

**Public Comment No. 683-NFPA 70-2018 [Global Input]**

Type your content here ...~~physical~~ damage

Statement of Problem and Substantiation for Public Comment

I have to respectfully disagree with the concept that the term, "Physical damage" is well understood. My basis for this is the fact that there have been many, many attempts to define the term based on the various understandings that experienced electricians and inspectors have. Based on the committee's response to PI 1781, it appears that removing the adjective will increase the consistency of interpretation of the rules that pertain to damage, while entailing no loss.

Related Item

- Based to committee statement in reponse to PI 1781

Submitter Information Verification

Submitter Full Name: David Shapiro

Organization: Safety First Electrical

Street Address:

City:

State:

Zip:

Submittal Date: Wed Aug 15 12:34:48 EDT 2018

Committee: NEC-AAC

Copyright Assignment

I, David Shapiro, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am David Shapiro, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 979-NFPA 70-2018 [Global Input]

This Global Public Comment requests that each CMP review all products under their purview and determine whether reconditioning should be permitted. This public comment is submitted by a task group assigned by the NEC Correlating Committee. This task group was charged with reviewing Public Input 2935 which was resolved by CMP-1 during the first draft stage. This PI would have required that "Reconditioned Equipment" be "listed as "reconditioned" and the "original listing marks removed". This PI has ramifications that are global in nature and impacts all products referenced in the NEC under the purview of every CMP.

Additional Proposed Changes

<u>File Name</u>	<u>Description Approved</u>
NEMA-Position_Refubishing_on_ElecEquip.pdf	

Statement of Problem and Substantiation for Public Comment

This Public Comment is submitted on behalf of a task group appointed by the NEC® Correlating Committee. This Task Group was appointed to review the use of refurbished equipment throughout the NEC®. Task Group members are Jim Dollard, Robert Osborne, Jim Pierce, and David Williams. This task group has been charged with reviewing Public Input (PI) 2935 which was resolved by CMP-1 during the first draft stage. This PI would have required that "Reconditioned Equipment" be "listed as "reconditioned" and the "original listing marks removed". This PI has ramifications that are global in nature and impacts all products referenced in the NEC under the purview of every CMP.

Task group members noted that some types of equipment are capable of being reconditioned, then re-evaluated to ensure compliance with the applicable product standards. Other types of equipment do not lend themselves to reconditioning due to the complexity of the product, the manufacturing process, or the level of knowledge the company performing the reconditioning may need, etc.

The "NEMA Policy on Reconditioned Electrical Equipment" details the following aspects of Reconditioning of Electrical Equipment:

- Fundamental Tenets for Reconditioning Electrical Equipment
- Electrical Infrastructure and Worker Safety
- Integrity of Reconditioned Equipment
- Listing or Certification Marks
- UL Guidance on the UL Mark
- Components or Assemblies Not Suitable For Reconditioning (Appendix A)
- Components or Assemblies Which May Be Reconditioned (Appendix B)

A PDF copy of this NEMA policy is attached and may also be found on the internet at the following URL:

https://www.nema.org/Policy/Documents/NEMA-Position_Refubishing%20on%20ElecEquip.pdf

NEC® section 110.21(A)(2), which was new for the 2017 Edition of the NEC®, included marking requirements for "Reconditioned Equipment". PI 2935 would have required that "Reconditioned Equipment" be "listed as "reconditioned" and the "original listing marks removed". CMP 1 resolved this PI. Due to the global nature of PI 2935 this Task Group, appointed by the NEC® Correlating Committee, has developed a number of Public Comments, based on the products identified in the referenced NEMA document, to determine whether or not equipment can be reconditioned, and if reconditioned, what additional requirements apply.

While several Public Comments were developed for specific equipment by this task group, not all equipment was addressed (neither was all the equipment noted in the NEMA Policy document addressed). This Global Public

Comment requests each CMP to review the products required to be listed under their purview and determine whether reconditioning should be permitted. It is recommended that the NEMA Policy document be used as one of the guidelines in making this determination. It is also recommended that one of the following options/examples be chosen for listed equipment:

Option 1 - Equipment NOT suitable for Reconditioning (EXAMPLE):

695.10 Listed Equipment. Diesel engine fire pump controllers, electric fire pump controllers, electric motors, fire pump power transfer switches, foam pump controllers, and limited service controllers shall be listed for fire pump service. [20:9.5.1.1, 10.1.2.1, 12.1.3.1]

Fire pump controllers and transfer switches shall not be permitted to be reconditioned.

Option 2 - Equipment which MAY BE suitable for Reconditioning (EXAMPLE):

408.8 Reconditioned Equipment.

(A) Panelboards. The use of reconditioned panelboards shall comply with (1) and (2):

(1) Industrial and commercial panelboards shall be permitted to be reconditioned. Reconditioned equipment shall be listed as "reconditioned" and the original listing mark removed.

(2) Panelboards installed in dwelling units shall not be permitted to be reconditioned.

(B) Switchboards and Switchgear. Low voltage switchgear, medium voltage switchgear and switchboards shall be permitted to be reconditioned. Reconditioned equipment shall be listed as "reconditioned" and the original listing mark removed.

Note that equipment where no specific guidance is provided would be permitted to be reconditioned and would only be required to meet the marking requirements in 110.21(A)(2).

Related Public Comments for This Document

<u>Related Comment</u>	<u>Relationship</u>
Public Comment No. 980-NFPA 70-2018 [New Section after 240.87(B)]	
Public Comment No. 981-NFPA 70-2018 [New Section after 240.61]	
Public Comment No. 982-NFPA 70-2018 [New Section after 240.101(B)]	
Public Comment No. 983-NFPA 70-2018 [Section No. 695.10]	
Public Comment No. 984-NFPA 70-2018 [Section No. 700.5(C)]	
Public Comment No. 985-NFPA 70-2018 [Section No. 701.5(C)]	
Public Comment No. 986-NFPA 70-2018 [Section No. 702.5]	
Public Comment No. 987-NFPA 70-2018 [New Section after 408.7]	

Related Item

- PI 2935

Submitter Information Verification

Submitter Full Name: James Dollard

Organization: IBEW Local Union 98

Street Address:

City:

State:

Zip:**Submittal Date:** Tue Aug 21 08:08:39 EDT 2018**Committee:** NEC-AAC**Copyright Assignment**

I, James Dollard, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am James Dollard, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

NEMA Policy on Reconditioned Electrical Equipment

Executive Summary:

The option of reconditioning existing equipment (instead of purchasing new equipment) exists today. Proper electrical equipment reconditioning provides a means to extend the life of electrical products as well as an opportunity in some cases to update installed equipment with the latest performance and safety features. However, not all components of the electrical infrastructure are candidates for reconditioning.

There are a number of precautions that must be adhered to when reconditioning electrical equipment if that equipment is to operate safely and with acceptable performance. Those precautions are discussed below and include the use of design qualified parts, testing to industry-recognized safety standards, original manufacturer specification and/or recommendations, when possible, and reconditioning performed by qualified personnel. The integrity of reconditioned electrical equipment must be established by documenting and demonstrating that component replacement has not compromised the manufacturer's original specifications and accepted industry standards.

The third party certification mark must be removed or obliterated from reconditioned electrical products to indicate that an evaluation of the reconditioning process or reconditioned product has not been conducted by the original third party.

As guidance, Appendix B provides a list of electrical products and components that are considered by NEMA suitable for reconditioning and Appendix A provides a list of electrical products considered not suitable for reconditioning. Medical Imaging Equipment is specifically not addressed by this policy (reference MITA 1, Good Refurbishment Practices for Medical Imaging Equipment).

Introduction:

The U.S. electrical industry includes discussions on implementing new technologies to enhance existing electrical infrastructure. Further, sustainability and safeguarding the environment are growing in importance. In the midst of this is the option for reconditioning existing equipment. Paramount in all this is the fundamental priority that all electrical systems operate while safe-guarding personnel and infrastructure from potential hazards (electrical, mechanical, fire, etc.). This forms the basis for the NEMA position on reconditioning electrical products.

Given that electrical systems are diverse in design, function, and application, not all components of the electrical infrastructure are candidates for reconditioning.

Definition:

Reconditioning: the process of restoring electromechanical systems, equipment, apparatus or components to operating conditions as recommended by the

manufacturer's instructions, using only design qualified parts. Reverse engineered parts (designs copied from existing parts by other manufacturers) are not considered to be "design qualified parts" unless specifically design verified under applicable Standards. Electrical industry practitioners and other organizations may also use the following terms/words to describe the process of reconditioning: remanufacturing, refurbishing, recycling, repairing, restoring, rebuilding, reengineering, and reusing.

In addition to design considerations, it is often impossible to obtain the service records, application environment, and operation parameters of all electrical components. Not having access to such information could have an adverse impact on the final safety and reliability of refurbished or reconditioned equipment. While NEMA supports the reconditioning of some electrical equipment, the components listed in Appendix A are not recommended for reconditioning, unless otherwise indicated by the original manufacturer. Normal servicing of equipment that remains within a facility should not be considered reconditioning or refurbishing. For electrical components suitable for reconditioning listed in Appendix B, the following fundamental tenets have been established.

Fundamental Tenets for Reconditioning Electrical Equipment

- Reconditioning electrical equipment may be a viable option for extending operational lifetime of equipment and enhancing equipment with additional features.
- Electrical equipment reconditioning activity must be based on available guidance documentation from the Original Equipment Manufacturer, or industry-developed standards. Where any conflict in guidance is noted between the OEM and industry standards, the OEM guidance should take precedence.
- Electrical equipment must be reconditioned and qualified to an industry-developed standard that ensures equipment is in a usable and safe operating condition. An industry-developed standard is a widely agreed upon rule, set of rules, procedures or requirements for a product, assembly or process which are developed by members or organizations of an aggregate of manufacturing and technically productive enterprises in a particular field. Products deemed to be candidates for reconditioning must be reconditioned and qualified to industry standards containing the most relevant and critical design aspects, testing criteria and manufacturing specifications when the item was built.
- Reconditioning work must be performed by qualified personnel.
- Electrical equipment that has been exposed to adverse conditions, such as fire, water damage, etc., may not be suitable for reconditioning.
- A comprehensive assessment of the electrical equipment being considered for reconditioning with service records, application, environment, service life, and operating parameters is critical before deciding to pursue reconditioning of the electrical equipment and system. Trained, skilled technicians should be able to assess whether a device or system is suitable for reconditioning through physical inspection and test.
- Appendix A provides guidance on which components or assemblies of the electrical system are not suitable for reconditioning because they may pose a

hazard. Appendix B provides guidance on the components or assemblies are suitable for reconditioning.

- Reconditioning electrical equipment must utilize electrical product safety standards as they contain design aspects, testing criteria and manufacturing specifications to ensure a given product will function as intended. These requirements are established to deliver a usable and safe operating condition as a key component of intended product functionality.

Electrical Infrastructure and Worker Safety

Electrical equipment that is properly installed, tested, maintained, and operated will provide reliable power as well as protect the electrical infrastructure. The reconditioning of electrical equipment requires the electrical industry, in collaboration with manufacturers, to establish performance specifications and accepted industry standards to help ensure safe and reliable equipment that help protect our electrical infrastructure so workers and users can continue to benefit from a safe and effective electrical system. Reconditioning standards must include prescriptive actions and performance requirements that result in equipment that complies with standards that include but are not limited to CSA, IEC, IEEE, NEC, OSHA, NFPA 70E, NFPA 70B, NETA ATS, NETA MTS, and EASA AR100 for example. Qualified personnel must possess the knowledge of how to assess equipment condition, potential hazards, and specifications to accurately determine the suitability for reconditioning. A safe and reliable electrical infrastructure that can be safely maintained is dependent on compliance with manufacturers' instructions, qualified workers, proper maintenance, and accepted industry standards for reconditioning activities.

Electrical Equipment Reliability, Performance and Safety

Proper electrical equipment reconditioning provides a means to extend the life of electrical products as well as an opportunity to update installed equipment with the latest performance and safety features. Establishing well defined guidelines for those performing the reconditioning activity, based on original manufacturer's requirements, creates a solid foundation for the electrical industry and users. It is paramount that reconditioned electrical equipment be reliable in not only providing power, but also in safely performing its intended function as part of a safe operating electrical system. Understanding the environment, electrical load characteristics and historical maintenance performed on equipment being considered for reconditioning are all important parts of an assessment for reconditioning that can have a significant bearing on reliability, performance and safety. The electrical equipment manufacturer is the foremost authority on the design, performance and intended safe application of their product. Reconditioned electrical equipment must not compromise the reliability, performance, safe operation, or maintenance of the electrical system.

Integrity of Reconditioned Equipment

Reconditioned electrical equipment must comply with all applicable standards at the time the equipment was initially built as a minimum as well as the original manufacturer's performance requirements in accordance with the nameplate markings and ratings. Replacement parts shall meet the design criteria (form, fit, and function) for the device to perform its intended function and provide safe operation. Replacement parts shall not include counterfeit parts (i.e., parts that have been misrepresented to be an authorized item of the legally authorized source.) Equipment shall operate safely in its intended application after reconditioning occurs. Care must be taken to ensure specific operations such as timing, sequencing, control, transfer, etc. continue to function in the manner originally intended, unless changes are specified during the reconditioning process. The integrity of reconditioned electrical equipment must be established by documenting and demonstrating that component replacement and performance changes have not compromised the manufacturer's specifications and accepted industry standards.

Listing or Certification Marks

NEMA members manufacture products that are more than likely to be evaluated as part of a third party certification program to nationally recognized safety standards. These products can be marked with a listing or certification mark when the products are manufactured and shipped from the factory. The organization that reconditions the product is responsible for adhering to the guidelines from the issuing agency authorizing the mark to determine if the mark can remain on the product after reconditioning. The organization that reconditions is responsible for any actions necessary for the mark to remain on the product (analysis, testing, etc.). Otherwise, reconditioned electrical products must have their mark removed or obliterated to indicate that an evaluation of the reconditioning process has not been conducted by the original third party.

The organization that reconditions the product is additionally responsible for applying a mark or seal that indicates that the equipment has been reconditioned. This mark must provide traceability to the reconditioning organization in the event that it is necessary to determine the details of who reconditioned the equipment and the report on what was completed during this process.

There are a number of NEMA products that are not allowed to be reconditioned due to the inherent safety characteristics and requirements for those products to be evaluated according to a regular follow up program to evaluate the safety performance requirements as a condition of maintaining the listing or certification mark. This process cannot be applied to reconditioned electrical products since these are normally destructive tests and sample sets of reconditioned products are not possible due to limited quantities or ratings of specific devices.

UL Guidance on the UL Mark

When the manufacturer places the UL Mark on the product at the factory, it is their attestation that the product complies with the applicable requirements. Unless there is further oversight or review/inspection (field inspection) UL cannot ascertain that the

product continues to comply with all requirements should field repairs, modifications or component replacements be made to the product.

Obviously there is little control over what manufacturers will or can do to equipment which left the factory with a certification mark. UL has created rebuilt categories where the reconditioning of product is done in an organized consistent manner under the supervision of UL's FUS (Follow-Up Services) field representatives. In these cases the first action conducted with equipment being rebuilt is the removal of the initial certification mark (if provided). Upon completion of the reconditioning, in accordance with the surveillance document, the manufacturer is permitted to affix a mark which clearly identifies the product as reconditioned.

Cases where a reconditioner is instructed to NOT remove any certification mark will result in confusion. Clearly such equipment in the field, which has undergone modification or reconditioning, is ineligible to bear a mark which designates a compliance with a certification standard.

APPENDIX A

COMPONENTS OR ASSEMBLIES NOT SUITABLE FOR RECONDITIONING*

Adjustable speed drives
Arc fault circuit breakers
Ballasts
Busway (mylar wrapped)
Busway (powder coated)
Cable tray
Cast resin transformers
Components containing semiconductors and transistors
Control transformers
Dry type transformers
Electrical Connectors
Electrical submetering equipment
Electrical vehicle supply equipment
Enclosed switches
Fire detectors, smoke alarms, co detectors
Fire pump controllers
Flexible and extension cords
Flexible conduit
Ground fault circuit breakers
High performance wire and cable
Lighting controls
Liquid filled transformers
Low and medium voltage fuse holders
Low and medium voltage non-renewable fuses
Low voltage power circuit breaker electronic trip units
Luminaires
Meters (electromechanical, electronic or digital)
Meter sockets
Molded case circuit breakers
Non-Metallic conduit, tubing, raceways and fittings
Non-metallic surface raceways and fittings
Outlet and junction boxes
Overload relays
Pin and sleeve plugs receptacles and connectors
Power and control cable
Protective relays (electronic or digital)
Residential panel boards
Solid state contactors and starters
Solid state drives
Strut type channel raceway
Surface metal raceways and fittings
Surge protective devices
Transfer switches
Wire or cable
Wireway
Wiring devices

*The components or products listed above are not recommended for reconditioning, unless otherwise indicated by the original manufacturer.

APPENDIX B

COMPONENTS OR ASSEMBLIES WHICH MAY BE RECONDITIONED

Electromechanical protective relays, and current transformers

High voltage circuit breakers

Industrial and commercial panel boards

Low and medium voltage power circuit breakers

Low and medium voltage replaceable link fuses

Low voltage switchgear

Manual and magnetic controllers

Medium voltage switchgear

Metallic conduit, tubing, raceways and fittings

Motor control centers

Motors

Switchboards

Uninterruptible Power Supply Equipment

**Public Comment No. 1248-NFPA 70-2018 [Global Input]**

The Correlating Committee directs Panel 1 to review all references to Article 310 under their purview. Article 310 has been divided into Article 310, Conductors for General Wiring, and Article 311, Medium Voltage Conductors and Cables for usability and clarity. Panel 1 shall appoint a task group to review all necessary references to verify their accuracy and submit Public Comments where necessary. This action instructs Panel 1 to submit a Public Comment(s) within the time frame required in the NEC schedule. This action shall be considered as a public comment.

Additional Proposed Changes

<u>File Name</u>	<u>Description Approved</u>
CN_270.pdf	70_CN270

Statement of Problem and Substantiation for Public Comment

NOTE: This Public Comment appeared as CC Note No. 270 in the First Draft Report.

The Correlating Committee directs Panel 1 to review all references to Article 310 under their purview. Article 310 has been divided into Article 310, Conductors for General Wiring, and Article 311, Medium Voltage Conductors and Cables for usability and clarity. Panel 1 shall appoint a task group to review all necessary references to verify their accuracy and submit Public Comments where necessary. This action instructs Panel 1 to submit a Public Comment(s) within the time frame required in the NEC schedule. This action shall be considered as a public comment.

Related Item

- Correlating Committee Note No. 270

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Fri Aug 24 14:43:20 EDT 2018
Committee: NEC-P01

Copyright Assignment

I, CC on NEC-AAC, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am CC on NEC-AAC, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Correlating Committee Note No. 270-NFPA 70-2018 [Global Input]****Submitter Information Verification**

Submitter Full Name: Sarah Caldwell

Committee:

Submittal Date: Fri May 11 17:54:55 EDT 2018

Committee Statement and Meeting Notes

Committee Statement: The Correlating Committee directs all panels to review all references to Article 310 under their purview. Article 310 has been divided into Article 310, Conductors for General Wiring, and Article 311, Medium Voltage Conductors and Cables for usability and clarity. Each panel shall appoint a task group to review all necessary references to verify their accuracy and submit Public Comments where necessary. This action instructs the referenced panels to submit a Public Comment(s) within the time frame required in the NEC schedule.

This action shall be considered as a public comment.

Ballot Results

✔ This item has passed ballot

12 Eligible Voters

0 Not Returned

12 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Affirmative All

Brunssen, James E.

Dressman, Kevin L.

Hickman, Palmer L.

Hittinger, David L.

Holub, Richard A.

Johnston, Michael J.

Kovacik, John R.

Manche, Alan

McDaniel, Roger D.

Pierce, James F.

Saporita, Vincent J.

Williams, David A.

**Public Comment No. 1249-NFPA 70-2018 [Global Input]**

The Correlating Committee directs Panel 1 to review all Articles, within their purview, that supplement or modify (90.3) GFCI requirements in 210.8 for correlation, clarity, usability and standardized format. A Correlating Committee Task Group will be appointed and will submit comments where necessary.

This action shall be considered as a public comment.

Additional Proposed Changes

<u>File Name</u>	<u>Description Approved</u>
CN_152.pdf	70_CN152

Statement of Problem and Substantiation for Public Comment

NOTE: This Public Comment appeared as CC Note No. 152 in the First Draft Report.

The Correlating Committee directs Panel 1 to review all Articles, within their purview, that supplement or modify (90.3) GFCI requirements in 210.8 for correlation, clarity, usability and standardized format. A Correlating Committee Task Group will be appointed and will submit comments where necessary.

This action shall be considered as a public comment.

Related Item

- Correlating Committee Note No. 152

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC

Organization: NEC Correlating Committee

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 24 14:48:29 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, CC on NEC-AAC, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am CC on NEC-AAC, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Correlating Committee Note No. 152-NFPA 70-2018 [Global Input]

Submitter Information Verification

Submitter Full Name: Erik Hohengasser

Committee:

Submittal Date: Thu May 10 18:00:52 EDT 2018

Committee Statement

Committee Statement: The Correlating Committee directs each panel to review all Articles, within their purview, that supplement or modify (90.3) GFCI requirements in 210.8 for correlation, clarity, usability and standardized format. A Correlating Committee Task Group will be appointed and will submit comments where necessary.

This action shall be considered as a public comment.

Ballot Results

✔ **This item has passed ballot**

12 Eligible Voters

0 Not Returned

12 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Affirmative All

Brunssen, James E.

Dressman, Kevin L.

Hickman, Palmer L.

Hittinger, David L.

Holub, Richard A.

Johnston, Michael J.

Kovacik, John R.

Manche, Alan

McDaniel, Roger D.

Pierce, James F.

Saporita, Vincent J.

Williams, David A.



Public Comment No. 685-NFPA 70-2018 [Global Input]

Type your content here ...

Informational Note: One example of a maximum height for easy reach is 2.0 m (6 ft 7 in.), used in Sections 240.24, 404.8, 490.41, 547.9, and 550.32.

Informational Note: Equipment placement that requires a user to reach more than 0.6m (2 ft) past an obstruction could violate the Americans with Disabilities Act

Statement of Problem and Substantiation for Public Comment

In light of the CMP's response to PI 1783, it is clear that, however useful it might be to have specific guidance, mandatory requirements have no place in definitions. Information in INs is by definition not mandatory, but still can provide useful guidance.

Related Item

- PI 1783 contains the larger rationale for adding this information; this revision seeks to address the CMPs legitimate objection to the form in which the change was initially proposed.

Submitter Information Verification

Submitter Full Name: David Shapiro

Organization: Safety First Electrical

Street Address:

City:

State:

Zip:

Submittal Date: Wed Aug 15 12:44:18 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, David Shapiro, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am David Shapiro, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 698-NFPA 70-2018 [Section No. 90.1(B)]****(B) Adequacy.**

This *Code* contains provisions that are considered necessary for safety. Compliance therewith, periodic inspections thereafter as may be specified by the Authority having Jurisdiction, and proper maintenance result in an installation that is essentially free from hazard but not necessarily efficient, convenient, or adequate for good service or future expansion of electrical use.

