 600 volts or less, normally found in offices or other business establishments and similar environments classified as ordinary locations, that are used for creation and manipulation of data, voice, video, and similar signals that are not communications equipment as defined in Part I of Article 100 and do not process communications circuits as defined in 800.2.

Information Technology Equipment Room. A room within the information technology equipment area that contains the information technology equipment. [**75:**3.3.9]

Remote Disconnect Control. An electric device and circuit that controls a disconnecting means through a relay or equivalent device.