Informational Note: Hazards often occur because of overloading of wiring systems by methods or usage not in conformity with this *Code*. This occurs because initial wiring did not provide for increases in the use of electricity. An initial adequate installation and reasonable provisions for system changes provide for future increases in the use of electricity.

Statement of Problem and Substantiation for Public Comment

Mr. Cook's addition does not impose a requirement on jurisdictional authorities, but it does serve an important purpose. The CPSC research that found a far-greater incidence of electrical fires in homes more than 40 years old resulted in a recommendation that such homes have electrical reinspection every 20 years. NFPA 73 provides guidelines for this. Jurisdictions often require inspectable documentation of maintenance for equipment such as switchgear. Systematic reinspection began in Detroit in 1911, and at least shortly thereafter in many cities, at least for certain occupancies such as theaters. This section does not impose requirements. However, just as it makes sense to mention the need for maintenance--not of every piece of equipment, not equally in all occupancies--it strikes me as highly appropriate to at least nod to the value of periodic reinspection, whether by jurisdictional authorities, qualified electricians, or others who recognize that no equipment lasts forever, that "trivial" repairs or modifications can result in significant hazard, and that checking can save lives.

Related Item

- This modifies PI 1234 in order to maintain the valuable addition while making clear that it is not intended to override the authority of AHJs.

Submitter Information Verification

Submitter Full Name: David Shapiro

Organization: Safety First Electrical

Street Address:

City:

State:

Zip:

Submission Date: Wed Aug 15 20:06:27 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, David Shapiro, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am David Shapiro, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 1197-NFPA 70-2018 [Section No. 90.2(A)]****(A)** Covered.

This *Code* covers the installation and removal of electrical conductors, equipment, and raceways; signaling and communications conductors, equipment, and raceways; and optical fiber cables for the following:

- (1) Public and private premises, including buildings, structures, mobile homes, recreational vehicles, and floating buildings
- (2) Yards, lots, parking lots, carnivals, and industrial substations
- (3) Installations of conductors and equipment that connect to the supply of electricity
- (4) Installations used by the electric utility, such as office buildings, warehouses, garages, machine shops, and recreational buildings, that are not an integral part of a generating plant, substation, or control center
- (5) Installations supplying shore power to ships and watercraft, including monitoring of leakage current
- (6) Systems used to export electric power from vehicles, including outlets mounted on the vehicle

Statement of Problem and Substantiation for Public Comment

This Public Comment asks that CMP-1 reconsider the decision to resolve PI 2442 and consider changes to Section 90.2 as detailed in PI 2442. The Committee Statement supporting the resolution for PI 2442 states that: "The submitter's intent is already covered by 90.2(A)(3) regarding the supply of electricity." Although this acknowledgement at the First Draft meeting is appreciated, the Committee Statement is not a substitute for clear and enforceable Code text. In fact, there is an inconsistent interpretation and understanding of the scope among some CMP12 members that leads to the inference that the requirement in 90.2(B)(1) is a generic exclusion applying to any electrical equipment on all automotive vehicles other than mobile homes and recreational vehicles. A revision to 90.2(A) is needed to clarify the scope and definitively indicate that equipment used to transfer power from an electric vehicle's storage battery is under the purview of the NEC®. This in turn will allow for consistent and correct application of the Code.

Additionally, CMP 12 revised the Scope of Article 625 (reference FR 8385), and the Correlating Committee has sent this FR to CMP 1 for information (CN 190). This Committee Note highlights the need to align verbiage from this FR with Section 90.2. This Public Comment seeks to codify the position of CMP 1 that this type of equipment is covered by the NEC®, and also to clearly identify the specific equipment covered, consistent with Section 625.1.

Related Item

- PI2442

Submitter Information Verification

Submitter Full Name: Joseph Bablo

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 24 11:10:23 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Joseph Bablo, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Joseph Bablo, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 1346-NFPA 70-2018 [Section No. 90.2(A)]****(A) Covered.**

This *Code* covers the installation and removal of electrical conductors, equipment, and raceways; signaling and communications conductors, equipment, and raceways; and optical fiber cables for the following:

- (1) Public and private premises, including buildings, structures, mobile homes, recreational vehicles, and floating buildings
- (2) Yards, lots, parking lots, carnivals, and industrial substations
- (3) Installations of conductors and equipment that connect to the supply of electricity
- (4) Installations used by the electric utility, such as office buildings, warehouses, garages, machine shops, and recreational buildings, that are not an integral part of a generating plant, substation, or control center
- (5) Installations supplying shore power to ships and watercraft, including monitoring of leakage current marinas and boatyards

Statement of Problem and Substantiation for Public Comment

The proposed wording including all "ships and watercraft" will have unintended consequences and cover large ships and watercraft already under the jurisdiction of the US Coast Guard, with safety standards for shore to ship power systems covered by the IEEE 80005 series of standards. We believe CMP1 intended to address the safety of power systems from shore to small watercraft and the moorage of floating buildings covered by Article 555 and stated in 555.1. CMP1 provided no data or technical substantiation that the proposal is intended to address large ships and terminals, such as cruise ships, LNG carriers, oil tankers, etc. In addition, the proposed wording requiring the monitoring of leakage current is overly restrictive in Article 90.2(A) and is not appropriate for this section.

Related Item

- FR-8370

Submitter Information Verification

Submitter Full Name: Louis Barrios

Organization: Shell Global Solutions

Affiliation: American Chemistry Council (ACC)

Street Address:

City:

State:

Zip:

Submission Date: Mon Aug 27 11:51:25 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Louis Barrios, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Louis Barrios, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 522-NFPA 70-2018 [Section No. 90.2(A)]****(A) Covered.**

This *Code* covers the installation and removal of electrical conductors, equipment, and raceways; signaling and communications conductors, equipment, and raceways; and optical fiber cables for the following:

- (1) Public and private premises, including buildings, structures, mobile homes, recreational vehicles, and floating buildings
- (2) Yards, lots, parking lots, carnivals, and industrial substations
- (3) Installations of conductors and equipment that connect to the supply of electricity
- (4) Installations used by the electric utility, such as office buildings, warehouses, garages, machine shops, and recreational buildings, that are not an integral part of a generating plant, substation, or control center
- (5) Installations ~~supplying shore power to ships and watercraft~~ covered in 555.1 , including monitoring of leakage current

Statement of Problem and Substantiation for Public Comment

This proposed revision is submitted to address concerns that the monitoring of leakage current would or could be applied outside the present scope of Article 555.

Related Item

- FR 8206

Submitter Information Verification

Submitter Full Name: James Dollard

Organization: IBEW Local Union 98

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 10 10:12:03 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, James Dollard, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am James Dollard, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 775-NFPA 70-2018 [Section No. 90.2(A)]****(A) Covered.**

This *Code* covers the installation and removal of electrical conductors, equipment, and raceways; signaling and communications conductors, equipment, and raceways; and optical fiber cables for the following:

- (1) Public and private premises, including buildings, structures, mobile homes, recreational vehicles, and floating buildings
- (2) Yards, lots, parking lots, carnivals, and industrial substations
- (3) Installations of conductors and equipment that connect to the supply of electricity
- (4) Installations used by the electric utility, such as office buildings, warehouses, garages, machine shops, and recreational buildings, that are not an integral part of a generating plant, substation, or control center
- (5) Installations supplying shore power to ships and watercraft, including monitoring of leakage current

Additional Proposed Changes

<u>File Name</u>	<u>Description Approved</u>
CN_126.pdf	70_CN126

Statement of Problem and Substantiation for Public Comment

NOTE: This Public Comment appeared as CC Note No. 126 in the First Draft Report on First Revision No. 8370.

It was the action of the Correlating Committee that this first revision be referred to Code-Making Panel 7 for information.

This action will be considered as a public comment.

Related Item

- First Revision No. 8370

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC

Organization: NEC Correlating Committee

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 17 11:14:25 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, CC on NEC-AAC, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am CC on NEC-AAC, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Correlating Committee Note No. 126-NFPA 70-2018 [Detail]****Submitter Information Verification**

Submitter Full Name: Erik Hohengasser

Committee:

Submittal Date: Thu May 10 14:27:55 EDT 2018

Committee Statement and Meeting Notes

Committee Statement: It was the action of the Correlating Committee that this first revision be referred to Code-Making Panel 7 for information.

This action will be considered as a public comment.

[First Revision No. 8370-NFPA 70-2018 \[Detail\]](#)

Ballot Results

✔ This item has passed ballot

12 Eligible Voters

0 Not Returned

12 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Affirmative All

Brunssen, James E.

Dressman, Kevin L.

Hickman, Palmer L.

Hittinger, David L.

Holub, Richard A.

Johnston, Michael J.

Kovacik, John R.

Manche, Alan

McDaniel, Roger D.

Pierce, James F.

Saporita, Vincent J.

Williams, David A.



Public Comment No. 1351-NFPA 70-2018 [Section No. 90.2(B)]

(B) Not Covered.

This Code does not cover the following:

- (1) Installations in ships, watercraft other than floating buildings , railway rolling stock, aircraft, or automotive vehicles other than mobile homes and recreational vehicles

Informational Note: Although the scope of this Code indicates that the Code does not cover installations in ships, portions of this Code are incorporated by reference into Title 46, Code of Federal Regulations, Parts 110–113.

- (2) Installations underground in mines and self-propelled mobile surface mining machinery and its attendant electrical trailing cable
- (3) Installations of railways for generation, transformation, transmission, energy storage, or distribution of power used exclusively for operation of rolling stock or installations used exclusively for signaling and communications purposes
- (4) Installations of communications equipment under the exclusive control of communications utilities located outdoors or in building spaces used exclusively for such installations
- (5) Installations under the exclusive control of an electric utility where such installations
 - (6) Consist of service drops or service laterals, and associated metering, or
 - (7) Are on property owned or leased by the electric utility for the purpose of communications, metering, generation, control, transformation, transmission, energy storage, or distribution of electric energy, or
 - (8) Are located in legally established easements or rights-of-way, or
 - (9) Are located by other written agreements either designated by or recognized by public service commissions, utility commissions, or other regulatory agencies having jurisdiction for such installations. These written agreements shall be limited to installations for the purpose of communications, metering, generation, control, transformation, transmission, energy storage, or distribution of electric energy where legally established easements or rights-of-way cannot be obtained. These installations shall be limited to federal lands, Native American reservations through the U.S. Department of the Interior Bureau of Indian Affairs, military bases, lands controlled by port authorities and state agencies and departments, and lands owned by railroads.

Informational Note to (4) and (5): Examples of utilities may include those entities that are typically designated or recognized by governmental law or regulation by public service/utility commissions and that install, operate, and maintain electric supply (such as generation, transmission, or distribution systems) or communications systems (such as telephone, CATV, Internet, satellite, or data services). Utilities may be subject to compliance with codes and standards covering their regulated activities as adopted under governmental law or regulation. Additional information can be found through consultation with the appropriate governmental bodies, such as state regulatory commissions, the Federal Energy Regulatory Commission, and the Federal Communications Commission.

Statement of Problem and Substantiation for Public Comment

PI -1010 should have been rejected. The phrases "other than floating buildings" and "other than mobile homes and recreational vehicles" were added to 90.2(B)(1) to clarify that not all watercraft and automotive vehicles are excluded from coverage by the NEC. Removing these phrases per FR-8211 will re-introduce confusion and potential conflict with other sections of the Code that the original addition of these phrases sought to correct.

Related Item

- FR-8211

Submitter Information Verification

Submitter Full Name: Louis Barrios

Organization: Shell Global Solutions

Affiliation: American Chemistry Council (ACC)

Copyright Assignment:

Street Address:

I, Louis Barrios, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Louis Barrios, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

Signature Date:

Mon Aug 27 12:28:38 EDT 2018

Committee:

NEC-POF

**Public Comment No. 816-NFPA 70-2018 [Section No. 90.2(B)]****(B) Not Covered.**

This Code does not cover the following:

- (1) Installations in ships, watercraft other than floating buildings , railway rolling stock, aircraft, or automotive vehicles other than mobile homes and recreational vehicles

Informational Note: Although the scope of this Code indicates that the Code does not cover installations in ships, portions of this Code are incorporated by reference into Title 46, Code of Federal Regulations, Parts 110–113.

- (2) Installations underground in mines and self-propelled mobile surface mining machinery and its attendant electrical trailing cable
- (3) Installations of railways for generation, transformation, transmission, energy storage, or distribution of power used exclusively for operation of rolling stock or installations used exclusively for signaling and communications purposes
- (4) Installations of communications equipment under the exclusive control of communications utilities located outdoors or in building spaces used exclusively for such installations
- (5) Installations under the exclusive control of an electric utility where such installations
 - (6) Consist of service drops or service laterals, and associated metering, or
 - (7) Are on property owned or leased by the electric utility for the purpose of communications, metering, generation, control, transformation, transmission, energy storage, or distribution of electric energy, or
 - (8) Are located in legally established easements or rights-of-way, or
 - (9) Are located by other written agreements either designated by or recognized by public service commissions, utility commissions, or other regulatory agencies having jurisdiction for such installations. These written agreements shall be limited to installations for the purpose of communications, metering, generation, control, transformation, transmission, energy storage, or distribution of electric energy where legally established easements or rights-of-way cannot be obtained. These installations shall be limited to federal lands, Native American reservations through the U.S. Department of the Interior Bureau of Indian Affairs, military bases, lands controlled by port authorities and state agencies and departments, and lands owned by railroads.

Informational Note to (4) and (5): Examples of utilities may include those entities that are typically designated or recognized by governmental law or regulation by public service/utility commissions and that install, operate, and maintain electric supply (such as generation, transmission, or distribution systems) or communications systems (such as telephone, CATV, Internet, satellite, or data services). Utilities may be subject to compliance with codes and standards covering their regulated activities as adopted under governmental law or regulation. Additional information can be found through consultation with the appropriate governmental bodies, such as state regulatory commissions, the Federal Energy Regulatory Commission, and the Federal Communications Commission.

Statement of Problem and Substantiation for Public Comment

This language was removed during the first revision process even though it is repetitive it does assist in the enforcement of the NEC

Related Item

- FR-8211

Submitter Information Verification

Submitter Full Name: James Rogers

Organization: Towns Of Oak Bluffs, Tisbury,
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 19 16:58:14 EDT 2018
Committee: NEC-P01

Copyright Assignment

I, James Rogers, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am James Rogers, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 1743-NFPA 70-2018 [Section No. 90.4]

90.4 Enforcement.

This *Code* is intended to be suitable for mandatory application by governmental bodies that exercise legal jurisdiction over electrical installations, including signaling and communications systems, and for use by insurance inspectors. The authority having jurisdiction for enforcement of the *Code* has the responsibility for making interpretations of the rules, for deciding on the approval of equipment and materials, and for granting the special permission contemplated in a number of the rules.

By special permission, the authority having jurisdiction may ~~waive~~ allow for 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 ~~where specific rules are not established in this~~ *Code* .

This *Code* may require new products, constructions, or materials that may not yet be available at the time the *Code* is adopted. In such event, the authority having jurisdiction may permit the use of the products, constructions, or materials that comply with the most recent previous edition of this *Code* adopted by the jurisdiction.

Statement of Problem and Substantiation for Public Comment

Here is one way this section can be interpreted. This is NOT a code or a standard it is merely a guideline! the AHJ can change ANYTHING. so thank you for clearing this up. The NEC is a guideline for AHJ's on electrical installations.

Please reconsider the message the CMP is sending. The substantiation is below

2017 NEC Handbook's notes.

The AHJ is responsible for interpreting the NEC. Using special permission (written consent), the AHJ may permit alternative methods where specific rules are not established in the NEC. For example, the AHJ may waive specific requirements in industrial occupancies, research and testing laboratories, and other occupancies where the specific type of installation is not covered in the NEC.

Related Item

- PI157

Submitter Information Verification

Submitter Full Name: Alfio Torrisi

Organization: Master

Street Address:

City:

State:

Zip:

Submittal Date: Wed Aug 29 19:40:00 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Alfio Torrisi, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Alfio Torrisi, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 753-NFPA 70-2018 [Article 100]

Article 100 Definitions

Scope. This article contains only those definitions essential to the application of this *Code*. It is not intended to include commonly defined general terms or commonly defined technical terms from related codes and standards. In general, only those terms that are used in two or more articles are defined in Article 100. Definitions are also found in XXX.2 sections of other articles.

Part I of this article contains definitions intended to apply wherever the terms are used throughout this *Code*. Part II contains definitions applicable to installations and equipment operating at over 1000 volts, nominal. Part III contains definitions applicable to Hazardous (Classified) Locations.

Part I. General

Accessible (as applied to equipment).

Capable of being reached for operation, renewal, and inspection. (CMP-1)

Accessible (as applied to wiring methods).

Capable of being removed or exposed without damaging the building structure or finish or not permanently closed in by the structure or finish of the building. (CMP-1)

Accessible, Readily (Readily Accessible).

Capable of being reached quickly for operation, renewal, or inspections without requiring those to whom ready access is requisite to take actions such as to use tools (other than keys), to climb over or under, to remove obstacles, or to resort to portable ladders, and so forth. (CMP-1)

Informational Note: Use of keys is a common practice under controlled or supervised conditions and a common alternative to the ready access requirements under such supervised conditions as provided elsewhere in the NEC.

Adjustable Speed Drive.

Power conversion equipment that provides a means of adjusting the speed of an electric motor. (CMP-11)

Informational Note: A variable frequency drive is one type of electronic adjustable speed drive that controls the rotational speed of an ac electric motor by controlling the frequency and voltage of the electrical power supplied to the motor.

Adjustable Speed Drive System.

A combination of an adjustable speed drive, its associated motor(s), and auxiliary equipment. (CMP-11)

Ampacity.

The maximum current, in amperes, that a conductor can carry continuously under the conditions of use without exceeding its temperature rating. (CMP-6)

Appliance.

Utilization equipment, generally other than industrial, that is normally built in standardized sizes or types and is installed or connected as a unit to perform one or more functions such as clothes washing, air-conditioning, food mixing, deep frying, and so forth. (CMP-17)

Approved.

Acceptable to the authority having jurisdiction. (CMP-1)

Arc-Fault Circuit Interrupter (AFCI).

A device intended to provide protection from the effects of arc faults by recognizing characteristics unique to arcing and by functioning to de-energize the circuit when an arc fault is detected. (CMP-2)

Askarel.

A generic term for a group of nonflammable synthetic chlorinated hydrocarbons used as electrical insulating media. (CMP-9)

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.

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. (CMP-18)

Authority Having Jurisdiction (AHJ).

An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure. (CMP-1)

Informational Note: The phrase “authority having jurisdiction,” or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

Automatic.

Performing a function without the necessity of human intervention. (CMP-1)

Bathroom.

An area including a basin (sink) with one or more of the following: a toilet, a urinal, a tub, a shower, a bidet, or similar plumbing fixtures. (CMP-2)

Battery System.

Interconnected battery subsystems consisting of one or more storage batteries and battery chargers, and can include inverters, converters, and associated electrical equipment. (CMP-13)

Bonded (Bonding).

Connected to establish electrical continuity and conductivity. (CMP-5)

Bonding Conductor or Jumper.

A reliable conductor to ensure the required electrical conductivity between metal parts required to be electrically connected. (CMP-5)

Bonding Jumper, Equipment.

The connection between two or more portions of the equipment grounding conductor. (CMP-5)

Bonding Jumper, Main.

The connection between the grounded circuit conductor and the equipment grounding conductor, or the supply-side bonding jumper, or both, at the service or at a supply-side disconnect(s). (CMP-5)

Bonding Jumper, Supply-Side.

A conductor installed on the supply side of a service or within a service equipment enclosure(s), or for a separately derived system, that ensures the required electrical conductivity between metal parts required to be electrically connected. (CMP-5)

Bonding Jumper, System.

The connection between the grounded circuit conductor and the supply-side bonding jumper, or the equipment grounding conductor, or both, at a separately derived system. (CMP-5)

Branch Circuit.

The circuit conductors between the final overcurrent device protecting the circuit and the outlet(s). (CMP-2)

Branch Circuit, Appliance.

A branch circuit that supplies energy to one or more outlets to which appliances are to be connected and that has no permanently connected luminaires that are not a part of an appliance. (CMP-2)

Branch Circuit, General-Purpose.

A branch circuit that supplies two or more receptacles or outlets for lighting and appliances. (CMP-2)

Branch Circuit, Individual.

A branch circuit that supplies only one utilization equipment. (CMP-2)

Branch Circuit, Multiwire.

A branch circuit that consists of two or more ungrounded conductors that have a voltage between them, and a grounded conductor that has equal voltage between it and each ungrounded conductor of the circuit and that is connected to the neutral or grounded conductor of the system. (CMP-2)

Building.

A structure that stands alone or that is separated from adjoining structures by fire walls. (CMP-1)

Cabinet.

An enclosure that is designed for either surface mounting or flush mounting and is provided with a frame, mat, or trim in which a swinging door or doors are or can be hung. (CMP-9)

Cable, Coaxial.

A cylindrical assembly composed of a conductor centered inside a metallic tube or shield, separated by a dielectric material, and usually covered by an insulating jacket. (CMP-16)

Cable, Optical Fiber.

A factory assembly or field assembly of one or more optical fibers having an overall covering. (CMP-16)

Informational Note: A field-assembled optical fiber cable is an assembly of one or more optical fibers within a jacket. The jacket, without optical fibers, is installed in a manner similar to conduit or raceway. Once the jacket is installed, the optical fibers are inserted into the jacket, completing the cable assembly.

Cable, Optical Fiber, Composite.

A cable containing optical fibers and current-carrying electrical conductors. (CMP-16)

Cable, Optical Fiber, Conductive.

A factory assembly of one or more optical fibers having an overall covering and containing non-current-carrying conductive member(s) such as metallic strength member(s), metallic vapor barrier(s), metallic armor, or metallic sheath. (CMP-16)

Cable, Optical Fiber, Nonconductive.

A factory assembly of one or more optical fibers having an overall covering and containing no electrically conductive materials. (CMP-16)

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, Class 3, and Type PLTC cables, and power-limited fire alarm cables in plenum, riser, and general-purpose applications. (CMP-16)

Charge Controller.

Equipment that controls dc voltage or dc current, or both, and that is used to charge a battery or other energy storage device. (CMP-13)

Circuit Breaker.

A device designed to open and close a circuit by nonautomatic means and to open the circuit automatically on a predetermined overcurrent without damage to itself when properly applied within its rating. (CMP-10)

Informational Note: The automatic opening means can be integral, direct acting with the circuit breaker, or remote from the circuit breaker.

Adjustable (as applied to circuit breakers).

A qualifying term indicating that the circuit breaker can be set to trip at various values of current, time, or both, within a predetermined range.

Instantaneous Trip (as applied to circuit breakers).

A qualifying term indicating that no delay is purposely introduced in the tripping action of the circuit breaker.

Inverse Time (as applied to circuit breakers).

A qualifying term indicating that there is purposely introduced a delay in the tripping action of the circuit breaker, which delay decreases as the magnitude of the current increases.

Nonadjustable (as applied to circuit breakers).

A qualifying term indicating that the circuit breaker does not have any adjustment to alter the value of the current at which it will trip or the time required for its operation.

Setting (of circuit breakers).

The value of current, time, or both, at which an adjustable circuit breaker is set to trip.

Circuit Integrity (CI) Cable.

Cable(s) used for 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. (CMP-3)

Class 1 Circuit.

The portion of the wiring system between the load side of the overcurrent device or power-limited supply and the connected equipment. (CMP-3)

Informational Note: See 725.41 for voltage and power limitations of Class 1 circuits.

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. (CMP-3)

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. (CMP-3)

Clothes Closet.

A nonhabitable room or space intended primarily for storage of garments and apparel. (CMP-1)

Communications Equipment.

The electronic equipment that performs the telecommunications operations for the transmission of audio, video, and data, and includes power equipment (e.g., dc converters, inverters, and batteries), technical support equipment (e.g., computers), and conductors dedicated solely to the operation of the equipment. (CMP-16)

Informational Note: As the telecommunications network transitions to a more data-centric network, computers, routers, servers, and their powering equipment, are becoming essential to the transmission of audio, video, and data and are finding increasing application in communications equipment installations.

Concealed.

Rendered inaccessible by the structure or finish of the building. (CMP-1)

Informational Note: Wires in concealed raceways are considered concealed, even though they may become accessible by withdrawing them.

Conductor, Bare.

A conductor having no covering or electrical insulation whatsoever. (CMP-6)

Conductor, Covered.

A conductor encased within material of composition or thickness that is not recognized by this *Code* as electrical insulation. (CMP-6)

Conductor, Insulated.

A conductor encased within material of composition and thickness that is recognized by this *Code* as electrical insulation. (CMP-6)

Conduit Body.

A separate portion of a conduit or tubing system that provides access through a removable cover(s) to the interior of the system at a junction of two or more sections of the system or at a terminal point of the system.

Boxes such as FS and FD or larger cast or sheet metal boxes are not classified as conduit bodies. (CMP-9)

Connector, Pressure (Solderless).

A device that establishes a connection between two or more conductors or between one or more conductors and a terminal by means of mechanical pressure and without the use of solder. (CMP-1)

Continuous Load.

A load where the maximum current is expected to continue for 3 hours or more. (CMP-2)

Control Circuit.

The circuit of a control apparatus or system that carries the electric signals directing the performance of the controller but does not carry the main power current. (CMP-11)

Controller.

A device or group of devices that serves to govern, in some predetermined manner, the electric power delivered to the apparatus to which it is connected. (CMP-1)

Cooking Unit, Counter-Mounted.

A cooking appliance designed for mounting in or on a counter and consisting of one or more heating elements, internal wiring, and built-in or mountable controls. (CMP-2)

Coordination, Selective (Selective Coordination).

Localization of an overcurrent condition to restrict outages to the circuit or equipment affected, accomplished by the selection and installation of overcurrent protective devices and their ratings or settings for the full range of available overcurrents, from overload to the available fault current, and for the full range of overcurrent protective device opening times associated with those overcurrents. (CMP-10)

Copper-Clad Aluminum Conductors.

Conductors drawn from a copper-clad aluminum rod, with the copper metallurgically bonded to an aluminum core. (CMP-6)

Cutout Box.

An enclosure designed for surface mounting that has swinging doors or covers secured directly to and telescoping with the walls of the enclosure. (CMP-9)

DC-to-DC Converter.

A device that can provide an output dc voltage and current at a higher or lower value than the input dc voltage and current. (CMP-4)

Dead Front.

Without live parts exposed to a person on the operating side of the equipment. (CMP-9)

Demand Factor.

The ratio of the 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. (CMP-2)

Device.

A unit of an electrical system, other than a conductor, that carries or controls electric energy as its principal function. (CMP-1)

Disconnecting Means.

A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply. (CMP-1)

Duty, Continuous.

Operation at a substantially constant load for an indefinitely long time. (CMP-1)

Duty, Intermittent.

Operation for alternate intervals of (1) load and no load; or (2) load and rest; or (3) load, no load, and rest. (CMP-1)

Duty, Periodic.

Intermittent operation in which the load conditions are regularly recurrent. (CMP-1)

Duty, Short-Time.

Operation at a substantially constant load for a short and definite, specified time. (CMP-1)

Duty, Varying.

Operation at loads, and for intervals of time, both of which may be subject to wide variation. (CMP-1)

Dwelling, One-Family.

A building that consists solely of one dwelling unit. (CMP-1)

Dwelling, Two-Family.

A building that consists solely of two dwelling units. (CMP-1)

Dwelling, Multifamily.

A building that contains three or more dwelling units. (CMP-1)

Dwelling Unit.

A single unit, providing complete and independent living facilities for one or more persons, including permanent provisions for living, sleeping, cooking, and sanitation. (CMP-2)

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. (CMP-5)

Electric Power Production and Distribution Network.

Power production, distribution, and utilization equipment and facilities, such as electric utility systems that are connected to premises wiring and are external to and not controlled by an interactive system. (CMP-13)

Electric Sign.

A fixed, stationary, or portable self-contained, electrically operated and/or electrically illuminated utilization equipment with words or symbols designed to convey information or attract attention. (CMP-18)

Electric-Discharge Lighting.

Systems of illumination utilizing fluorescent lamps, high-intensity discharge (HID) lamps, or neon tubing. (CMP-18)

Electrical Circuit Protective System

A system consisting of components and materials intended for installation as protection for specific electrical wiring systems with respect to the disruption of electrical circuit integrity upon exterior fire exposure. (CMP-16)

Electric Vehicle (EV).

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 electric vehicles having a second source of motive power. Off-road, self-propelled electric mobile equipment, such as industrial trucks, hoists, lifts, transports, golf carts, airline ground support equipment, tractors, boats, and the like, are not considered electric vehicles. (CMP-12)

Electrical Datum Plane.

- (1) In land areas subject to tidal fluctuation, the electrical datum plane is a horizontal plane 600 mm (2 ft) above the highest tide level for the area occurring under normal circumstances, that is, highest high tide.
- (2) In land areas not subject to tidal fluctuation, the electrical datum plane is a horizontal plane 600 mm (2 ft) above the highest water level for the area occurring under normal circumstances.
- (3) In land areas subject to flooding, the electrical datum plane based on (1) or (2) above is a horizontal plane 600 mm (2 ft) above the point identified as the prevailing high water mark or an equivalent benchmark based on seasonal or storm-driven flooding from the authority having jurisdiction.
- (4) The electrical datum plane for floating structures and landing stages that are (a) installed to permit rise and fall response to water level, without lateral movement, and (b) that are so equipped that they can rise to the datum plane established for (1) or (2) above, is a horizontal plane 750 mm (30 in.) above the water level at the floating structure or landing stage and a minimum of 300 mm (12 in.) above the level of the deck. (CMP-17)

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 may or may not operate in a current-limiting fashion, depending on the type of control selected. (CMP-10)

Enclosed.

Surrounded by a case, housing, fence, or wall(s) that prevents persons from accidentally contacting energized parts. (CMP-1)

Enclosure.

The case or housing of apparatus, or the fence or walls surrounding an installation to prevent personnel from accidentally contacting energized parts or to protect the equipment from physical damage. (CMP-1)

Informational Note: See Table 110.28 for examples of enclosure types.

Energized.

Electrically connected to, or is, a source of voltage. (CMP-1)

Engineer - A person duly licensed to practice as a professional or registered engineer in his/her state or territory

Engineering Supervision - Supervision provided by an engineer

Equipment.

A general term, including fittings, devices, appliances, luminaires, apparatus, machinery, and the like used as a part of, or in connection with, an electrical installation. (CMP-1)

Equipotential Plane.

Accessible conductive parts bonded together to reduce voltage gradients in a designated area. (CMP-17)

Exposed (as applied to live parts).

Capable of being inadvertently touched or approached nearer than a safe distance by a person. (CMP-1)

Informational Note: This term applies to parts that are not suitably guarded, isolated, or insulated.

Exposed (as applied to wiring methods).

On or attached to the surface or behind panels designed to allow access. (CMP-1)

Externally Operable.

Capable of being operated without exposing the operator to contact with live parts. (CMP-1)

Fault Current.

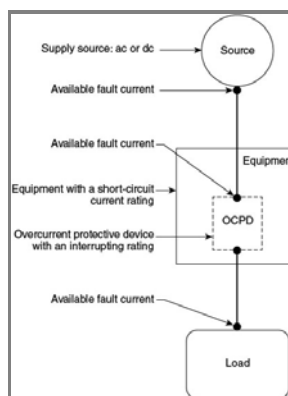
An objectionable current that flows due to an abnormal circuit condition. (CMP-10)

Fault Current, Available (Available Fault Current).

The largest amount of current capable of being delivered at a point on the system during a short-circuit condition. (CMP-10)

Informational Note: A short-circuit can occur during abnormal conditions such as a fault between circuit conductors or a ground fault. See Informational Note Figure 100.1.

Figure Informational Note Figure 100.1 Available Fault Current.

**Feeder.**

All circuit conductors between the service equipment, the source of a separately derived system, or other power supply source and the final branch-circuit overcurrent device. (CMP-2)

Festoon Lighting.

A string of outdoor lights that is suspended between two points. (CMP-18)

Field Evaluation Body (FEB).

An organization or part of an organization that performs field evaluations of electrical or other equipment. [790, 2018] (CMP-1)

Informational Note: NFPA 790-2018, *Standard for Competency of Third-Party Field Evaluation Bodies*, provides guidelines for establishing the qualification and competency of a body performing field evaluations of electrical products and assemblies with electrical components.

Field Labeled (as applied to evaluated products).

Equipment or materials to which has been attached a label, symbol, or other identifying mark of an FEB indicating the equipment or materials were evaluated and found to comply with requirements as described in an accompanying field evaluation report. [790, 2018] (CMP-1)

Fitting.

A means for connecting raceway, cable, or cord to an enclosure, box, or raceway system. (CMP-1)

Free Air (as applied to conductors).

Open or ventilated environment that allows for air flow around an installed conductor with no other conductors closer than one cable diameter and no insulation or building materials in contact with the conductor insulation for more than 75 mm (3 in.) for every 3 m (10 ft) of conductor.

Fuel Cell.

An electrochemical system that consumes fuel to produce an electric current. In such cells, the main chemical reaction used for producing electric power is not combustion. However, there may be sources of combustion used within the overall cell system, such as reformers/fuel processors. (CMP-4)

Fuel Cell System.

The complete aggregate of equipment used to convert chemical fuel into usable electricity and typically consisting of a reformer, stack, power inverter, and auxiliary equipment. (CMP-4)

Garage.

A building or portion of a building in which one or more self-propelled vehicles can be kept for use, sale, storage, rental, repair, exhibition, or demonstration purposes. (CMP-1)

Informational Note: For commercial garages, repair and storage, see Article 511.

Generating Capacity, Inverter.

The sum of parallel-connected inverter maximum continuous output power at 40°C in kilowatts. (CMP-4)

Ground.

The earth. (CMP-5)

Ground Fault.

An unintentional, electrically conductive connection between an ungrounded conductor of an electrical circuit and the normally non-current-carrying conductors, metallic enclosures, metallic raceways, metallic equipment, or earth. (CMP-5)

Grounded (Grounding).

Connected (connecting) to ground or to a conductive body that extends the ground connection. (CMP-5)

Grounded, Solidly.

Connected to ground without inserting any resistor or impedance device. (CMP-5)

Grounded Conductor.

A system or circuit conductor that is intentionally grounded. (CMP-5)

Ground-Fault Circuit Interrupter (GFCI).

A device intended for the protection of personnel that functions to de-energize a circuit or portion thereof within an established period of time when a current to ground exceeds the values established for a Class A device. (CMP-2)

Informational Note: Class A ground-fault circuit interrupters trip when the current to ground is 6 mA or higher and do not trip when the current to ground is less than 4 mA. For further information, see UL 943, *Standard for Ground-Fault Circuit Interrupters*.

Ground-Fault Current Path.

An electrically conductive path from the point of a ground fault on a wiring system through normally non-current-carrying conductors, grounded conductors, equipment, or the earth to the electrical supply source. (CMP-5)

Informational Note: Examples of ground-fault current paths are any combination of equipment grounding conductors, metallic raceways, metallic cable sheaths, electrical equipment, and any other electrically conductive material such as metal, water, and gas piping; steel framing members; stucco mesh; metal ducting; reinforcing steel; shields of communications cables; grounded conductors; and the earth itself.

Ground-Fault Protection of Equipment.

A system intended to provide protection of equipment from damaging line-to-ground fault currents by operating to cause a disconnecting means to open all ungrounded conductors of the faulted circuit. This protection is provided at current levels less than those required to protect conductors from damage through the operation of a supply circuit overcurrent device. (CMP-5)

Grounding Conductor, Equipment (EGC).

A conductive path(s) that provides an effective ground-fault current path and connects normally non-current-carrying metal parts of equipment together and to the system grounded conductor or to the grounding electrode conductor, or both. (CMP-5)

Informational Note No. 1: It is recognized that the equipment grounding conductor also performs bonding.

Informational Note No. 2: See 250.118 for a list of acceptable equipment grounding conductors.

Grounding Electrode.

A conducting object through which a direct connection to earth is established. (CMP-5)

Grounding Electrode Conductor.

A conductor used to connect the system grounded conductor or the equipment to a grounding electrode or to a point on the grounding electrode system. (CMP-5)

Guarded.

Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach or contact by persons or objects to a point of danger. (CMP-1)

Guest Room.

An accommodation combining living, sleeping, sanitary, and storage facilities within a compartment. (CMP-2)

Guest Suite.

An accommodation with two or more contiguous rooms comprising a compartment, with or without doors between such rooms, that provides living, sleeping, sanitary, and storage facilities. (CMP-2)

Habitable Room.

A room in a building for living, sleeping, eating, or cooking, but excluding bathrooms, toilet rooms, closets, hallways, storage or utility spaces, and similar areas.

Handhole Enclosure.

An enclosure for use in underground systems, provided with an open or closed bottom, and sized to allow personnel to reach into, but not enter, for the purpose of installing, operating, or maintaining equipment or wiring or both. (CMP-9)

Hermetic Refrigerant Motor-Compressor.

A combination consisting of a compressor and motor, both of which are enclosed in the same housing, with no external shaft or shaft seals, with the motor operating in the refrigerant. (CMP-11)

Hoistway.

Any shaftway, hatchway, well hole, or other vertical opening or space in which an elevator or dumbwaiter is designed to operate. (CMP-12)

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 does not constitute a power source for the purpose of this definition. (CMP-4)

Identified (as applied to equipment).

Recognizable as suitable for the specific purpose, function, use, environment, application, and so forth, where described in a particular *Code* requirement. (CMP-1)

Informational Note: Some examples of ways to determine suitability of equipment for a specific purpose, environment, or application include investigations by a qualified testing laboratory (listing and labeling), an inspection agency, or other organizations concerned with product evaluation.

In Sight From (Within Sight From, Within Sight).

Where this *Code* specifies that one equipment shall be "in sight from," "within sight from," or "within sight of," and so forth, another equipment, the specified equipment is to be visible and not more than 15 m (50 ft) distant from the other. (CMP-1)

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 push buttons, pilot lights, selector switches, timers, switches, and 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. (CMP-11)

Information Technology Equipment (ITE).

Equipment and systems rated 1000 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 805.2. (CMP-12)

Informational Note: For information on listing requirements for both information technology equipment and communications equipment, see UL 60950-1-2014, *Information Technology Equipment — Safety — Part 1: General Requirements* or UL 62368-1-2014, *Audio/Video Information and Communication Technology Equipment Part 1: Safety Requirements*.

Innerduct.

A nonmetallic raceway placed within a larger raceway. (CMP-16)

Interactive Inverter.

An inverter intended for use in parallel with power source(s) such as an electric utility to supply common loads. (CMP-13)

Interactive System.

An electric power production system that is operating in parallel with and capable of delivering energy to an electric primary source supply system. (CMP-4)

Interrupting Rating.

The highest current at rated voltage that a device is identified to interrupt under standard test conditions. (CMP-10)

Informational Note: Equipment intended to interrupt current at other than fault levels may have its interrupting rating implied in other ratings, such as horsepower or locked rotor current.

Intersystem Bonding Termination.

A device that provides a means for connecting intersystem bonding conductors for communications systems to the grounding electrode system. (CMP-16)

Inverter.

Equipment that changes dc to ac. (CMP-4)

Inverter Input Circuit.

Conductors between the inverter and the ESS in stand-alone and multimode inverter systems.

Inverter Input Circuit.

Conductors connected to the dc input of an inverter. (CMP-4)

Inverter Output Circuit.

Conductors between the inverter and another electric power production source, such as a utility for an electrical production and distribution network.

Inverter Output Circuit.

Conductors connected to the ac output of an inverter. (CMP-4)

Isolated (as applied to location).

Not readily accessible to persons unless special means for access are used. (CMP-1)

Kitchen.

An area with a sink and permanent provisions for food preparation and cooking. (CMP-2)

Labeled.

Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner. (CMP-1)

Informational Note: When a listed product is of such a size, shape, material, or surface texture that it is not possible to apply legibly the complete label to the product, the complete label may appear on the smallest unit container in which the product is packaged.

Laundry Area.

An area containing or designed to contain a laundry tray, clothes washer, or clothes dryer.

Lighting Outlet.

An outlet intended for the direct connection of a lampholder or luminaire. (CMP-18)

Lighting Track (Track Lighting).

A manufactured assembly designed to support and energize luminaires that are capable of being readily repositioned on the track. Its length can be altered by the addition or subtraction of sections of track. (CMP-18)

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 or 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. (CMP-1)

Informational Note: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. Use of the system employed by the listing organization allows the authority having jurisdiction to identify a listed product.

Live Parts.

Energized conductive components. (CMP-1)

Location, Damp.

Locations protected from weather and not subject to saturation with water or other liquids but subject to moderate degrees of moisture. (CMP-1)

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.

Location, Dry.

A location not normally subject to dampness or wetness. A location classified as dry may be temporarily subject to dampness or wetness, as in the case of a building under construction. (CMP-1)

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. (CMP-1)

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 may also include parts to protect the light source or the ballast or to distribute the light. A lampholder itself is not a luminaire. (CMP-18)

Messenger or Messenger Wire.

A wire that is run integral with or parallel to a cable or conductor to provide mechanical support for the cable or conductor. (CMP-6)

Motor Control Center.

An assembly of one or more enclosed sections having a common power bus and principally containing motor control units. (CMP-11)

Multimode Inverter.

Equipment having the capabilities of both the interactive inverter and the stand-alone inverter. (CMP-4)

Multioutlet Assembly.

A type of surface, flush, or freestanding raceway designed to hold conductors and receptacles, assembled in the field or at the factory. (CMP-18)

Neutral Conductor.

The conductor connected to the neutral point of a system that is intended to carry current under normal conditions. (CMP-5)

Neutral Point.

The common point on a wye-connection in a polyphase system or midpoint on a single-phase, 3-wire system, or midpoint of a single-phase portion of a 3-phase delta system, or a midpoint of a 3-wire, direct-current system. (CMP-5)

Informational Note: At the neutral point of the system, the vectorial sum of the nominal voltages from all other phases within the system that utilize the neutral, with respect to the neutral point, is zero potential.

Nonautomatic.

Requiring human intervention to perform a function. (CMP-1)

Nonlinear Load.

A load where the wave shape of the steady-state current does not follow the wave shape of the applied voltage. (CMP-1)

Informational Note: Electronic equipment, electronic/electric-discharge lighting, adjustable-speed drive systems, and similar equipment may be nonlinear loads.

Outlet.

A point on the wiring system at which current is taken to supply utilization equipment. (CMP-1)

Outline Lighting.

An arrangement of incandescent lamps, electric-discharge lighting, or other electrically powered light sources to outline or call attention to certain features such as the shape of a building or the decoration of a window. (CMP-18)

Overcurrent.

Any current in excess of the rated current of equipment or the ampacity of a conductor. It may result from overload, short circuit, or ground fault. (CMP-10)

Informational Note: A current in excess of rating may be accommodated by certain equipment and conductors for a given set of conditions. Therefore, the rules for overcurrent protection are specific for particular situations.

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. Such devices are provided with interrupting ratings appropriate for the intended use but no less than 5000 amperes. (CMP-10)

Overcurrent Protective Device, Supplementary.

A device intended to provide limited overcurrent protection for specific applications and utilization equipment such as luminaires and appliances. This limited protection is in addition to the protection provided in the required branch circuit by the branch-circuit overcurrent protective device. (CMP-10)

Overload.

Operation of equipment in excess of normal, full-load rating, or of a conductor in excess of its ampacity that, when it persists for a sufficient length of time, would cause damage or dangerous overheating. A fault, such as a short circuit or ground fault, is not an overload. (CMP-10)

Panelboard.

A single panel or group of panel units designed for assembly in the form of a single panel, including buses and automatic overcurrent devices, and equipped with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet or cutout box placed in or against a wall, partition, or other support; and accessible only from the front. (CMP-9)

Photovoltaic (PV) System.

The total components, circuits, and equipment up to and including the PV system disconnecting means that, in combination, convert solar energy into electric energy. (CMP-4)

Plenum.

A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system. (CMP-3)

Power Outlet.

An enclosed assembly that may include receptacles, circuit breakers, fuseholders, fused switches, buses, and watt-hour meter mounting means; intended to supply and control power to mobile homes, recreational vehicles, park trailers, or boats or to serve as a means for distributing power required to operate mobile or temporarily installed equipment. (CMP-19)

Power Production Equipment.

The generating source and all associated distribution equipment to the source disconnecting means that generates electricity from a source other than a utility supplied service. (CMP-4)

Informational Note: Examples of power production equipment include such items as generators, solar photovoltaic systems, and fuel cell systems.

Power-Limited Tray Cable (PLTC).

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. (CMP-3)

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. (CMP-1)

Informational Note: Power sources include, but are not limited to, interconnected or stand-alone batteries, solar photovoltaic systems, other distributed generation systems, or generators.

Prime Mover.

The machine that supplies the mechanical horsepower of a generator. (CMP-13)

Qualified Person.

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. (CMP-1)

Informational Note: Refer to *NFPA 70E-2018, Standard for Electrical Safety in the Workplace*, for electrical safety training requirements.

Raceway.

An enclosed channel designed expressly for holding wires, cables, or busbars, with additional functions as permitted in this *Code*. (CMP-8)

Informational Note: A raceway is identified within specific article definitions.

Raceway, Communications.

An enclosed channel of nonmetallic materials designed expressly for holding communications wires and cables; optical fiber cables; data cables associated with information technology and communications equipment; Class 2, Class 3, and Type PLTC cables; and power-limited fire alarm cables in plenum, riser, and general-purpose applications. (CMP-16)

Rainproof.

Constructed, protected, or treated so as to prevent rain from interfering with the successful operation of the apparatus under specified test conditions. (CMP-1)

Raintight.

Constructed or protected so that exposure to a beating rain will not result in the entrance of water under specified test conditions. (CMP-1)

Receptacle.

A contact device installed at the outlet for the connection of an attachment plug, or for the direct connection of electrical utilization equipment designed to mate with the corresponding contact device. 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. (CMP-18)

Informational Note: A duplex receptacle is an example of a multiple receptacle that has two receptacles on the same yoke.

Receptacle Outlet.

An outlet where one or more receptacles are installed. (CMP-18)

Remote-Control Circuit.

Any electrical circuit that controls any other circuit through a relay or an equivalent device. (CMP-3)

Retrofit Kit.

A general term for a complete subassembly of parts and devices for field conversion of utilization equipment. (CMP-18)

Sealable Equipment.

Equipment enclosed in a case or cabinet that is provided with a means of sealing or locking so that live parts cannot be made accessible without opening the enclosure. (CMP-1)

Informational Note: The equipment may or may not be operable without opening the enclosure.

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. (CMP-5)

Service.

The conductors and equipment connecting the serving utility to the wiring system of the premises served. (CMP-10)

Service Cable.

Service conductors made up in the form of a cable. (CMP-4)

Service Conductors.

The conductors from the service point to the service disconnecting means. (CMP-4)

Service Conductors, Overhead.

The overhead conductors between the service point and the first point of connection to the service-entrance conductors at the building or other structure. (CMP-4)

Service Conductors, Underground.

The underground conductors between the service point and the first point of connection to the service-entrance conductors in a terminal box, meter, or other enclosure, inside or outside the building wall. (CMP-4)

Informational Note: Where there is no terminal box, meter, or other enclosure, the point of connection is considered to be the point of entrance of the service conductors into the building.

Service Drop.

The overhead conductors between the utility electric system and the service point. (CMP-10)

Service-Entrance Conductors, Overhead System.

The service conductors between the terminals of the service equipment and a point usually outside the building, clear of building walls, where joined by tap or splice to the service drop or overhead service conductors. (CMP-4)

Service-Entrance Conductors, Underground System.

The service conductors between the terminals of the service equipment and the point of connection to the service lateral or underground service conductors. (CMP-4)

Informational Note: Where service equipment is located outside the building walls, there may be no service-entrance conductors or they may be entirely outside the building.

Service Equipment.

The necessary equipment, consisting of a circuit breaker(s) or switch(es) and fuse(s) and their accessories, connected to the utility electric system and intended to constitute the main control and disconnect of the utility electric system. (CMP-10)

Service Lateral.

The underground conductors between the utility electric supply system and the service point. (CMP-4)

Service Point.

The point of connection between the facilities of the serving utility and the premises wiring. (CMP-4)

Informational Note: The service point can be described as the point of demarcation between where the serving utility ends and the premises wiring begins. The serving utility generally specifies the location of the service point based on the conditions of service.

Short-Circuit Current Rating.

The prospective symmetrical fault current at a nominal voltage to which an apparatus or system is able to be connected without sustaining damage exceeding defined acceptance criteria. (CMP-10)

Show Window.

Any window, including windows above doors, used or designed to be used for the display of goods or advertising material, whether it is fully or partly enclosed or entirely open at the rear and whether or not it has a platform raised higher than the street floor level. (CMP-2)

Single-Pole Separable Connector.

A device that is installed at the ends of portable, flexible, single-conductor cable that is used to establish connection or disconnection between two cables or one cable and a single-pole, panel-mounted separable connector. (CMP-15)

Signaling Circuit.

Any electrical circuit that energizes signaling equipment. (CMP-3)

Special Permission.

The written consent of the authority having jurisdiction. (CMP-1)

Stand-Alone System.

A system that is capable of supplying power independent of an electric power production and distribution network. (CMP-4)

Informational Note: Though stand-alone systems are capable of operating independent of a utility supply they may include a connection to a utility supply for use when not operating in stand-alone mode.

Structure.

That which is built or constructed, other than equipment. (CMP-1)

Surge Arrester.

A protective device for limiting surge voltages by discharging or bypassing surge current; it also prevents continued flow of follow current while remaining capable of repeating these functions. (CMP-5)

Surge-Protective Device (SPD).

A protective device for limiting transient voltages by diverting or limiting surge current; it also prevents continued flow of follow current while remaining capable of repeating these functions and is designated as follows:

Type 1: Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side of the service disconnect overcurrent device.

Type 2: Permanently connected SPDs intended for installation on the load side of the service disconnect overcurrent device, including SPDs located at the branch panel.

Type 3: Point of utilization SPDs.

Type 4: Component SPDs, including discrete components, as well as assemblies. (CMP-5)

Informational Note: For further information on Type 1, Type 2, Type 3, and Type 4 SPDs, see UL 1449, *Standard for Surge Protective Devices*.

Switch, Bypass Isolation.

An automatic or a nonautomatic device used in conjunction with a transfer switch to provide a means of directly connecting load conductors to a power source and of disconnecting the transfer switch. (CMP-13)

Switch, General-Use.

A switch intended for use in general distribution and branch circuits. It is rated in amperes, and it is capable of interrupting its rated current at its rated voltage. (CMP-9)

Switch, General-Use Snap.

A form of general-use switch constructed so that it can be installed in device boxes or on box covers, or otherwise used in conjunction with wiring systems recognized by this *Code*. (CMP-9)

Switch, Isolating.

A switch intended for isolating an electrical circuit from the source of power. It has no interrupting rating, and it is intended to be operated only after the circuit has been opened by some other means. (CMP-9)

Switch, Motor-Circuit.

A switch rated in horsepower that is capable of interrupting the maximum operating overload current of a motor of the same horsepower rating as the switch at the rated voltage. (CMP-11)

Switch, Transfer.

An automatic or nonautomatic device for transferring one or more load conductor connections from one power source to another. (CMP-13)

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 are generally accessible from the rear as well as from the front and are not intended to be installed in cabinets. (CMP-9)

Switchgear.

An 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. (CMP-9)

Informational Note: All switchgear subject to *NEC* requirements is metal enclosed. Switchgear rated below 1000 V or less may be identified as "low-voltage power circuit breaker switchgear." Switchgear rated over 1000 V may be identified as "metal-enclosed switchgear" or "metal-clad switchgear." Switchgear is available in non-arc-resistant or arc-resistant constructions.

Thermal Protector (as applied to motors).

A protective device for assembly as an integral part of a motor or motor-compressor that, when properly applied, protects the motor against dangerous overheating due to overload and failure to start. (CMP-11)

Informational Note: The thermal protector may consist of one or more sensing elements integral with the motor or motor-compressor and an external control device.

Thermally Protected (as applied to motors).

The words *Thermally Protected* appearing on the nameplate of a motor or motor-compressor indicate that the motor is provided with a thermal protector. (CMP-11)

Ungrounded.

Not connected to ground or to a conductive body that extends the ground connection. (CMP-5)

Uninterruptible Power Supply.

A power supply used to provide alternating current power to a load for some period of time in the event of a power failure. (CMP-13)

Informational Note: In addition, it may provide a more constant voltage and frequency supply to the load, reducing the effects of voltage and frequency variations.

Utilization Equipment.

Equipment that utilizes electric energy for electronic, electromechanical, chemical, heating, lighting, or similar purposes. (CMP-1)

Voltage (of a circuit).

The greatest root-mean-square (rms) (effective) difference of potential between any two conductors of the circuit concerned. (CMP-1)

Informational Note: Some systems, such as 3-phase 4-wire, single-phase 3-wire, and 3-wire direct current, may have various circuits of various voltages.

Voltage, Nominal.

A nominal value assigned to a circuit or system for the purpose of conveniently designating its voltage class (e.g., 120/240 volts, 480Y/277 volts, 600 volts). (CMP-1)

Informational Note No. 1: The actual voltage at which a circuit operates can vary from the nominal within a range that permits satisfactory operation of equipment.

Informational Note No. 2: See ANSI C84.1-2011, *Voltage Ratings for Electric Power Systems and Equipment* (60 Hz).

Informational Note No. 3: Certain battery units may be considered to be rated at nominal 48 volts dc, but may have a charging float voltage up to 58 volts. In dc applications, 60 volts is used to cover the entire range of float voltages.

Voltage to Ground.

For grounded circuits, the voltage between the given conductor and that point or conductor of the circuit that is grounded; for ungrounded circuits, the greatest voltage between the given conductor and any other conductor of the circuit. (CMP-1)

Watertight.

Constructed so that moisture will not enter the enclosure under specified test conditions. (CMP-1)

Weatherproof.

Constructed or protected so that exposure to the weather will not interfere with successful operation. (CMP-1)

Informational Note: Rainproof, raintight, or watertight equipment can fulfill the requirements for weatherproof where varying weather conditions other than wetness, such as snow, ice, dust, or temperature extremes, are not a factor.

Part II. Over 1000 Volts, Nominal**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. Electronically actuated fuses may or may not operate in a current-limiting fashion, depending on the type of control selected. (CMP-10)

Fuse.

An overcurrent protective device with a circuit-opening fusible part that is heated and severed by the passage of overcurrent through it. (CMP-10)

Informational Note: A fuse comprises all the parts that form a unit capable of performing the prescribed functions. It may or may not be the complete device necessary to connect it into an electrical circuit.

Controlled Vented Power Fuse.

A fuse with provision for controlling discharge circuit interruption such that no solid material may be exhausted into the surrounding atmosphere.

Informational Note: The fuse is designed so that discharged gases will not ignite or damage insulation in the path of the discharge or propagate a flashover to or between grounded members or conduction members in the path of the discharge where the distance between the vent and such insulation or conduction members conforms to manufacturer's recommendations.

Expulsion Fuse Unit (Expulsion Fuse).

A vented fuse unit in which the expulsion effect of gases produced by the arc and lining of the fuseholder, either alone or aided by a spring, extinguishes the arc.

Nonvented Power Fuse.

A fuse without intentional provision for the escape of arc gases, liquids, or solid particles to the atmosphere during circuit interruption.

Power Fuse Unit.

A vented, nonvented, or controlled vented fuse unit in which the arc is extinguished by being drawn through solid material, granular material, or liquid, either alone or aided by a spring.

Vented Power Fuse.

A fuse with provision for the escape of arc gases, liquids, or solid particles to the surrounding atmosphere during circuit interruption.

Multiple Fuse.

An assembly of two or more single-pole fuses. (CMP-10)

Substation.

An assemblage of equipment (e.g., switches, interrupting devices, circuit breakers, buses, and transformers) through which electric energy is passed for the purpose of distribution, switching, or modifying its characteristics. (CMP-9)

Switching Device.

A device designed to close, open, or both, one or more electrical circuits. (CMP-1)

Circuit Breaker.

A switching device capable of making, carrying, and interrupting currents under normal circuit conditions, and also of making, carrying for a specified time, and interrupting currents under specified abnormal circuit conditions, such as those of short circuit.

Cutout.

An assembly of a fuse support with either a fuseholder, fuse carrier, or disconnecting blade. The fuseholder or fuse carrier may include a conducting element (fuse link) or may act as the disconnecting blade by the inclusion of a nonfusible member.

Disconnecting Means.

A device, group of devices, or other means whereby the conductors of a circuit can be disconnected from their source of supply.

Disconnecting (or Isolating) Switch (Disconnecter, Isolator).

A mechanical switching device used for isolating a circuit or equipment from a source of power.

Interrupter Switch.

A switch capable of making, carrying, and interrupting specified currents.

Oil Cutout (Oil-Filled Cutout).

A cutout in which all or part of the fuse support and its fuse link or disconnecting blade is mounted in oil with complete immersion of the contacts and the fusible portion of the conducting element (fuse link) so that arc interruption by severing of the fuse link or by opening of the contacts will occur under oil.

Oil Switch.

A switch having contacts that operate under oil (or askarel or other suitable liquid).

Regulator Bypass Switch.

A specific device or combination of devices designed to bypass a regulator.

Part III. Hazardous (Classified) Locations (CMP-14).**Aircraft Painting Hangar.**

An aircraft hangar constructed for the express purpose of spray/coating/dipping applications and provided with dedicated ventilation supply and exhaust.

Associated Apparatus.

Apparatus in which the circuits are not necessarily intrinsically safe themselves but that affects the energy in the intrinsically safe circuits and is relied on to maintain intrinsic safety. Such apparatus is 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. Such apparatus 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 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.

Dust particles that are 500 microns or smaller (i.e., material passing a U.S. No. 35 Standard Sieve as defined in ASTM E11-2015, *Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves*), and present a fire or explosion hazard when dispersed and ignited in air.

Informational Note: See ASTM E1226-2012a, *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.

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-ignitionproof, or a flameproof seal.

Different Intrinsically Safe Circuits.

Intrinsically safe circuits in which the possible interconnections have not been evaluated and identified as intrinsically safe.

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 No. 1: For further information on dust-ignitionproof enclosures, see ANSI/UL 1203-2015, *Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Hazardous (Classified) Locations*.

Informational Note No. 2: Dust-ignitionproof enclosures are sometimes additionally marked Type 9 per NEMA 250-2014, *Enclosures for Electrical Equipment*.

Dusttight.

Enclosures constructed so that dust will not enter under specified test conditions.

Informational Note No. 1: For further information, see ANSI/UL 121201-2017, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations*.

Informational Note No. 2: Enclosure Types 3, 3X, 3S, 3SX, 4, 4X, 5, 6, 6P, 12, 12K, and 13, per NEMA 250-2014, *Enclosures for Electrical Equipment* and ANSI/UL 50E-2015, *Enclosures for Electrical Equipment, Environmental Considerations*, are considered dusttight.

Electrical Resistance Trace Heating “60079-30-1”.

Type of protection for the purpose of producing heat on the principle of electrical resistance and typically composed of one or more metallic conductors and/or an electrically conductive material, suitably electrically insulated and protected.

Informational Note: See ANSI/UL 60079-30-1-2017, *Explosive Atmospheres — Part 30-1: Electrical Resistance Trace Heating — General and Testing Requirements*.

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: See ANSI/UL 60079-18-2015, *Explosive atmospheres — Part 18: Equipment protection by encapsulation “m”*.

Explosionproof Equipment.

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. (CMP-14)

Informational Note No. 1: For further information, see ANSI/UL 1203-2015, *Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations*.

Informational Note No. 2: Explosionproof enclosures are sometimes additionally marked Type 7 per NEMA 250-2014, *Enclosures for Electrical Equipment*.

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/UL 60079-1-2015, *Explosive Atmospheres — Part 1: Equipment Protection by Flameproof Enclosures “d”*.

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-12.12.01-2013, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations*.

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/UL 60079-7-2017, *Explosive Atmospheres — Part 7: Equipment Protection by Increased Safety “e”*.

Inherently Safe Optical Radiation “op is”.

Type of protection to minimize the risk of ignition in explosive atmospheres from optical radiation where visible or infrared radiation is incapable of producing sufficient energy under normal or specified fault conditions to ignite a specific explosive atmosphere.

Informational Note: See ANSI/UL 60079-28-2017, *Explosive Atmospheres — Part 28: Protection of Equipment and Transmission Systems Using Optical Radiation*.

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: See UL 913-2015, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1 Hazardous (Classified) Locations*; and ANSI/UL 60079-11-2013, *Explosive Atmospheres — Part 11: Equipment protection by intrinsic safety “i”*.

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 913-2013, *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.

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 but does not meet the requirements of a spray booth or spray room, as herein defined. [33:3.3.18.1]

Informational Note: See Section 14.3 of NFPA 33, *Standard for Spray Application Using Flammable or Combustible Materials*, for limited finishing workstations.

Liquid 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/UL 60079-6-2016, *Explosive Atmospheres — Part 6: Equipment protection by liquid immersion “o”*.

Major Repair Garage.

A building or portions of a building where major repairs, such as engine overhauls, painting, body and fender work, and repairs that require draining of the motor vehicle fuel tank are performed on motor vehicles, including associated floor space used for offices, parking, or showrooms. [30A:3.3.12.1]

Membrane Enclosure.

A temporary enclosure used for the spraying of workpieces that cannot be moved into a spray booth where open spraying is not practical due to the proximity to other operations, finish quality, or concerns such as the collection of overspray.

Informational Note: See Chapter 18 of NFPA 33-2016, *Standard for Spray Application Using Flammable or Combustible Materials*, for information on the construction and use of membrane enclosures.

Minor Repair Garage.

A building or portions of a building used for lubrication, inspection, and minor automotive maintenance work, such as engine tune-ups, replacement of parts, fluid changes (e.g., oil, antifreeze, transmission fluid, brake fluid, air-conditioning refrigerants), brake system repairs, tire rotation, and similar routine maintenance work, including associated floor space used for offices, parking, or showrooms. [30A:3.3.12.2]

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.

Motor Fuel Dispensing Facility.

That portion of a property where motor fuels are stored and dispensed from fixed equipment into the fuel tanks of motor vehicles or marine craft or into approved containers, including all equipment used in connection therewith. [30A:3.3.11]

Informational Note: Refer to Articles 510 and 511 with respect to electrical wiring and equipment for other areas used as lubricatoriums, service rooms, repair rooms, offices, salesrooms, compressor rooms, and similar locations.

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-12.12.01-2013, *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-12.12.01-2013, *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-12.12.01-2013, *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-12.12.01-2013, *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.

Optical Radiation.

Electromagnetic radiation at wavelengths in vacuum between the region of transition to X-rays and the region of transition to radio waves, that is approximately between 1 nm and 1000 μm .

Informational Note: For additional information on types of protection that can be applied to minimize the risk of ignition in explosive atmospheres from optical radiation in the wavelength range from 380 nm to 10 μm , see ANSI/UL 60079-28-2017, *Explosive Atmospheres — Part 28: Protection of Equipment and Transmission Systems Using Optical Radiation*.

Optical System With Interlock “op sh”.

Type of protection to minimize the risk of ignition in explosive atmospheres from optical radiation where visible or infrared radiation is confined inside optical fiber or other transmission medium with interlock cut-off provided to reliably reduce the unconfined beam strength to safe levels within a specified time in case the confinement fails and the radiation becomes unconfined.

Informational Note: See ANSI/UL 60079-28-2017, *Explosive Atmospheres — Part 28: Protection of Equipment and Transmission Systems Using Optical Radiation*.

Outdoor Spray Area.

A spray area that is outside the confines of a building or that has a canopy or roof that does not limit the dissipation of the heat of a fire or dispersion of flammable vapors and does not restrict fire-fighting access and control. For the purpose of this standard, an outdoor spray area can be treated as an unenclosed spray area. [33:3.3.2.3.1]

Portable Equipment.

Equipment with electrical components suitable to be moved by a single person without mechanical aids.

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/UL 60079-5-2016, *Explosive Atmospheres — Part 5: Equipment protection by powder filling “q”*.

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.

Pressurized Enclosure “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/UL-60079-2-2017, *Explosive Atmospheres — Part 2: Equipment protection by pressurized enclosures “p”*.

Process Seal.

A seal between electrical systems and flammable or combustible process fluids where a failure could allow the migration of process fluids into the premises' wiring system.

Protected Optical Fiber Cable.

Optical fiber cable protected from releasing optical radiation into the atmosphere during normal operating conditions and foreseeable malfunctions by additional armoring, conduit, cable tray, or raceway.

Informational Note: See ANSI/UL 60079-28-2017, *Explosive Atmospheres — Part 28: Protection of Equipment and Transmission Systems Using Optical Radiation*.

Protected Optical Radiation “op pr”.

Type of protection to minimize the risk of ignition in explosive atmospheres from optical radiation where visible or infrared radiation is confined inside optical fiber or other transmission medium under normal constructions or constructions with additional mechanical protection based on the assumption that there is no escape of radiation from the confinement.

Informational Note: See ANSI/UL 60079-28-2017, *Explosive Atmospheres — Part 28: Protection of Equipment and Transmission Systems Using Optical Radiation*.

Protection by Enclosure “t”.

Type of protection for explosive dust atmospheres where electrical equipment is provided with an enclosure providing dust ingress protection and a means to limit surface temperatures.

Informational Note: For additional information, see ANSI/UL 60079-31-2015, *Explosive Atmospheres — Part 31: Equipment Dust Ignition Protection by Enclosure “t”*.

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, *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 mA, and 25 mW, 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 No. 1: The following apparatus are examples of simple apparatus:

- (1) Passive components; for example, switches, instrument connectors, plugs and sockets, junction boxes, resistance temperature devices, and simple semiconductor devices such as LEDs
- (2) 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
- (3) Sources of generated energy; for example, thermocouples and photocells, that do not generate more than 1.5 volts, 100 mA, and 25 mW

Informational Note No. 2: For further information, refer to ANSI/UL 913-2013, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, Hazardous (Classified) Locations*; and ANSI/UL 60079-11-2013, *Explosive Atmospheres — Part 11: Equipment Protection by Intrinsic Safety “i.”*

Spray Area.

Any fully enclosed, partly enclosed, or unenclosed area in which dangerous 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, 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 path up to and including recirculation particulate filters; (6) any solvent concentrator (pollution abatement) unit or solvent recovery (distillation) unit; and (7) the inside of a membrane enclosure. The following are not 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 recirculation particulate filters; and (4) exhaust ducts from solvent concentrator (pollution abatement) units. [33:3.3.2.3]

Informational Note: Unenclosed spray areas are 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 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 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. [33:3.3.15]

Informational Note: A spray booth is an enclosure or insert within a larger room used for spray/coating/dipping applications. A spray booth can be fully enclosed or have open front or face and can include separate conveyor entrance and exit. The spray booth is provided with a dedicated ventilation exhaust with supply air from the larger room or from a dedicated air supply.

Spray Room.

A power-ventilated fully enclosed room used exclusively for open spraying of flammable or combustible materials. [33:3.3.16]

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 60079-15-2013, *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; 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; nor any combination thereof.

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]

Ventilated.

Provided with a means to permit circulation of air sufficient to remove an excess of heat, fumes, or vapors.

Volatile Flammable Liquid.

A flammable liquid having a flash point below 38°C (100°F), or a flammable liquid whose temperature is above its flash point, or a Class II combustible liquid that has a vapor pressure not exceeding 276 kPa (40 psia) at 38°C (100°F) and whose temperature is above its flash point.

Statement of Problem and Substantiation for Public Comment

There are numerous references in the National Electric Code which state, in one form or other, that a given activity or method is "permissible under engineering supervision", but there is no definition of "engineering supervision" contained in Article 100. Further, there is no rule or requirement preventing an untrained, unlicensed, unqualified person from claiming to be an "engineer" and hence able to provide "engineering supervision". Throughout the 50 US states, the various state boards which govern engineering licensure typically do not allow a person to use the title of "Engineer" in any public setting without holding a license to practice engineering. Adding the definition of "engineer" and "engineering supervision" would prevent an interpretation of the NEC that would allow an unlicensed engineer from offering "engineering supervision" in the context of the NEC.

Related Item

- Article 100 - Definitions

Submitter Information Verification

Submitter Full Name: Joel McDaniel

Organization: Home

Street Address:

City:

State:

Zip:

Submission Date: Thu Aug 16 21:46:47 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Joel McDaniel, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Joel McDaniel, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 1237-NFPA 70-2018 [Definition: Accessible (as applied to equipment).]

Accessible (as applied to equipment).

~~Capable of being reached for operation, renewal, and inspection~~ Admitting close approach; not guarded by elevation, or other effective means . (CMP-1)

Statement of Problem and Substantiation for Public Comment

The new definition is much too broad and applies no restrictions as to what methods can be used to reach the equipment. All equipment that has been installed is capable of being reached by some method. Mr. Palmer's negative vote comment is correct.

Related Item

- First Revision No. 8304-NFPA 70-2018

Submitter Information Verification

Submitter Full Name: Don Ganiere

Organization: [Not Specified]

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 24 14:06:02 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Don Ganiere, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Don Ganiere, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 1984-NFPA 70-2018 [Definition: Building.]****Building.**

A- Any structure that stands alone or that is separated from adjoining structures by fire walls used or intended for supporting or sheltering any use or occupancy . (CMP-1)

Statement of Problem and Substantiation for Public Comment

The committee statement provided in response to PI 3614 did not address the language or substantiation provided. It is important that we have a definition of a building that ensures consistent enforcement of NEC rules and that is not in conflict with other standards. The proposed definition of a building would harmonize with the International Building Code, the most widely adopted building code in the country.

The existing definition references a fire wall as a component that may constitute a building. The definition of a fire wall is "a fire-resistance-rated wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall." We have many structures built which have fire walls within them according to the use and occupancy. Just because we have a fire wall doesn't mean we have a separate building. The simplest form of this is that most single family dwellings have a fire wall of some type between the garage and the dwelling portion. If we apply our current language and according to 230.2, which generally states that each building can only be served by one service, we could have a possibility of having a service for the garage and a second for the dwelling portion.

On a larger scale, where we have a large structure that is separated by fire walls, if a designer was to treat each fire wall separated section as a separate building, he could install several smaller services, and thereby avoid GFP or arc flash requirements. This could lead to first responders having difficulty finding all the service points in the event of a fire.

Related Item

- PI 3614

Submitter Information Verification

Submitter Full Name: Randal Hunter

Organization: HTS

Street Address:

City:

State:

Zip:

Submittal Date: Thu Aug 30 13:36:29 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Randal Hunter, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Randal Hunter, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 2114-NFPA 70-2018 [Definition: Building.]****Building.**

A structure ~~that stands alone or that is separated from adjoining structures by fire walls~~, usually enclosed by walls and a roof, constructed to provide support or shelter for an intended occupancy. (CMP-1)

Statement of Problem and Substantiation for Public Comment

The committee statement provided in response to PI 3614 did not address the language or substantiation provided. It is important that we have a definition of a building that ensures consistent enforcement of NEC rules and that is not in conflict with other standards. The proposed definition of a building would harmonize with NFPA 5000, Building Construction and Safety Code.

The existing definition references a fire wall as a component that may constitute a building. The definition of a fire wall is "a fire-resistance-rated wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall." We have many structures built which have fire walls within them according to the use and occupancy. Just because we have a fire wall doesn't mean we have a separate building. The simplest form of this is that most single family dwellings have a fire wall of some type between the garage and the dwelling portion. If we apply our current language and according to 230.2, which generally states that each building can only be served by one service, we could have a possibility of having a service for the garage and a second for the dwelling portion.

On a larger scale, where we have a large structure that is separated by fire walls, if a designer was to treat each fire wall separated section as a separate building, he could install several smaller services, and thereby avoid GFP or arc flash requirements. This could lead to first responders having difficulty finding all the service points in the event of a fire.

Related Item

- PI 3614

Submitter Information Verification

Submitter Full Name: Randal Hunter

Organization: HTS

Street Address:

City:

State:

Zip:

Submittal Date: Thu Aug 30 18:52:19 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Randal Hunter, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Randal Hunter, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 251-NFPA 70-2018 [Definition: Dwelling, Multifamily.]****Dwelling, Multifamily.**

A building or portion of that contains three or more contiguous dwelling units. (CMP-1)

Statement of Problem and Substantiation for Public Comment

It is important to include "portion of" because if the building contains other occupancy's the AHJ concludes it is an "other building" (see 334.10 (3) and does not not allow NM cable to be use as intended for a multifamily such as, above a suspended ceiling (see 334.12(A)(2) or other requirements such as, an appliance disconnect (see 422.34(D). Other buildings also have this language such as, the definitions of Garages (100), Hospitals(517), Health care facility(517),Assembly occupancy(518). with this clarity the AHJ can clearly apply the rules for NM cable in a portion of a building that contains other occupancy's. The contiguous requirement would require the dwelling units to be grouped to qualify as a multifamily, if not I could have three units on the same floor separated by other occupancy's an use the suspended ceiling in an area that is also commercial space to install NM cable.

Related Item

- Public Input No. 1431-NFPA 70-2017

Submitter Information Verification

Submitter Full Name: Alfio Torrissi

Organization: master

Street Address:

City:

State:

Zip:

Submittal Date: Sun Jul 22 06:57:40 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Alfio Torrissi, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Alfio Torrissi, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 1240-NFPA 70-2018 [Definition: Fitting.]

Fitting.

A means for connecting raceway, cable, or cord to an enclosure, box, or raceway system or for connecting a raceway to another raceway . (CMP-1)

Statement of Problem and Substantiation for Public Comment

The definition accepted in the FR appears not to include couplings. Conduit couplings have always been considered to be fittings.

Related Item

- First Revision No. 8342-NFPA 70-2018

Submitter Information Verification

Submitter Full Name: Don Ganiere

Organization: [Not Specified]

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 24 14:20:38 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Don Ganiere, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Don Ganiere, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 1257-NFPA 70-2018 [Definition: Fitting.]

Fitting.

A means for connecting raceway, cable, or cord to an enclosure, box, or raceway system or cable tray system . (CMP-1)

Statement of Problem and Substantiation for Public Comment

There are fittings such as an LCC clamp that connects conduit to cable tray systems. Since cable tray systems are not raceways, I believe cable trays should be included if this revised definition moves forward.

Related Item

- FR-8342

Submitter Information Verification

Submitter Full Name: Paul Guidry

Organization: Fluor Enterprises, Inc.

Affiliation: Associated Builders and Contractors

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 24 15:57:52 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Paul Guidry, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Paul Guidry, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 1261-NFPA 70-2018 [Definition: Fitting.]****Fitting.**

A means for connecting raceway, cable, or cord to an enclosure, box, or raceway system. (CMP-1)

Statement of Problem and Substantiation for Public Comment

I disagree with changing the definition of "Fitting". The proposed change does not encompass all fittings. For instance a coupling could be considered to be a fitting.

Related Item

- FR-8342

Submitter Information Verification

Submitter Full Name: Paul Guidry

Organization: Fluor Enterprises, Inc.

Affiliation: Associated Builders and Contractors

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 24 16:04:01 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Paul Guidry, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Paul Guidry, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 1287-NFPA 70-2018 [Definition: Fitting.]

Fitting.

A means for connecting raceway, cable, or cord to an enclosure, box, or raceway system. (CMP-1)

Informational Note: Examples of fittings are; angle fitting, bushings, cable tray fittings, conduit bodies, connectors, couplings, elbows;, expansion, expansion deflection, and deflection fittings;, liquidtight conduit fittings, sealing fittings, hubs-locknuts, nipples, service-entrance heads, threadless fittings, and transition couplings.

Statement of Problem and Substantiation for Public Comment

The informational note that was included in the original PI would add much clarity to this definition. it should be included in the 2020 code.

Related Item

- Public Input No. 3981-NFPA 70-2017

Submitter Information Verification

Submitter Full Name: Don Ganiere

Organization: [Not Specified]

Street Address:

City:

State:

Zip:

Submittal Date: Sat Aug 25 21:08:11 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Don Ganiere, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Don Ganiere, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 597-NFPA 70-2018 [Definition: Fitting.]****Fitting.**

~~A means for connecting raceway, cable, or cord to an enclosure, box, or raceway system~~ An accessory such as a locknut, bushing, or other part of a wiring system that is intended to perform a mechanical rather than an electrical function . (CMP-1)

Statement of Problem and Substantiation for Public Comment

The existing term is used hundreds of times in the NEC, It has been used for many editions of the NEC without any noted problem. A proposed change like this should be circulated to all Code Panels for their consideration and concurrence before a change is made to the term.

If the proposed definition were to stand, we would no longer call conduit couplings a fitting. A device to connect wiring methods such as EMT and flexible metal conduit would no longer be a fitting. And a nonmetallic bushing that is used to protect conductors from abrasion would no longer be a fitting. So, what would these devices (no longer fittings) be called?

I am sure there are many other examples of problems that would be created by changing the definition. Please explain how the NEC would benefit from such a change?

Related Item

- FR-8342

Submitter Information Verification

Submitter Full Name: Phil Simmons

Organization: Simmons Electrical Services

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 13 15:45:30 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Phil Simmons, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Phil Simmons, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 86-NFPA 70-2018 [Definition: Fitting.]

Fitting.

A means for connecting raceway, cable, or cord to an enclosure, box, or raceway system. (CMP-1) A means for connecting cable tray or strut-type channel raceway to form a structural system.

Statement of Problem and Substantiation for Public Comment

Fittings are also used for structural systems such as cable trays and strut-type channel raceway as referenced in Section 392.2 and 384.2.

Related Item

- FR 8342

Submitter Information Verification

Submitter Full Name: Vince Baclawski

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Thu Jun 28 10:54:56 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Vince Baclawski, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Vince Baclawski, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 1508-NFPA 70-2018 [Definition: Identified (as applied to equipment).]

Identified (as applied to equipment).

Recognizable as suitable by marking, coloring, or information included in the manufacturer's literature for the specific purpose, function, use, environment, application, and so forth, where described in a particular Code requirement. (CMP-1)

Informational Note: Some examples of ways to determine suitability of equipment for a specific purpose, environment, or application include investigations by a qualified testing laboratory (listing and labeling), an inspection agency, or other organizations concerned with product evaluation.

Statement of Problem and Substantiation for Public Comment

The response to PI 3078 stated that there were sufficient examples in the IN to determine suitability, but the only information in the IN relates to the process of product evaluation and certification, not to the actual identification of the equipment. Adding the proposed language into this definition provides clear and helpful language to the installer, designer and enforcer of what to look for when determining suitability. The response indicated that the revision might create inconsistencies, but no actual examples were given, and the language does not unduly limit methods of identification. Marking, coloring, and providing information in a set of instructions are the commonly used methods of identifying suitable uses and these methods leave a wide range of options for identification.

Related Item

- PI 3078

Submitter Information Verification

Submitter Full Name: Christel Hunter

Organization: Cerro Wire

Street Address:

City:

State:

Zip:

Submission Date: Wed Aug 29 09:38:30 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Christel Hunter, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Christel Hunter, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 1997-NFPA 70-2018 [Definition: Labeled.]

Labeled.

Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner. (CMP-1)

Informational Note:- ~~When~~ If a listed product is of such a size, shape, material, or surface texture that it is not possible to apply legibly the complete label to the product, the complete label may appear on the smallest unit container in which the product is packaged.

Statement of Problem and Substantiation for Public Comment

Based on the NEC Style Manual the term "when" should be used in relation to time. The term "if" is better based on being conditional which is the situation in this case.

Related Item

- FR 8360

Submitter Information Verification

Submitter Full Name: Paul Dobrowsky

Organization: Innovative Technology Services

Street Address:

City:

State:

Zip:

Submittal Date: Thu Aug 30 14:14:28 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Paul Dobrowsky, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Paul Dobrowsky, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 1212-NFPA 70-2018 [Definition: Service Equipment.]****Service Equipment.**

The necessary equipment, consisting of a circuit breaker(s) or switch(es) and fuse(s) and their accessories, connected to the utility electric system and intended to constitute the main control and disconnect of the utility electric system. (CMP-10)

Additional Proposed Changes

<u>File Name</u>	<u>Description Approved</u>
CN_61.pdf	70_CN 61

Statement of Problem and Substantiation for Public Comment

NOTE: This Public Comment appeared as CC Note No. 61 in the First Draft Report on First Revision Nos. 8197, 8195 & 8199.

The Correlating Committee directs that this First Revision be reviewed and correlated with FR-8197 and FR-8195. The term "utility electric system" is not defined within the NEC. The term should be reviewed and correlated with the term "serving utility" in figure 230.1.

This action will be considered as a public comment.

Related Item

• FR 8197 • FR 8195 • FR 8199

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC

Organization: NEC Correlating Committee

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 24 13:06:08 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, CC on NEC-AAC, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am CC on NEC-AAC, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Correlating Committee Note No. 61-NFPA 70-2018 [Definition: Service Equipment.]****Submitter Information Verification**

Submitter Full Name: Sarah Caldwell

Committee:

Submittal Date: Wed May 09 17:03:23 EDT 2018

Committee Statement and Meeting Notes

Committee Statement: The Correlating Committee directs that this First Revision be reviewed and correlated with FR-8197 and FR-8195. The term "utility electric system" is not defined within the NEC. The term should be reviewed and correlated with the term "serving utility" in figure 230.1.

This action will be considered as a public comment.

First Revision No. 8199-NFPA 70-2018 [Definition: Service Equipment.]

Ballot Results

✔ **This item has passed ballot**

12 Eligible Voters
0 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Affirmative All

Brunssen, James E.
Dressman, Kevin L.
Hickman, Palmer L.
Hittinger, David L.
Holub, Richard A.
Johnston, Michael J.
Kovacik, John R.
Manche, Alan
McDaniel, Roger D.
Pierce, James F.
Saporita, Vincent J.
Williams, David A.



Public Comment No. 1744-NFPA 70-2018 [New Definition after Definition: Circuit Breaker.]

Circuit Conductors

Circuit conductors include all ungrounded and grounded conductors. Equipment grounding conductors, grounding electrode conductors, and bonding conductors are not circuit conductors.

Statement of Problem and Substantiation for Public Comment

The response to PI 3063 stated that Section 110.10 differentiates between the circuit conductor and the equipment grounding conductor. In a roundabout way, that is true, but it does not explicitly indicate what a circuit conductor is or is not, and the subject of that section is Circuit Impedance, Short-Circuit Current Ratings, and Other Characteristics - probably not an obvious place for a code user to look for guidance on the term "circuit conductor." Using this as a reference is not helpful to the user of the code, whereas a clear and concise definition of what a circuit conductor is (and is not) would be very helpful when applying the many relevant code requirements. The language in 110.10 also does not address bonding conductors or grounding electrode conductors.

Related Item

- PI 3063

Submitter Information Verification

Submitter Full Name: Christel Hunter

Organization: Cerro Wire

Street Address:

City:

State:

Zip:

Submittal Date: Wed Aug 29 19:42:50 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Christel Hunter, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Christel Hunter, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 1741-NFPA 70-2018 [New Definition after Definition: Copper-Clad Aluminum Condu...]

Crawl Space

An area with a height of less than 6.5' that is designed to allow human entry.

Statement of Problem and Substantiation for Public Comment

The response to PI 580 indicated a preference for the Merriam Webster definition of crawl space. That definition is: a shallow unfinished space beneath the first floor or under the roof of a building especially for access to plumbing or wiring.

That's a pretty good definition, but it would not cover areas such as mechanical spaces between floors in buildings that are accessed via an access panel or similar method of entry. It is common to have spaces between floors that do not have sufficient height to allow for the full minimum height required by 110.26(A)(3), and the provisions in 110.26(A)(4) are appropriate, but the accessible opening requirement in 110.26(A)(4)(a) would not apply if the Merriam Webster definition for crawl space is used.

Related Item

- PI 580

Submitter Information Verification

Submitter Full Name: Christel Hunter

Organization: Cerro Wire

Street Address:

City:

State:

Zip:

Submittal Date: Wed Aug 29 19:21:40 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Christel Hunter, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Christel Hunter, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 1353-NFPA 70-2018 [New Definition after Definition: Festoon Lighting.]

New Definition after Festoon Lighting

Field Evaluation (Field Evaluated). The process used to determine conformance with requirements for one-of-a-kind, limited production, used, or modified products that are not listed or field labeled under a certification program. [790, 2018, 3.3.3]

Statement of Problem and Substantiation for Public Comment

The panel's statement in the resolution of the PI 2595 was not entirely correct. The term "field evaluation" is found in both the definitions of "Field Evaluation Body" and the definition of "Field Labeled". I believe that definitions are part of the NEC which is contrary to the panel statement indicating that definitions are not part of the NEC.

In addition, from the action by CMP-10 with FR 8460, this term is now used in 230.66.

In a code wide coordinated effort, a number of other public comments are being submitted to CMP-1 for new section 110.3(D) and to CMP-4 for various sections in the alternate energy articles, to resolve the misuse of the term "field labeled" and to the more correct term, "field evaluation" or "field evaluated". These comments further identify the need to have this term defined in Article 100.

Please see the related comments attached to this comment.

Related Public Comments for This Document

<u>Related Comment</u>	<u>Relationship</u>
Public Comment No. 1489-NFPA 70-2018 [New Section after 110.3(C)]	
Public Comment No. 1490-NFPA 70-2018 [Section No. 690.4(B)]	
Public Comment No. 1491-NFPA 70-2018 [Section No. 690.12(B)(2)]	
Public Comment No. 1492-NFPA 70-2018 [Section No. 691.5]	
Public Comment No. 1513-NFPA 70-2018 [Section No. 692.6]	
Public Comment No. 1518-NFPA 70-2018 [Section No. 694.7(B)]	
Public Comment No. 1519-NFPA 70-2018 [Section No. 694.7(F)]	
Public Comment No. 1521-NFPA 70-2018 [Section No. 705.6]	
Public Comment No. 1523-NFPA 70-2018 [Section No. 705.170]	
Public Comment No. 1525-NFPA 70-2018 [Section No. 710.6]	
Public Comment No. 1489-NFPA 70-2018 [New Section after 110.3(C)]	
Public Comment No. 1490-NFPA 70-2018 [Section No. 690.4(B)]	
Public Comment No. 1491-NFPA 70-2018 [Section No. 690.12(B)(2)]	
Public Comment No. 1492-NFPA 70-2018 [Section No. 691.5]	
Public Comment No. 1513-NFPA 70-2018 [Section No. 692.6]	
Public Comment No. 1518-NFPA 70-2018 [Section No. 694.7(B)]	
Public Comment No. 1519-NFPA 70-2018 [Section No. 694.7(F)]	
Public Comment No. 1521-NFPA 70-2018 [Section No. 705.6]	
Public Comment No. 1523-NFPA 70-2018 [Section No. 705.170]	
Public Comment No. 1525-NFPA 70-2018 [Section No. 710.6]	
Public Comment No. 1531-NFPA 70-2018 [Section No. 705.11(E)]	

Related Item

- PI 2595 • FR 8460

Submitter Information Verification

Submitter Full Name: Charles Mello

Organization: cdcmello Consulting LLC

Affiliation: self

Copyright Assignment:

Street Address:

City: I, Charles Mello, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

State: By checking this box I affirm that I am Charles Mello, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

Zip:

Signature Date:

Submitter:

Committee:

Mon Aug 27 12:41:04 EDT 2018
NEC-POF



Public Comment No. 1292-NFPA 70-2018 [New Definition after Definition: Fitting.]

TITLE OF NEW CONTENT

Fixed Electric Equipment. Electrical equipment that is fastened in place by being firmly secured to the surface on which it is mounted.

Statement of Problem and Substantiation for Public Comment

The term Fixed does not relate to the equipment's state of repair.
This is a clear, understandable, and enforceable definition.

Portable and mobile types of equipment are defined. Fixed types of equipment should also be defined.

Related Item

- PI 3161

Submitter Information Verification

Submitter Full Name: Michael Weitzel

Organization: Central Washington Electrical

Street Address:

City:

State:

Zip:

Submittal Date: Sat Aug 25 23:03:00 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Michael Weitzel, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Michael Weitzel, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 252-NFPA 70-2018 [New Definition after Definition: Photovoltaic (PV) System.]

TITLE OF NEW CONTENT

Type your content here ...Physical Damage,

Damage that may occur during normal surrounding activities

Statement of Problem and Substantiation for Public Comment

Normal is essential to this definition as many AHJ's take scenarios to the extreme. I had an inspector say a truck could jumped a cub crashed through a fence and hit the service for the reason to require protection from physical damage, another time I had a piece of pvc emerging from grade to an LB entering a home with 3 feet of crushed stone extending from the home and the AHJ said in 20 years they can re-landscape and therefor it was subject to physical damage. This is an abuse of the physical damage protection requirement and this definition would curb these out of the normal occurrence requirement and further clarify when physical damage could be anticipated.

Related Item

- Public Input No. 177-NFPA 70-2017

Submitter Information Verification

Submitter Full Name: Alfio Torrasi

Organization: master

Street Address:

City:

State:

Zip:

Submission Date: Sun Jul 22 07:43:16 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Alfio Torrasi, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Alfio Torrasi, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 1746-NFPA 70-2018 [New Definition after Definition: Receptacle Outlet.]

Reconditioned Equipment

Equipment that has been returned to near new or original operational level.

Statement of Problem and Substantiation for Public Comment

The response to PI 2794 stated that reconditioned equipment does not necessarily mean that the equipment is safe and reliable, and of course that is true for all equipment, since even new equipment experiences failures and creates hazards. The proposed language in this PC offers a definition that describes the intended state of reconditioned equipment, which is to take used equipment and evaluate, repair and service it so that the equipment will operate for the intended purpose. The wording was based on a definition found online at The Law Dictionary, a free online legal dictionary.

Related Item

- PI 2794

Submitter Information Verification

Submitter Full Name: Christel Hunter

Organization: Cerro Wire

Street Address:

City:

State:

Zip:

Submission Date: Wed Aug 29 19:57:36 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Christel Hunter, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Christel Hunter, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 2010-NFPA 70-2018 [Section No. 110.1]

110.1 Scope.

This article covers general requirements for the examination and approval, installation and use, access to and spaces about electrical conductors and equipment; enclosures intended for personnel entry; and tunnel installations.

Informational Note 1 : See Informative Annex J for information regarding ADA accessibility design.

Informational Note 2: For additional information regarding electrical safety IEEE 3007.3
Recommended Practice for Electrical Safety in Industrial and Commercial Power Systems.

Statement of Problem and Substantiation for Public Comment

Previous editions of the NEC referenced the IEEE Color books in Fine Print Notes in many locations. IEEE 3007.3 document is one of several that replaces content in ANSI/IEEE 241 Recommended Practice for Electric Power Systems in Commercial Buildings -- the so-called "Gray Book"; and the ANSI/IEEE 141 Recommended Practice for Power Distribution for Industrial Plants -- the so-called "Red Book"; both of which are now being sunsetted and superseded by 3007.3. It features "safety by design"; and not just safety for electricians working close to live parts; or occupants exposed to shock hazard -- but safety that results from power security. Forced outages occur more frequently and put more people at risk than flash and shock hazards.*

The stronger the linkage between the NFPA and IEEE on electrical power technology the better. The "silos" that now exist between the fire safety culture of the NFPA and the electrical engineering science culture of the IEEE does not serve the purpose of optimal electrical safety and national power security. I would not like to see a major regional contingency descend upon the United States and have legislators wondering why there could not have been more sharing of information between NFPA and the IEEE technical committees. (Not that sharing information is not present to some degree how; but the sharing could be better). More information sharing is possible with the modular technical crosswalks that are now possible with the emergent suite of IEEE dot standards

* The IEEE Education and Healthcare Facilities Committee tracks forced outages in school districts, college and university campuses

Related Item

- Public Input No. 3410-NFPA 70-2017 [Section No. 110.1]

Submitter Information Verification

Submitter Full Name: Michael Anthony

Organization: Standards Michigan

Affiliation: IEEE Education & Healthcare Facilities Committee

Street Address:

City:

State:

Zip:

Submission Date: Thu Aug 30 14:39:46 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Michael Anthony, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Michael Anthony, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 1389-NFPA 70-2018 [New Section after 110.3]

(D) Field Evaluations.

When Field Evaluations shall be are performed they shall be by recognized qualified electrical Field Evaluation Bodies (FEB) and shall be completed in accordance with applicable product standards recognized as achieving equivalent and effective safety for equipment installed to comply with this Code . . In addition to any field evaluation label, field evaluation reports shall be provided to the FEB client and the Authority Having Jurisdiction.

Statement of Problem and Substantiation for Public Comment

Substantiation: As an AHJ when we come across unlisted equipment that do not meet the requirements of 110.(A),(B) or (C) we may allow the use of a field evaluation. This information helps aid us in our decision to allow these types of inspection and by whom. The information note gives us direction. This section correlates to the need for the definitions for "Field Evaluations (PI-2595P) and FEB (PI-2695)"

Related Item

• PI-2595 • PI-2695 • PI-3714

Submitter Information Verification

Submitter Full Name: Richard Hollander

Organization: City Of Tucson

Street Address:

City:

State:

Zip:

Submission Date: Mon Aug 27 18:42:08 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Richard Hollander, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Richard Hollander, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 2157-NFPA 70-2018 [Section No. 110.3(A)]****(A) Examination.**

In judging equipment, considerations such as the following shall be evaluated:

(1) Suitability for installation and use in conformity with this Code

Informational Note No. 1: Equipment may be new, reconditioned, refurbished, or remanufactured.

Informational Note No. 2: Suitability of equipment use may be identified by a description marked on or provided with a product to identify the suitability of the product for a specific purpose, environment, or application. Special conditions of use or other limitations and other pertinent information may be marked on the equipment, included in the product instructions, or included in the appropriate listing and labeling information. Suitability of equipment may be evidenced by listing or labeling.

Informational Note No. 3:

Industry standards are available for guidelines for reconditioning of equipment, such as the PEARL (Professional Electrical Apparatus Reconditioning

League) EERS (ELECTRICAL EQUIPMENT RECONDITIONING STANDARD) for Electrical Apparatus and Equipment used in Commercial and Industrial Applications

- (2) Mechanical strength and durability, including, for parts designed to enclose and protect other equipment, the adequacy of the protection thus provided**
- (3) Wire-bending and connection space**
- (4) Electrical insulation**
- (5) Heating effects under normal conditions of use and also under abnormal conditions likely to arise in service**
- (6) Arcing effects**
- (7) Classification by type, size, voltage, current capacity, and specific use**
- (8) Other factors that contribute to the practical safeguarding of persons using or likely to come in contact with the equipment**

Statement of Problem and Substantiation for Public Comment

Industry standards are now available for the reconditioning of electrical equipment. The Professional Electrical Apparatus Reconditioning League ELECTRICAL EQUIPMENT RECONDITIONING STANDARD for Electrical Apparatus and Equipment used in Commercial and Industrial Applications is a comprehensive standard used for reconditioning electrical equipment. Since this is a newer standard, it would be helpful to the code user to include this information in the NEC.

Related Item

- PI 4350

Submitter Information Verification

Submitter Full Name: Howard Herndon

Organization: National Field Services

Street Address:

City:

State:

Zip:

Submittal Date: Thu Aug 30 21:11:14 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Howard Herndon, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Howard Herndon, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 1489-NFPA 70-2018 [New Section after 110.3(C)]

Add a new section after 110.3(C)

110.3(D) Field Evaluations. Field Evaluations shall be performed by recognized qualified electrical Field Evaluation Bodies (FEB) and shall be completed in accordance with applicable product standards recognized as achieving equivalent and effective safety for equipment installed to comply with this Code . In addition to any field evaluation label, field evaluation reports shall be provided to the FEB client and the Authority Having Jurisdiction.

Informational Note: International Accreditation Services (IAS) as well as many cities, counties and states provide recognitions of FEBs that perform field evaluations of certain products to ensure that they meet the requirements of the applicable product safety standards. These recognitions are done either from adoption and implementation of NFPA 790 or referencing NFPA 790 as criteria for qualification in local policies and procedures. If the field evaluation is done by a qualified electrical FEB program, the field applied evaluation label signifies that the evaluated product complies with the requirements of one or more appropriate product safety test standards as detailed in the accompanying engineering report.

Statement of Problem and Substantiation for Public Comment

The proposed text submitted under PI 2614 did not require or infer that field evaluations were required. There was a similar PI submitted by a different submitter, that may have implied this, but it was not in this proposed text. The proposed text mimics the exact text accepted by CMP-1 for the 2017 NEC in 110.3(C) including the informational note. The only changes were from "Product testing, evaluation, and listing (product certification)" to "field evaluations" and from "recognized qualified electrical testing laboratories" to "field evaluation bodies". Other editorial changes were made for clarity and proper grammar.

The informational note also mimics the information note found in 110.3(C) and provides information and guidance to the user and AHJ that there are means of accreditation for FEBs and there are standards for guiding qualification of FEBs as well as the field evaluation process. This is similar language used in 110.3(C) for the OSHA NRTL recognitions as well as recognitions of testing laboratories by jurisdictions outside of OSHA.

The need for this new section is from the many field evaluations being completed daily by a number of field evaluation bodies as well in some states by professional engineers that hold themselves out as qualified to perform safety evaluations of uncertified products and equipment. The four largest third-party independent field evaluation companies in the United States perform evaluations of on the order of 50,000 equipment items per year and growing. Considering all the smaller companies and local single providers this number easily doubles. For consistency across the jurisdictions that enforce the NEC, this section is needed for the AHJs to have enforceable language in the Code to use as a basis to accept field evaluations when they are required.

This is one of a package of comments submitted for field evaluations and correcting term "field labeled" that is being misused. Please see the related comments noted for this public comment input.

Related Public Comments for This Document

<u>Related Comment</u>	<u>Relationship</u>
Public Comment No. 1353-NFPA 70-2018 [New Definition after Definition: Festoon Lighting.]	
Public Comment No. 1490-NFPA 70-2018 [Section No. 690.4(B)]	
Public Comment No. 1491-NFPA 70-2018 [Section No. 690.12(B)(2)]	
Public Comment No. 1492-NFPA 70-2018 [Section No. 691.5]	
Public Comment No. 1513-NFPA 70-2018 [Section No. 692.6]	
Public Comment No. 1518-NFPA 70-2018 [Section No. 694.7(B)]	
Public Comment No. 1519-NFPA 70-2018 [Section No. 694.7(F)]	
Public Comment No. 1521-NFPA 70-2018 [Section No. 705.6]	
Public Comment No. 1523-NFPA 70-2018 [Section No. 705.170]	
Public Comment No. 1525-NFPA 70-2018 [Section No. 710.6]	

[Public Comment No. 1353-NFPA 70-2018 \[New Definition after Definition: Festoon Lighting.\]](#)

[Public Comment No. 1490-NFPA 70-2018 \[Section No. 690.4\(B\)\]](#)

[Public Comment No. 1491-NFPA 70-2018 \[Section No. 690.12\(B\)\(2\)\]](#)

[Public Comment No. 1492-NFPA 70-2018 \[Section No. 691.5\]](#)

[Public Comment No. 1513-NFPA 70-2018 \[Section No. 692.6\]](#)

[Public Comment No. 1518-NFPA 70-2018 \[Section No. 694.7\(B\)\]](#)

[Public Comment No. 1519-NFPA 70-2018 \[Section No. 694.7\(F\)\]](#)

[Public Comment No. 1521-NFPA 70-2018 \[Section No. 705.6\]](#)

[Public Comment No. 1523-NFPA 70-2018 \[Section No. 705.170\]](#)

[Public Comment No. 1525-NFPA 70-2018 \[Section No. 710.6\]](#)

[Public Comment No. 1531-NFPA 70-2018 \[Section No. 705.11\(E\)\]](#)

Related Item

- PI 2614

Submitter Information Verification

Submitter Full Name: Charles Mello

Organization: Cdcmello Consulting Llc

Affiliation: Self

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 28 23:23:04 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Charles Mello, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Charles Mello, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 1276-NFPA 70-2018 [Section No. 110.4]****110.4 Voltages.**

Throughout this *Code*, the voltage considered shall be that at which the circuit operates the nominal voltage of the system. The voltage rating of electrical equipment shall be in accordance with 110.4(A) or 110.4(B)

110.4(A) The voltage rating of the electrical equipment shall not be less than the nominal voltage of the system

110.4(B) The voltage rating of the electrical equipment shall be permitted to be less than the nominal voltage of the system only if the electrical equipment has been listed to operate at the nominal voltage level of the system.

informational note: An example of electrical equipment that might be rated differently than the system voltage is a circuit to which it is connected 115 volt electrical motor that is designed to operate on a 120 volt circuit .

Statement of Problem and Substantiation for Public Comment

There are two issues with the definition as currently written. The first is "...the voltage considered shall be that at which the circuit operates." There are quite a few 480 volt systems that operate at around 500 volts or so. Likewise, it is not the actual voltage that is present at any given time that should describe the system It is the nominal voltage that describes the system. The second issue is for equipment that has a rating that is less than the nominal voltage of the system, such as motors. As currently written, 110.4 does not allow a 460 volt motor to be connected to a 480 volt circuit.

Related Item

- 1375-NFPA 70-2017

Submitter Information Verification

Submitter Full Name: Eric Stromberg

Organization: Los Alamos National Laboratory

Affiliation: Self

Street Address:

City:

State:

Zip:

Submittal Date: Sat Aug 25 14:53:15 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Eric Stromberg, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Eric Stromberg, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 1360-NFPA 70-2018 [Section No. 110.5]

110.5 Conductors.

Conductors normally used to carry current shall be of copper , or aluminum , or copper clad aluminum unless otherwise provided in

this

this Code .

Where

Where the conductor material is not specified, the sizes given in

this

this Code

shall

shall apply to copper conductors. Where other materials are used, the size shall be changed accordingly. Conductors shall only be permitted where the circuit components are identified for use with such conductor.

Informational Note:

~~For~~

~~For copper-clad aluminum~~

conductors

1

see 310

see 310 .

14

15 .

Statement of Problem and Substantiation for Public Comment

PUBLIC COMMENT RESPONSE:

- Panel statement in error. The panel's resolution statement saying that copper-clad aluminum is not "normally used to carry current" is incorrect. The panel statement actually substantiates the problem. Some users or inspectors could very easily choose not to use copper-clad aluminum or to turn down valid Code compliant installations using copper-clad aluminum because it is not identified as what appears to be the "allowed conductors" in 110.5. Copper-Clad Aluminum wire (ASTM B-566), one of only three conductor metals allowed for branch circuits in Code, should not be a footnote, but should have equal representation along with the two other metals.
- Current 110.5 Language Sets the Tone for Putting Copper-Clad Aluminum wire (ASTM B-566) at a Commercial Disadvantage: copper-clad aluminum as a conductor should not be relegated to an Informational Note by such a "Foundational Article" as 110.5, which lays the basis for understanding conductors throughout the rest of Code. As stated in the original substantiation, the informational note does not direct the user to any special information that is provided about copper-clad aluminum any more than information that is provided for single metal-copper or aluminum conductors.

As stated in the original substantiation of PI 2111, there are 68 uses of copper-clad aluminum in the 2017 NEC and where conductor materials are specified, copper-clad aluminum is equivalently listed right along with copper and aluminum implying any of these materials are suitable to be used within their ratings, listings of terminations, and any other limitations from that section. These 68 sections and locations in tables clearly provide that copper-clad aluminum conductors are suitable to normally carry current in electrical circuits.

- Copper-Clad Aluminum Electrical Conductors Have a ½ Century of Commercial Use: For over 50 years copper-clad aluminum conductors have been and continue to be manufactured (now on the order of 50 million feet per year and growing), sold, and installed "to normally carry current" in the United States as well as other countries that adopt the NEC for 110/20 Volt 60 Hertz systems. Copper-Clad Aluminum has been used widely as a branch

circuit conductor since 1971, and has been installed in over 100,000 dwellings in the USA as principal residential wiring. It has performed safely for nearly ½ a century as a residential conductor, without one documented case of failure (unlike solid single-metal 1350 aluminum NM cable from the 1960's). In Latin American and Caribbean countries that also adopt the NEC (most of those countries have adopted the NEC as a national Code...), there have been over 40,000 residential installations of copper-clad aluminum conductors since 2011 without any known failures.

- **Panel Statement Technical Substantiation.** The panel did not provide any technical reason that copper-clad aluminum should not have the same status as copper or aluminum for general use conductors in Section 110.5 as copper-clad aluminum presently has in Tables 310.15(8)(16) through 310.15(8)(20) for conductors 2000 Volts and below, Sections 250.62, 250.102, 250.118, 310.10(H), 310.106(8), 328.100, 330.104, 334.104, 336.104 and 340.104 as well as other references in Chapters 4, 5, and 8 of the NEC. The breath of use of copper-clad aluminum has historically varied based on the cost of copper and aluminum wire, where allowed. Where cost effective, copper-clad aluminum has been and continues to be readily used in dwelling and non-dwelling applications.
- **Ensuing Proper Equipment Application.** The added clause, which does mimic 110.14, was provided to again ensure the reader and user of the Code that any conductor used - copper, aluminum, or copper-clad aluminum - must be compatible with the devices, equipment and terminals where the conductor is installed. While this may be somewhat redundant with 110.14, the misapplication of conductors continues to be a problem with installations today not withstanding the requirements in 110.14, therefore the added text does provide value and clarity.
- **Conductor Material Options.** Copper-Clad Aluminum is one of only three industrial metals currently in existence that can be generally used as a conductor in branch circuits (all three metals are distinct and unique as a material), so to not give each metal equal footing to the other is unnecessarily misleading the user of this Code. Copper-Clad Aluminum is a BIMETAL (one single metal whose matrix contains two distinct metallic components united by a true metallurgical bond stronger than the metals that it unites); copper-clad aluminum wire (ASTM B566) is not electro-plated, hot dipped, painted nor powder-coated aluminum wire. The cladding process creates a metallurgical bond between two dissimilar metals (AA-8000 series aluminum and O₂ free Copper), which means that the less noble metal of a bimetal is NOT sacrificial to the other. This is not the case with materials designed to only give cathodic protection as with copper coated or electroplated wires, nickel or tin-plated copper, zinc plated steel, hot-dipped galvanized wire, etc. Given this technical information, the panel should adopt the proposed text change and delete the informational note that implies the relegation of copper-clad aluminum to something lesser than a valid conductor for wiring purposes.

Related Item

- 2111

Submitter Information Verification

Submitter Full Name: Peter Graser

Organization: Copperweld

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 27 13:32:26 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Peter Graser, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Peter Graser, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 643-NFPA 70-2018 [New Section after 110.7]****“110.7” becomes “110.7A”**

The text of the new 110.7A remains the same as existing 110.7. This is to make room for the newly proposed 110.7B mentioned below.

-

“110.7B Incomplete and Abandoned Work

Incomplete or abandoned electrical work, in the immediate vicinity of new electric work, shall be removed.”

“Exception: Incomplete or abandoned work may remain if all remaining work is properly secured and supported. Also, all ungrounded and grounded conductors, in their existing or prior state, are terminated in a way that the installation is free from electrical faults if any of these conductors were inadvertently energized.”

TITLE OF NEW CONTENT

Type your content here ...

Additional Proposed Changes**File Name****Description Approved**

Proposed_Code_Changes_2020.docx

Statement of Problem and Substantiation for Public Comment

Complete it or delete it. Several articles, such as 110.7, 110.12, and 300.18, come close but don't quite say it.

All electrical work should be free from faults. Incomplete or abandoned work that became inadvertently energized could present an unsafe condition.

I'm picturing 'in the immediate vicinity' of the proposal to mean work adjacent to new wiring. The electric work does not have to grow to include the whole premises.

The existing text of 110.7 would remain the same but become “110.7A”.

This proposal is similar to the already existing 725.25 and 760.25.

Related Item

- 110.7

Submitter Information Verification

Submitter Full Name: Norman Feck

Organization: State of Colorado

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 14 14:04:12 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Norman Feck, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Norman Feck, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

Public Input

Proposed Code Changes for 2020 NFPA 70

Norman Feck
State of Colorado Electrical Inspector
8968 County Rd 300
Parachute, CO 81635
Norman.Feck@state.co.us
970-230-2120
08/14/2018

Note:

Proposed code change text is typed in blue and is within blue parenthesis.

Existing, quoted code text is typed in black and is within black parenthesis.

My thoughts on existing and proposed NEC articles are typed in black.

“110.7” becomes “110.7A”

The text of the new 110.7A remains the same as existing 110.7. This is to make room for the newly proposed 110.7B mentioned below.

“110.7B Incomplete and Abandoned Work

Incomplete or abandoned electrical work, in the immediate vicinity of new electric work, shall be removed.”

“Exception: Incomplete or abandoned work may remain if all remaining work is properly secured and supported. Also, all ungrounded and grounded conductors, in their existing or prior state, are terminated in a way that the installation is free from electrical faults if any of these conductors were inadvertently energized.”

Complete it or delete it. Several articles, such as 110.7, 110.12, and 300.18, come close but don't quite say it.

All electrical work should be free from faults. Incomplete or abandoned work that became inadvertently energized could present an unsafe condition.

I'm picturing 'in the immediate vicinity' of the proposal to mean work adjacent to new wiring. The electric work does not have to grow to include the whole premises.

The existing text of 110.7 would remain the same but become “110.7A”.

This proposal is similar to the already existing 725.25 and 760.25.

"110.12C New Construction Materials and Wiring Methods

Newly constructed jobsites require electrical materials designed for new construction work. Wiring method installation at newly constructed jobsites shall be performed as new construction according their associated code article(s). Remodel type junction boxes, lighting fixtures, and so forth shall not be permitted. Fished wiring methods described and allowed elsewhere in this code are reserved for finished buildings or structures; also remaining finished portions of existing buildings or structures under construction."

Presently, there is nothing in NEC70 that prevents a contractor from building and finishing a building then have the electrical work installed at a later date. Fished wiring methods are difficult to near impossible to inspect.

“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.

Terminals for more than one conductor and terminals used to connect aluminum shall be so identified.”

“Where stranded conductors are terminated by wire-binding screws, without the aid of crimp-on terminals, the strands shall be twisted in a counter clockwise direction as the installer faces the end of the conductor to be terminated to prevent the strands from being squeezed out from under the screw.”

110.14(A) does mandate a “thoroughly good connection” but does not prohibit the direct connection of stranded conductors under a wire binding screw unless a manufacturer prohibited it in the product instructions. The NEC board could implement this proposal to prevent poor connections made in the field, knowing splices and terminals are where faults usually occur due to an improper or flawed connection.

I believe it should be permissible to land conductors in this way provided the “thoroughly good connection” is made.

If the electrical code panel finds the direct connection of a conductor under a wire binding screw is unacceptable, language in this code could be added saying this so the practice could be more easily enforced as prohibited.

“110.14(B) Splices

Conductors shall be spliced or joined with splicing devices identified for the use or by brazing, welding, or soldering with a fusible metal alloy. Soldered splices shall first be spliced or joined so as to be mechanically and electrically secure without solder and then be soldered. All splices and joints and the free ends of conductors shall be covered with an insulation equivalent to that of the conductors or with an identified insulating device.

Wire connectors or splicing means installed on conductors for direct burial shall be listed for such use.”

“Terminations and splices made within 18” of earth shall be wet location rated.”

My experience in the field has shown connections made within 18” of earth (earth – not grade, not concrete) are vulnerable and will deteriorate at a rate greater than outdoor terminations made above 18”.

Factors such as sprinkler systems spraying these boxes regularly, climate, or some soils being more corrosive than others, does corrode splices made in these junction boxes more so than splices made in less harsh conditions. Outlets for wall mount luminaires, for example, would not be subject to this new code text and rightfully so. If a fixture was installed correctly per 410.10(A), the terminations I generally witness are fine. It is when opening low mount outdoor junction boxes that an electrician is more likely to observe deteriorating terminations and splices, even if the boxes were installed according to 314.15.

These wet location splices and terminations follow the reasoning of 250.64(A), 250.120(B), and 406.9 in that these connections are vulnerable. I find it necessary that these wet location splices and terminations are rated for wet locations for the same reasoning as they are necessary in 314.30(C).

This new code entry would prevent disconnects, panelboards, etc. from being mounted within 18” of earth in many cases.

“210.5(C)(1) Branch Circuits Supplied from More Than One Nominal Voltage System

Change 210.5(C)(1) Exception to “210.5C1 Exception No. 1” then add
“210.5(C)(1) Exception No. 2: The requirements of 210.5(C)(1) for posting of identification means for ungrounded conductors shall not be required at industrial installations where conditions of maintenance and supervision ensure only qualified persons service the equipment.”

This is similar to 110.24 and 392.18(H) exception. These environments are most likely to have qualified persons present to service electrical equipment. Note: I prefer ‘at’ industrial installations rather than ‘in’ as we read in 392.18(H).

"210.52 Dwelling Unit Receptacle Outlets

This section provides requirements for 125-volt, 15- and 20-ampere receptacle outlets. The receptacles required by this section shall be in addition to any receptacle that is:

- (1) Part of a luminaire or appliance, or
- (2) Controlled by a wall switch in accordance with 210.70(A)(1), Exception No. 1, or
- (3) Located within cabinets or cupboards, or
- (4) Located more than 1.7 m (5 ½') above the floor

Permanently installed electric baseboard heaters equipped with factory-installed receptacle outlet or outlets provided as a separate assembly by the manufacturer shall be permitted as the required outlet or outlets for the wall space utilized by such permanently installed heaters. Such receptacle outlets shall not be connected to the heater circuits." ["Receptacles shall not be mounted directly above electric or hot water baseboard heaters."](#)

["Exception: Receptacles mounted at 5 ½' or greater above hot water baseboard heaters shall be permitted. Those receptacles mounted at greater than 5 ½' above baseboard heaters shall not be counted as part of the required number of receptacle outlets."](#)

I think not only of potential fire hazards from damaged cords but of the affected ampacity (400.5(A)) of an electric cord draped across or through heated parts of baseboard heaters. The design of electric baseboard heaters doesn't generally have the cords in direct contact with heated surfaces. At least, not as much as with hot water baseboard heaters. There's no way to control what will be plugged in, drapes, furniture layout, direct contact to heated surfaces, ambient heat, insulation, etc. The best precaution is to not allow receptacles directly above electric or baseboard heaters. Instead of (1) 8' heater, (2) separated 4 footers will be installed; for example. Those receptacles at 5 ½' or greater above the baseboard heaters (notice it says above baseboard heaters not floor) will likely be plugging wall mount TVs or similar. By implementing this new proposed text [Information Note of 210.52 and Information Note of 424.9 can be omitted.](#)

"210.52E3 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 "and within its perimeter" from the balcony, deck, or porch. The receptacle outlet shall not be located more than 2.0 m (6 ½') above the balcony, deck, or porch." "Where balconies, decks, or porches are connected by stairway(s) of three risers or more, each connected balcony, deck, or porch shall be considered a separate balcony, deck, or porch and each shall have at least one additional receptacle outlet installed accessible and within its perimeter."

Stairways cause separate spaces. Added receptacles for these added deck spaces would prevent extension cords draped across the steps. Multi-tier decks don't always meet grade level and the upper level of a dwelling unit where those receptacles would already be required. Square footage doesn't factor into the code language. Multi-tier means likely more elaborate and greater square footage. Added convenience receptacles would add safety.

The NEC Handbook says to install the receptacle within the spaces perimeter. The code book should state that as well for both installers' and code official's sake.

210.70(A)(1) Habitable Rooms

Presently, the article reads: "At least one wall switch-controlled lighting outlet shall be installed in every habitable room, kitchen, and bathroom." "An additional wall switch-controlled lighting outlet shall be installed at each entrance, unless within 10' of another entrance with a wall switch, to every habitable room and bathroom when that room is 60 sq.' or greater in size." "A switched receptacle is not considered one of the receptacle outlets required by 210.52."

The idea behind the first sentence of this code change is to prevent a person from having to cross a dark room to turn the lights on in that room, lessening the chances of a person hurting themselves. The 60sq.' or greater size (similar to 210.52(I)) makes this added code text reasonable.

The new text "unless within 10' of another entrance with a wall switch" makes it so doorways or entrances adjacent to each other or very near each other do not require an additional wall switch. A Jack and Jill bathroom could be an example of not requiring (or prohibiting either) an additional wall switch.

The second sentence on a switched receptacle not being considered a wall space receptacle is taken word for word from the NEC70 Handbook. Placing it in the code book is very useful and makes it more easily enforced by code officials and adhered to by installers.

210.70(A)(2)(4) and 210.70(A)(2)(5)

Move existing text of 210.70(A)(2)(4) to 210.70(A)(2)(5)

210.70(A)(2)(4) Now reads: “An additional wall switch-controlled lighting outlet shall be installed in hallways with a long dimension of 10’ or greater. This measurement shall be taken from the center line of the hallway without passing through a doorway. The installed switches shall be at opposite ends of the hallway.”

This proposal, if enacted, lessens the chance of a person being caught in a dark residential hallway. Commercial hallways often have 24 hour un-switched egress lighting.

Three-way switching is not mandated but would likely be installed.

The 10’ dimension is derived from 210.52(H).

210.70(A)(2)(5) Now reads: “Lighting outlets controlled in accordance with 210.70(A)(2)(3), and A(2)(4) shall not be controlled by use of dimmer switches unless they provide the full range of dimming control at each location.”

The newer version of 210.70(A)(2)(4) should be included to 210.70(A)(2)(5) to prevent someone from entering a darkened hallway by use a maintained dimmable switch at one end of the hallway or the other.

Some electronic 3-way switches and typical potentiometer 3-way switches that didn’t have full range of dimming control at each end would violate the new 210.70A(2)(5). Other electronic switches with slave switches do have that full range capability at each end and are code compliant.

215.12(C)(1) Feeders Supplied from More Than One Nominal Voltage System

Add the exception: “The requirements of 210.5(C)(1) for posting of identification means for ungrounded conductors shall not be required at industrial installations where conditions of maintenance and supervision ensure that only qualified persons service the equipment.”

This is similar to 110.24 and 392.18 Exception. These environments are most likely to have qualified persons present to service the electrical equipment. Note: I prefer ‘at’ rather than ‘in’ as we read in 392.18(H).

"225.32A Marking

Each main disconnecting means shall be permanently marked to identify it as a main disconnect."

This is similar to 230.70B. It is a requirement to label each of the one through six service disconnecting means as a service disconnect. At a detached building or structure, up to six disconnecting means are also allowed for the feeder. Each of these disconnecting means shall be labeled 'MAIN' so the user would know that's what it takes to shut off all power for that detached building or structure.

“225.37 Identification” becomes “225.37A Multiple Circuits Identification.” 2017’s 225.37 text remains the same for this new title.

“225.37B Identification of Remote Branch Circuits and Feeders

Where the physical location source for a branch circuit or feeder is unclear while at the load end of a branch circuit or feeder, a permanent label shall be required stating a physical description of where the source is derived.”

“Informational Note: Examples: Motorized gate, premises with multiple outbuildings, pole based luminaire.”

This new 225.37B code entry is similar to current 408.4B, just the other end of the circuit.

The new 225.37B is a good idea just like 408.4B is a good idea. Once the original electrician leaves the job, service electricians, maintenance personnel, and homeowners, may have a hard time locating the source of a circuit at a remote location.

"230.82(3) Meter disconnect switches rated not in excess of 1000v provided they meet all the following:

1. They have a short circuit rating equal to or greater than the available short circuit current.
2. They are marked suitable for service equipment.
3. A main bonding jumper shall connect the grounded conductor(s) to the meter disconnect switch enclosure.
4. All metal housings and service enclosures are grounded in accordance with Part VII and bonded in accordance with Part V of Article 250.
5. They are capable of interrupting the load served.
6. The meter disconnect shall be legibly field marked on its exterior in a manner suitable for the environment as follows:

METER DISCONNECT
NOT SERVICE EQUIPMENT

Informational Note: See 250.24B2 for meter disconnect switch main bonding jumper requirement."

250.24B2 is a new proposal and included in this submittal.

The meter disconnect switch required provisions are placed in a list for easier reading.

The new #2 on this list is similar to 230.66. Although it is advertised with # 6 on this as 'NOT SERVICE EQUIPMENT', it is line side equipment and subject to the same conditions as equipment regarded as service equipment.

The new main bonding jumper entry (#3) is added following the logic of 250.24C. Whether it's regarded as service equipment or a meter disconnect switch, it is placed line side in the system and is subject to the same conditions as the service equipment. The meter disconnect switch doesn't know it isn't service equipment. If *each* service disconnect switch is required to be bonded, the meter disconnect switch should be also. Presently, there is no code to enforce it this way. On the other hand, if the electrical code making panel finds the meter disconnect switch enclosure should **not** be bonded to the grounded conductor(s), a code entry should be implemented stating it shall **not** have the main bonding jumper installed.

“240.23 Change in size of Grounded Conductor”

“Where ungrounded conductors are increased in size from the minimum size that has sufficient ampacity for the intended installation, grounded conductors, where installed, shall be increased in size proportionately, according to the circular mil area of the ungrounded conductors.”

Whether conductor sizes are increased for voltage drop or any other reason from their minimum size that has sufficient ampacity, the increased fault current carried by the ungrounded conductors is introduced to the grounding or grounded conductor, depending on the fault. The grounded conductor is now expected to carry increased currents as is the case with proportionately upsized equipment grounding conductors of 250.122B.

"240.24E

In dwelling units, "other than dwelling units," dormitories, and guest rooms or guest suites Overcurrent devices, other than supplementary overcurrent protection, shall not be located in bathrooms" , "showering facilities, or locker rooms with showering facilities."

Overcurrent protection devices are installed at the wet location outdoors all day and every day. Even so, showers mean no shoes, no clothes, almost guaranteed wet conditions and it would be best to prohibit overcurrent protective devices in these environments even if the panels were 110.28 compliant. The newer 210.8B7 does require GFCI protection for personnel in locker rooms with showering facilities.

“250.24(B)(1) Main Bonding Jumper at Service Disconnect Enclosure(s) “

250.24(B) would read as it presently does, with the title changed, and would be changed to 250.24(B)(1). Following that, this new entry would be added:

“250.24(B)(2) Main Bonding Jumper at Non-Service Meter Disconnect Enclosure(s), Supply Side of Service

Where a meter disconnect switch is installed on the line side of a meter, as allowed by 230.82(3), an un-spliced main bonding jumper shall be used to connect the equipment grounding conductor(s) and the meter disconnecting means enclosure to the grounded conductor within the enclosure in accordance with 250.28.”

Utility companies sometimes require a cold sequence disconnecting means, allowable by 230.82(3). Attention is needed for the grounding of NEC service and utility company required disconnects where installed together.

This new code entry follows the direction of 250.24(B) and 250.24(C). While 230.82(3) has made it abundantly clear that this disconnect is not a service disconnecting means, the intent of the code is clear on this needed connection and it needs to be pointed out in this proposed new code location. 250.24(B) and 250.24(C) mandate that the equipment grounding conductor(s), grounded conductor, enclosure connection be made for *‘each disconnect’*. This connection is necessary due to the disconnecting means physical and electrical location in the service and fault current characteristics that come with it.

Presently, the AHJ could enforce this connection one way or the other with little ground to stand on without a clear passage in the NEC, meaning if the main bonding jumper ***shouldn’t*** be installed in a line side meter disconnect, the NEC should provide that new language in 2020, if I’m found to be incorrect with this proposal.

“250.30A(6)(c)(1) A connector listed as grounding and bonding equipment”
”made for the purpose of connecting and bonding multiple service equipment or separately derived system’s grounding electrode conductors.”

I believe, this should be elaborated on as proposed. A 250.94 Intersystem Bond Terminal Device meets the description as stated in the 2017 NEC other than its’ title “Bonding for Communication Systems”. The new language helps prevent a misapplication of an intersystem bonding terminal device.

250.102(C)(2) Remains as it is written with this added on to the end:

"Where supply side bonding jumpers are routed along with ungrounded supply conductors, in parallel within two or more raceways, the supply side bonding jumpers shall divvy equally and be routed in each raceway and be sized in accordance with 250.102(C)(1) based on the size of the ungrounded conductors in each raceway or cable."

This is similar to 250.122F and for the same reasoning. Paralleling supply side bonding jumpers this way facilitates ungrounded conductors in cancelling highly inductive fault currents.

Presently, 250.102(C)(2) language does not prevent someone from routing a supply side bonding jumper through less than each line side raceways. I do know it is unnecessary to route through the metal raceways. The bond for those raceways may derive from either of the metal enclosures that the raceways are connecting using supply side bonding jumpers or utilizing 250.142A grounded conductor bonding. I believe the closest reference to call the practice a violation would be 250.4(A)(5). The parallel paths of the metal raceway and the supply side bonding jumper within may be regarded as a greater impedance with those two different routes imposing on each other in the event of a ground fault, creating a choking affect.

Adding the new NEC language I've shown for 250.102(C)(2) would prevent an electrician from routing a supply side bonding jumper(s) in less than each parallel raceway. The alternative is to add NEC language that prohibits routing supply side bonding jumpers through service metal raceways unnecessarily but I don't agree with this as the title of 250.102(C)(2) already implies compliance.

Now a whole other discussion is in store. 'Non-metallic raceways between metal service enclosures'. Now the supply side bonding jumper is required within the raceway(s) between enclosures to bond the enclosures to meet 250.80 and 250.92B if the grounded conductor wasn't serving that purpose and it wouldn't if main bonding jumpers weren't installed at meter enclosures, line-side gutters, and the like.

Main bonding jumpers are required at each service disconnect metal enclosure but not the other line side enclosures (A possible exception to that is my newly proposed 250.24(B)(2) of this submittal.). Possibly, a utility company doesn't want that main bonding jumper in the meter or Current Transformer enclosure. Possibly, 250.92B already infers no non-metallic raceways are permitted for service conductors but that would be inconsistent with something like 230.30B or 230.43.

My newly proposed 250.102(A)(2) language covers both metallic and non-metallic service raceways. The highest fault currents of an electrical installation are at the service and I think it's important that parallel supply side bonding jumpers should divvy into each raceway when they are routed within those raceways.

“300.5D3” “Underground Circuit Conductors 120 volts to Ground and Greater

Service, feeder, and branch circuit conductors that are not encased in concrete and that are buried 450mm (18”) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300mm (12”) above the underground installation.”

The NEC Handbook tells us that this ribbon is not required for feeders or branch circuits because unlike service conductors these have short circuit and overload protection. Throughout the NEC we go to great lengths to provide physical protection of electrical conductors so it’s difficult to find logic with the reason given in the NEC Handbook. A warning ribbon installed at the proper height above the conductors provides a higher degree of safety. It also can be a great value for so little cost considering repairs and down time in the event these conductors are hit. A warning ribbon including feeders and branch is one more sensible precaution in preventing ground faults or short circuits.

Note: Depending on the demarcation location, an electrical inspector may have little jurisdiction on what happens on the line side of the service point of connection, therefore, little say on the service conductors’ installation.

"300.11B Wiring Systems Installed Above Suspended Ceilings

Support wires that do not provide secure support shall not be permitted as the sole support. Support wires and associated fittings that do provide secure support and that are installed in addition the ceiling grid support wires shall be permitted as the sole support. Where independent wires are used they shall be secured at both ends. "Grid wires for the support of electrical wiring shall be 12 gauge or greater and be made for the purpose as a grid support wire." "Cables and raceways shall not be supported by ceiling grids."

This added sentence ensures residential grade grid wire, bailing wire, etc., from being installed. Beside the strength of lesser than 12 gauge wire, clips made for the support of electrical cables, conduits, and boxes are made for heavier gauge wire.

300.15C Protection

“A box or conduit body shall not be required where cables enter or exit from conduit or tubing that is used to provide cable support or protection against physical damage. A fitting shall be provided on the end(s) of the conduit or tubing to protect the cable from abrasion.”

“Exception: A fitting shall not be required where conductors exit a raceway within the pole of a pole-supported luminaire.”

Often, underground conduits are sized up from what is required for ease pulling lengthy conductors. Conductors and conduits may also be sized up for increased conductor size, considering voltage drop. Grouping more than 2 conduits to enter the bottom of a light pole fixture can make it physically difficult to fit fittings adjacent to each other. I don't think this fitting is necessary for pulling or after-installation reasons. The conductors would be pulled in a direct direction when working through the handhole cover, causing no damage to conductors. The conductors, in their stagnant after installation position, exit the conduits in a direct direction, causing no damage to the conductors.

The blue text of 2014 NEC Handbook mentions a fitting is required for raceways 'on poles'. It doesn't mention 'within a light pole'.

300.4G does not provide an exception for bushings required on PVC type or non-metallic conduit. I believe this is the right call not just because of the 'heavier' conductors, as mentioned in the NEC Handbook, but because of the position of the conductors may be placed in, within an enclosure where the insulation can be gouged into by the fitting; metallic or non-metallic. This is not the case for the confines of a light pole.

The likeliest way I see damage occurring would be if the installer(s) pulled the conductors into the conduit without the light pole in place and pulled at an angle other than directly out faced direction of the conduit. Damaging the conductors this way would be clearly evident while pulling the conductors, and would bring into question the qualifications of those installers.

I didn't see that 410 Part IV makes an added mention that luminaire poles are required to be a listed product. Therefore, I didn't mention that in the proposal. 110.2 makes it possible for an inspector to look for a listing already.

"310.120E Installation of Conductor and Cable Markings

An effort to install conductors and cables shall be made in a manner that does not conceal manufacturer markings at all enclosures, junction boxes, cabinets, pull points, and similar conductor and cable accessible points."

It is difficult for inspectors to inspect a job, service electricians to do their work, estimators, etc. when you can't read manufacturer markings on the conductors or cables. This new code proposal would mean it would now be a violation to phase tape the entire exposed length of a conductor within an enclosure. This would work nicely with things like 200.6B4 and 250.119A2c. It also means, install the conductors facing the enclosure opening. This is all within reason considering the manufacturer marking intervals on conductors and cables. That's why I wrote "An effort to install..." in the proposal. It considers manufacturer interval markings, varied conductor length, concealment by adjacent conductors, etc.

This proposal would apply more to conductors than cables since cable jackets are removed at their enclosure destinations.

“312.2 Damp and Wet Locations

In damp or wet locations, surface type enclosures within the scope of this article shall be placed or equipped so as to prevent moisture or water from entering and accumulating within the cabinet or cut out box, and shall be mounted so there is 6-mm (1/4”) airspace between the enclosure and the wall or other supporting surface. Enclosures installed in wet locations shall be weatherproof. For enclosures in wet locations, raceways or cables entering “at or” above the level of uninsulated live parts shall use “threaded hub fittings” listed for wet locations.”

“Enclosures designed to be surface mounted shall be surface mounted when installed in a damp or wet location or if raceways served route through a wet or damp location at or above the enclosure mounted height. Weep holes of enclosures designed for damp or wet locations shall not be blocked by structure.”

Four items to address:

1. Entering an enclosure with live parts with raceways or cables, I propose, will become a little more stringent by including the level of uninsulated live parts not just “above the level of uninsulated live parts”. Driving or sideways rains, sprinkler system water, or similar can enter an enclosure and wash live parts by existing standards. By adding “at or” would include the lowest height of busbars or uninsulated live parts.
2. Wet location fittings, by themselves, are insufficient when connected directly to an enclosure without the aid of a threaded hub. Raintight EMT connectors, PVC male adapters and the like do allow water to seep around the fitting and into the enclosure. The raintight portion of the fitting appears to cover the raceway side of the fitting, not the flat surface enclosure side of the fitting. The locknut or locknut/gasket combination does not adequately keep water and moisture out. Corrosion, faulted circuits, etc. can occur if rains and moisture can’t be kept out of the enclosures listed in 312.1 and the enclosures of 408 included to 312 by 408.2.

3. Raintight EMT fittings, PVC male adapters and the like suffice installed below busbar level.

314.15 sufficiently covers junction boxes on this matter. 408.2 would cover panelboards, etc. by referring to article 312 provided my proposed new text to 312.2 is added.

4. Dimples out the back of some enclosures are designed to step the enclosure off the surface. These dimples become non-functional when this type of enclosure is embedded (within stucco for example). Enclosures mounted this way may never experience a problem. Problems can arise if moisture were able to enter the enclosure or enter around the enclosure and become trapped. Premature failure, or worse, of the enclosure or components within the enclosure will occur if moisture and water is trapped. Water may also enter from a conduit entering the enclosure.

Existing installations across the country that have already been inspected and approved appear to violate the already written first part of 312.2 by trapping enclosures and weep holes due to structure. The structure can be stucco finish or finished carpentry in an attempt to hide an 'unsightly' electrical enclosure. 110.26 clearances may also come into play and be referenced.

I'd say please disregard the latter part of my proposal on blocking weep holes if this is already considered to be adequately written in the NEC (possibly not adequately enforced in the field).

Please do consider though, the first part of the proposal on threaded hub fittings at or above live parts or busbars. This, I believe, is overdue.

[“312.26 Coarse Thread Screws](#)

Coarse thread screw(s) shall not enter electrical enclosures.”

Whether coarse thread screws are added before conductors, busbars, electrical components, etc. are installed or added to an existing installation; they are a recipe for disaster. Coarse thread self-tapper screws are very convenient and are used this way. I believe it should be a violation. The closest I see the NEC to addressing this is 314.23B1.

The way the new entry is worded allows coarse thread screws to exit enclosures. For instance, an electrical component could be installed in an electrical enclosure with coarse thread self-tapper screws zipped from the inside to the outside of the enclosure.

Long before I became an inspector, an inspector friend of mine told me of the time he removed a meter enclosure cover and it blew up in his face and hands. A brass address tag was zipped to the meter enclosure cover with a framing screw. Evidently, the screw entered the ungrounded conductor insulation and was just shy of the conductor itself. My friend pushed in on the meter cover enough while removing it that the screw traveled the distance and caused a faulted circuit. Don't ask about tamper tags and energized circuits because that's all I know of the story!

This isn't the only reason. I believe field installed sharp points and edges do not belong. Often, they are installed blind to what is enclosed. They can also inhibit the removal of covers by dragging on conductors.

[“314.26 Coarse Thread Screws](#)

[Coarse thread screw\(s\) shall not enter electrical enclosures.”](#)

Whether coarse thread screws are added before conductors, busbars, electric components, etc. are installed or added to an existing installation; they are a recipe for disaster. Coarse thread self-tapper screws are very convenient and are used this way. I believe this should be a violation. The closest I see the NEC to addressing this is 314.23B1.

The way the new entry is worded allows coarse thread screws to exit enclosures. For instance, an electrical component could be installed in an electrical enclosure with coarse thread self-tapper screws zipped from the inside to the outside of the enclosure.

"342.29 Double Locknuts

Double locknuts shall be used per each enclosure opening that is not a threaded hub."

Present NEC language does not exist which would allow a nipple between two enclosures to use just one pair of locknuts, not two pair, to install the nipple. One pair per nipple, likely, does not ensure a good grounding path and can distort the enclosure out of shape.

"344.29 Double Locknuts

Double locknuts shall be used per each enclosure opening that is not a threaded hub."

Present NEC language does not exist which would allow a nipple between two enclosures to use just one pair of locknuts, not two pair, to install the nipple. One pair per nipple, likely, does not ensure a good grounding path and can distort the enclosures out of shape.

352.12 Uses Not Permitted

“PVC conduit shall not be used under the conditions specified in 352.12(A) through “(G)”.”

“352.12F Southern Exposure

On south exterior of buildings or structures where subject to the sun’s rays and within 40 degrees of due south.”

“Exception: Southern exposed PVC shall be allowed when the conduit has 10’ of free air on all sides of the conduit other than supports for the conduit.”

I’ve found these conduits bake and become toasted in one summer season. If the conduits were installed in this manner due to being bent with a PVC oven for too long, the installation could be called a code violation for installing damaged product. 110.3A2, 110.12B, 110.13B could almost be quoted as articles saying southern exposed PVC is a present violation (with 110.3A2 may be the best) but are long shots to pointing at this practice as a code violation.

These PVC conduits are stamped ‘Sunlight Resistant’ not ‘Sunlight Proof’. Possibly, a violation per 110.3B could be cited.

An example for the exception would be a free standing strut rack like structure. The conduits on a free standing strut are also vulnerable but apparently less so than conduits mounted to the outside of a building face subjected to southern exposure. The conduits (and conductors) are exposed to increased temperature from the radiated heat which is a greater temperature than that of a free standing strut rack located in the same geographical location.

["352.12G](#)

[Rooftops."](#)

PVC conduit does have a stamp on it that reads: "Sunlight Resistant". It may be resistant but cannot withstand direct and prolonged exposure without damaging the conduit.

Conduits installed in direct and prolonged exposure to the sun toast and bubble. They are damaged. The conduits also sag between supports even when supported at appropriate intervals.

Perhaps 110.3B could be cited deeming PVC on rooftops a violation. Being sunlight resistant is not being sunlight proof.

“352.44 Expansion Fittings

Expansion fittings for PVC conduit shall be provided to compensate for thermal expansion and contraction where length change, in accordance with Table 352.44 is expected to be 6mm (1/4”) or greater in a straight run between securely mounted items such as boxes, cabinets, elbows, or other conduit terminations.”

“Expansion fittings for PVC conduit shall also be provided where underground runs of conduit emerge from the ground to compensate for earth settling and heaving characteristics.”

“Exception: Where the authority having jurisdiction deems a PVC conduit installation is not susceptible to movement that could cause damage, the expansion fitting shall not be required; such as short runs of underground conduit.”

The inspector, generally, will not witness back fill. Furthermore, an excavator, not an electrician may do the back fill. The conduits may shift and won't be bedded well and invariably the conduits, in time, are pulled from the bottom of an enclosure. Earth grade does heave, as well. PVC conduits are fragile compared to other non-flexible conduits and need this extra precaution. Soil conditions vary across the country; bentonite and such. Presently, I look for slip risers or expansion fittings if the PVC conduits do not rest solidly at the bottom of the trench and the vertical portion must be supported per 352.30.

Perhaps 300.5(J) could have new language added that directly requires the expansion fitting instead of adding to 352.44 as I am suggesting, making it apply to other raceways. It is the more fragile raceways that I am concerned with, though.

Newer language in 300.7B talks about expansion fittings but it's about motion due to temperature not ground (Earth) motion.

110.3(A)(2) could also be cited for the problem but, again, I would like a code entry that is more specific to the on-going problem. 300.7(B) requires expansion fittings for thermal reasons only. 300.4(H) requires expansion fittings where raceways cross structural joints only.

I included an exception due to short overall runs of conduit or other conditions that may exist where the PVC conduit isn't susceptible to movement that could damage the installation.

I realize thermal expansion of PVC conduits does factor in here but the conduits I'm discussing are generally short runs (the above ground portion of those runs) emerging from the ground that are subject to earth movement which at times may play a bigger role in busting up these conduits and/or the enclosures to which they are attached.

Code making panel, please consider Article 353 HDPE and Article 355 RTRC to have the same new language as I've proposed for 352.44.

"392.18H

Exception: Where not accessible (as applied to equipment), "at" 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 ensure safe maintenance and operation."

'At' is the better preposition to use here rather than the existing 'in'. Cable tray is installed both indoors and outdoors.

"406.5D Position of Receptacle Faces

After installation, receptacle faces shall be flush with or project from faceplates of insulating material and shall project a minimum of 0.44mm (.015") from metal faceplates."

No change whatsoever with this NEC code. The change I'd like to see is for [manufacturers of floor boxes to adhere to 406.5D](#). Often, floor box receptacles are installed according to the instructions but the blades of a cord plug make poor contact because the floor box receptacle cover prevents plugging in entirely.

"408.4B Source of Supply

All switchboards, switchgear, and panel-boards supplied by a feeder(s) in other than one- or two- family dwellings shall be permanently marked to indicate each device or equipment where the power originates" **"with a physical description, if not within sight, at minimum"**. "The label shall be permanently affixed, of sufficient durability to withstand the environment involved, and not handwritten."

"Where the power originates" is good but is insufficient. Writing: "FED FROM PANEL L2B", for example, may be adequate in some cases. More remote located feeder fed locations would greatly benefit by having a physical description of where it is fed from. The labeling could still include the name of the panel or gear it's fed from, but more important, it would now be required to write: "FED FROM 60 YARDS S.W.", for example.

Perhaps the code making panel would consider omitting "in other than one- or two- family dwellings". A feeder panel in a residential basement in a housing subdivision is rather self-explanatory but so many dwellings have acreage and with that, outbuildings. Feeder panels are fed from feeder panels and these installations would also benefit by having physical descriptions indicating where their source originates.

"408.26 Coarse Thread Screws

Coarse thread screw(s) shall not enter electrical enclosures."

Whether coarse thread screws are added before conductors, busbars, electric components, etc. are installed or added to an existing installation; they are a recipe for disaster. Coarse thread self-tapper screws are very convenient and are used this way. I believe this should be a violation. The closest I see the NEC addressing this is 314.23(B)(1).

The way the new entry is worded allows coarse thread screws to exit enclosures. For instance, an electrical component could be installed in an electrical enclosure with coarse thread self-tapper screws zipped from the inside to the outside of the enclosure.

"409.26 Coarse Thread Screws

Coarse thread screw(s) shall not enter electrical enclosures."

Whether coarse thread screws are added before conductors, busbars, electric components, etc. are installed or added to an existing installation; they are a recipe for disaster. Coarse thread screws are very convenient and are used this way. I believe this should be a violation. The closest I see the NEC addressing this is 314.23(B)(1).

The way the new entry is worded allows coarse thread screws to exit enclosures. For instance, an electrical component could be installed in an electrical enclosure with coarse thread self-tapper screws zipped from the inside to the outside of the enclosure.

410.36B Suspended Ceilings.

“Framing members of suspended ceiling systems used to support luminaires shall be securely fastened to each other and shall be securely attached to the building structure at appropriate intervals.” “Luminaires shall be supported independent of the grid support system and according to 300.11. Recessed lay-in type luminaires shall require a minimum of two grid wires per fixture, installed catty-corner to the luminaire. Flush and recessed can type luminaires shall require a minimum of one grid wire per fixture. Other type fixtures shall require ample support and in accordance with 300.11 or per manufacturer instructions.”

“Exception: Exit light luminaires and similar shall be permitted to be supported by the grid support system.”

Presently, all electrical work installed above accessible grid ceilings is required to be installed independent of the grid support system, other than the luminaires. I believe the luminaires should be supported independent of the grid support system. Many electricians have stories to tell about light fixtures crashing to the ground.

Luminaires shall not be fastened to the grid with this new wording and rightfully so. If the grid system fails, we would like the chance that the electrician provided grid wires for the above grid electrical work will continue to support the electrical work.

"422.30 General

A means shall be provided to simultaneously disconnect each appliance from all ungrounded conductors in accordance with the following sections of Part III. If an appliance is supplied by more than one branch circuit or feeder, these disconnecting means shall be grouped and identified as being the multiple disconnecting means for the appliance" "and each disconnecting means shall state the number of disconnects the appliance has." "Each disconnecting means shall simultaneously disconnect all ungrounded conductors that it controls." "The 110.25 allowances of 422.31 shall not apply to any disconnecting means of any appliance with more than one disconnecting means."

Appliances come in all sizes and access to the full appliance after installation can be trying (although that nameplate better be visible 422.60B). The number of disconnects should be readily apparent. The disconnecting means might not be disconnects on the wall beside the appliance. They could be cord and plug disconnects and I've seen these scattered on the equipment. Furthermore, an appliance may be accompanied by more nearby appliances, meaning more disconnects to study. This proposal would make a safer working environment for workers providing maintenance for the equipment and operators of the appliance(s).

Removing the 110.25 allowance must be made mandatory. A combination of breaker lock(s) and other disconnecting mean(s) is unwise.

Chapter 5, Special Occupancies

Any time and everywhere a 'seal' is mentioned in Chapter 5, 'seal' shall now be referred to as: "[seal fitting or sealing fitting](#)."

Fitting(s) should be added to seal or sealing. This would clarify that a seal fitting is required to be a wrenched in place fitting rather than duct sealing compound packed into the conduit. The fitting shall, of course, be installed per manufacturer's instructions using necessary packing and compounds.

This isn't necessary for 502.15 (See 502.15 Information Note)

This isn't necessary for 504.70 because in that entry it states that the seal shall be identified for the purpose.

514.9 refers to it as a sealing fitting, other times not, like 501.15.

When and where the NEC is requiring a wrenched in place fitting, *seal fitting* or *sealing fitting* shall replace 'seal'. The word 'seal' by itself will be indicative of duct sealing compound as being adequate. A seal fitting shall also acceptable in place of duct sealing compound.

"550.32 Service Equipment

(A) Mobile Home Service Equipment

The mobile home service equipment shall be located adjacent to the mobile home and not mounted in or on the mobile home. The service equipment shall be located in sight from and not more than 9.0 m (30') from the exterior wall of the mobile home it serves. The service equipment shall be permitted to be located elsewhere on the premises, provided that a disconnecting means suitable for use as service equipment is located within sight from and not more than 9.0 m (30') from the exterior wall of the mobile home it serves and is rated not less than that required for service equipment in accordance with 550.32(C). Grounding at" *"this added feeder"* "disconnecting means shall be in accordance with 250.32." *"Grounding for the mobile home served shall be in accordance with 250.32."*

Both 250.32A and B mention building(s) and structure(s). 'Equipment' is not mentioned. 2017 NEC offered us new definitions for building and structure making it clear 'equipment' shouldn't be confused with 'structure'. The NEC defines a mobile home as a structure. This would mandate establishing a grounding electrode system at a mobile home structure in addition to the already required service grounding electrode system which is detached but within 30' of the mobile home.

When 550.32A mentions service, I read that as the NEC 70 definition of service because I'm reading the code book. If 550.32A is referring to service as Oxford dictionary would define service, I think this is a mistake. The word service mentioned in NEC 70 should always be the Article 100 version. If a disconnecting means is to aid in servicing equipment or other and is not Article 100 service, refer to it as a maintenance disconnecting means. This paragraph encourages a new Article 100 definition: *'Maintenance Disconnecting Means'*. Sure, we could be *servicing* the building, structure, or equipment at the disconnecting means but the disconnecting means could be a service, feeder, or branch circuit at the given building, structure, or equipment.

Thank you very much for reviewing the proposals mentioned. I am available if NFPA personnel would like more input regarding my proposed code changes for the 2020 NEC 70.

Norman Feck
State of Colorado Electrical Inspector
8968 County Rd 300
Parachute, CO 81635
Norman.Feck@state.co.us
970-230-2120
08/14/2018

**Public Comment No. 2086-NFPA 70-2018 [Section No. 110.9]****110.9 Interrupting Rating.**

Equipment intended to interrupt current at fault levels shall have an interrupting rating at nominal circuit voltage at least equal to 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 at least equal to the current that must be interrupted.

Informational Note: In order to maintain compliance with this Section in the face of future equipment changes, including unannounced transformer changes by the serving utility, it is often judicious to upsize equipment Interrupting Rating beyond that required for the calculated current, in order to ensure future safety.

Statement of Problem and Substantiation for Public Comment

Mr. Dollard's proposed change may not quite work as he presented it, but it was not frivolous. The tendency toward lower impedance, and toward switching out equipment without appropriate recalculation, are reason enough to move away from minimum ratings. Add to this the common utility practice of replacing distribution lines and transformers without so much as informing customers, and it seems that this warning is warranted. I do recognize that Section 90.1(B) covers the same territory in general terms. Because this aspect of adequacy is not about convenience but safety, perhaps adding a few words is warranted.

Related Item

- It attempts to address the concern raised in PI 3208

Submitter Information Verification

Submitter Full Name: David Shapiro

Organization: Safety First Electrical

Street Address:

City:

State:

Zip:

Submission Date: Thu Aug 30 16:41:19 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, David Shapiro, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am David Shapiro, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 846-NFPA 70-2018 [Section No. 110.9]

110.9 Interrupting Rating.

Equipment intended to interrupt current at fault levels shall have an interrupting rating at nominal circuit voltage at least equal to 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 at least equal to the current that must be interrupted.

Additional Proposed Changes

<u>File Name</u>	<u>Description Approved</u>
CN_138.pdf	70_CN138

Statement of Problem and Substantiation for Public Comment

NOTE: This Public Comment appeared as CC Note No. 138 in the First Draft Report on Public Input No. 3208.

The Correlating Committee directs that Public Input 3208 be referred to CMP-10 for action in Article 230 or Article 240.

This action will be considered as a public comment.

Related Item

- PI 138

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC

Organization: NEC Correlating Committee

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 20 11:53:53 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, CC on NEC-AAC, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am CC on NEC-AAC, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Correlating Committee Note No. 138-NFPA 70-2018 [Detail]****Submitter Information Verification**

Submitter Full Name: Erik Hohengasser

Committee:

Submittal Date: Thu May 10 15:39:08 EDT 2018

Committee Statement and Meeting Notes

Committee Statement: The Correlating Committee directs that Public Input 3208 be referred to CMP-10 for action in Article 230 or Article 240.

This action will be considered as a public comment.

Ballot Results

✔ This item has passed ballot

12 Eligible Voters

0 Not Returned

12 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Affirmative All

Brunssen, James E.

Dressman, Kevin L.

Hickman, Palmer L.

Hittinger, David L.

Holub, Richard A.

Johnston, Michael J.

Kovacik, John R.

Manche, Alan

McDaniel, Roger D.

Pierce, James F.

Saporita, Vincent J.

Williams, David A.



Public Comment No. 2078-NFPA 70-2018 [New Section after 110.12]

(D) Metallic Means of Support

Metallic means of support shall be used in spaces above egress.

Information Note: Nonmetallic supports exhibit weakening and potential failure in fires which jeopardize the safety of people exiting a building or emergency personnel responding to a fire.

Statement of Problem and Substantiation for Public Comment

Emergency responders and building occupant safety is at risk during building fires because people can become entangled and trapped in cabling which has fallen out of molten or failing plastic supports. In many cases, non-continuous plastic supports are relatively small such that they have little fire resistance compared with continuous raceways. Even if people can free themselves from fallen cabling, this takes time which is otherwise needed to exit the building or fulfill the objectives of emergency personnel. The frequency of emergency responders becoming trapped in fallen cabling has become so common that firefighters have created and publicly distributed training videos on how to escape in these situations

(<http://www.fireengineering.com/topics/m/video/36928837/the-quick-release-method.htm?q=cable+entanglement>) [1].

Additionally, the Greater Tucson Fire Foundation raised financial support in 2011 to purchase cable cutters for hundreds of Tucson, Arizona firefighters so that they are equipped to deal with cable entanglement [2].

There have been documented fatalities due to cable entrapment both in the U.S. and England. In Memphis, Tennessee, in 1994, a fireman was entangled in cables that had fallen after the nonmetallic raceway collapsed due to the heat (<http://www.fireengineering.com/articles/print/volume-148/issue-3/features/tragedy-in-a-residential-high-rise-memphis-tennessee.html> [9]). Although this installation may have been non-compliant with Code, this result shows the impact that nonmetallic materials can have in a fire.

More recently in England two firemen died due in part to being tangled in cabling that had fallen from plastic raceway in the ceiling of a Southampton residential building (<http://www.bbc.co.uk/news/uk-england-hampshire-22126431> [10]). An article [6] in Electrical Contracting News identifies another recent incident in which a fireman died in Stevenage, Hertfordshire, after he became entangled in electrical cables which "had fallen after plastic trunking, the only support for the cables, melted and failed." The article [6] goes on to report that changes are in process to Great Britain's Wiring Regulations (BS 7671 [7]) to ensure that "wiring systems in any escape route should be supported so that they are not subject to premature failure in a fire." Revisions have already been made in a standard for fire alarm system cabling, BS 5839-1 [8], to require cable supports/raceway which will not collapse in a fire. While the documented incidents involve firefighters, it is not even known how many building occupants may have died in the past either becoming entangled in fallen cabling, overcome by smoke/heat trying to remove a cabling obstruction, or forced to seek an alternate exit due to a significant amount of cabling obstruction.

In January 2015, BS 7671 (UK Wiring Regulations) was published with Amendment 3 which requires metal supports for cables installed in escape routes [3, 4] and went into effect on July 1, 2015. This requirement is no longer limited only to fire alarm systems, but now includes all wiring methods.

NFPA 101 (Life Safety Code, 2012) [5] already addresses the requirement to maintain egress free from obstruction. Sections 7.1.10 and 7.1.10.1 (Means of Egress Reliability) state, 7.1.10.1 General. Means of egress shall be continuously maintained free of all obstructions or impediments to full instant use in case of fire or other emergency.

Sections 12.2.5.4, 12.2.5.4.2, and 12.2.5.4.3 (New Assembly Occupancies) and 13.2.5.4, 13.2.5.4.2, and 13.2.5.4.3 (Existing Assembly Occupancies) also emphasize this requirement.

12.2.5.4 General Requirements for Access and Egress Routes Within Assembly Areas.

12.2.5.4.2 Access and egress routes shall be maintained so that any individual is able to move without undue hindrance, on personal initiative and at any time, from an occupied position to the exits.

12.2.5.4.3 Access and egress routes shall be maintained so that crowd management, security, and emergency medical personnel are able to reach any individual at any time, without undue hindrance.

13.2.5.4 General Requirements for Access and Egress Routes Within Assembly Areas.

13.2.5.4.2 Access and egress routes shall be maintained so that any individual is able to move without undue hindrance, on personal initiative and at any time, from an occupied position to the exits.

13.2.5.4.3 Access and egress routes shall be maintained so that crowd management, security, and emergency medical personnel are able to reach any individual at any time, without undue hindrance

The solution that is easy to understand and enforce is a straightforward requirement regarding the allowable materials of a cable support used above egress. Melting temperatures of metallic and non-metallic materials are significantly different – compare the low carbon steel melting temperature of approximately 1450 °C versus 200-400 °C for many typical thermoplastics used in cable supports. This difference translates to a greater resistance to heat for steel which enables a metallic support to survive and carry load significantly longer than nonmetallic supports. The intent is not to eliminate the use of non-metallic supports/raceway in all applications, as they provide an appropriate and cost-effective option in other locations. The objective is to focus on egress which causes the highest risk to life safety.

In conclusion, there have been verifiable incidents in which firefighters have died due to entanglement from cabling fallen from plastic raceway that was weakened due to fire. This is not just a theoretical discussion or anecdotal evidence. In addition, NFPA 101 already emphasizes the need to maintain egress free from obstruction at all times, including during a fire. There is a clear opportunity in the NEC to improve consistency within NFPA Codes and save further loss of life.

Bibliography:

- [1] Fire Engineering Training Minutes. Presented by Mike Ciampo, Fire Department of New York. Accessed 9/25/15. <http://www.fireengineering.com/topics/m/video/36928837/the-quick-release-method.htm?q=cable+entanglement>
- [2] "Rescue Tools" Greater Tucson Fire Foundation. Accessed 9/25/15. <http://www.tucsonfirefoundation.com/health-and-wellbeing/>
- [3] "Fire resisting supports in escape routes" Accessed 9/25/15. <http://electrical.theiet.org/wiring-matters/54/escape-routes/index.cfm>
- [4] "Amendment 3 to BS 6761 tackles 'cable entanglement' deaths" Accessed 9/25/15. <http://www.voltimum.co.uk/articles/amendment-3-bs-7671-tackles-cable-entanglementdeaths>
- [5] NFPA 101: Life Safety Code, 2012.
- [6] Rawlinson, J. August 2014, Vol. 34, No. 8, "Change for the Better." Electrical Contracting News (ECN), pp. 24-25. <http://edition.pagesuiteprofessional.co.uk/Launch.aspx?EID=dd8a7ebe-4f8b-4aa6-a9a1-d6b4692f6a23> (see attached)
- [7] BS 7671:2008+A2:2013, Requirements for electrical installations. IET Wiring Regulations. Seventeenth edition.
- [8] BS 5839-1:2013, Fire detection and fire alarm systems for buildings. Code of practice for design, installation, commissioning and maintenance of systems in non-domestic premises
- [9] Chubb, M., and Joe Caldwell. 3/1/1995. "Tragedy in a Residential High-Rise, Memphis, Tennessee." Fire Engineering, <http://www.fireengineering.com/articles/print/volume-148/issue-3/features/tragedy-in-a-residential-high-rise-memphis-tennessee.html>
- [10] April 15, 2013. "Shirley Towers flats blaze: 'Possible safety breaches'". BBC. <http://www.bbc.co.uk/news/uk-england-hampshire-22126431>

Related Item

• 4032 • 4110 • 4113 • 4116 • 4126

Submitter Information Verification

Submitter Full Name: Ward Judson

Organization: nVent plc

Street Address:

City:

State:

Zip:

Submission Date: Thu Aug 30 16:27:43 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Ward Judson, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Ward Judson, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 230-NFPA 70-2018 [Section No. 110.12]

110.12 Mechanical Execution of Work.

Electrical equipment shall be installed in a neat and workmanlike manner.

Informational Note: Accepted industry practices are described in ANSI/NECA 1-2015, *Standard for Good Workmanship in Electrical Construction*, and other ANSI-approved installation standards.

(A) Unused Openings.

Unused openings, other than those intended for the operation of equipment, those intended for mounting purposes, or those permitted as part of the design for listed equipment, shall be closed to afford protection substantially equivalent to the wall of the equipment. Where metallic plugs or plates are used with nonmetallic enclosures, they shall be recessed at least 6 mm (¼ in.) from the outer surface of the enclosure.

(B) Integrity of Electrical Equipment and Connections.

Internal parts of electrical equipment, including busbars, wiring terminals, insulators, and other surfaces, shall not be damaged or contaminated by foreign materials such as paint, plaster, cleaners, abrasives, or corrosive residues. There shall be no damaged parts that may adversely affect safe operation or mechanical strength of the equipment such as parts that are broken; bent; cut; or deteriorated by corrosion, chemical action, or overheating.

(C) Cables and Conductors.

Cables and conductors installed exposed on the surfaces of ceilings and sidewalls shall be supported by the building structure in such a manner that the cables and conductors will not be damaged by normal building use. Such cables and conductors 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 and 300.11. Nonmetallic cable ties and other nonmetallic cable 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.

Informational Note No. 1: Accepted industry practices are described in ANSI/NECA/BICSI 568-2006, *Standard for Installing Commercial Building Telecommunications Cabling*; ANSI/NECA/FOA 301-2009, *Standard for Installing and Testing Fiber Optic Cables*; and other ANSI-approved installation standards.

Informational Note No. 2: See 4.3.11.2.6.5 and 4.3.11.5.5.6 of NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for discrete combustible components installed in accordance with 300.22(C).

Informational Note No. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber cable properties.

Informational Note No. 4: See 11.1.2.3 of NFPA 1-2015 Fire Code, for removal of abandoned wiring

Statement of Problem and Substantiation for Public Comment

It makes practical sense to include this important informational note in the NEC. If it is not going to be required by the NEC, at least let installers know that other codes address abandoned wiring. A service disconnect that gets abandoned in place could lead to real danger to emergency responders if they are unaware that the NEW service disconnect is now on the other end of the building. Or, imagine if during every renovation, the contractors simply left all of the old panels, meters, disconnects, pipes etc. etc. in place with no way for the next person to know which equipment is abandoned and which is not!!!! This would be a nightmare scenario and it needs to be addressed.

Related Item

- PI 259

Submitter Information Verification

Submitter Full Name: Russ Leblanc

Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 18 08:45:20 EDT 2018
Committee: NEC-P01

Copyright Assignment

I, Russ Leblanc, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Russ Leblanc, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 646-NFPA 70-2018 [New Section after 110.12(C)]****“110.12D New Construction Materials and Wiring Methods**

Newly constructed jobsites require electrical materials designed for new construction work. Wiring method installation at newly constructed jobsites shall be performed as new construction according their associated code article(s). Remodel type junction boxes, lighting fixtures, and so forth shall not be permitted. Fished wiring methods described and allowed elsewhere in this code are reserved for finished buildings or structures; also remaining finished portions of existing buildings or structures under construction.”

TITLE OF NEW CONTENT

Type your content here ...

Statement of Problem and Substantiation for Public Comment

Presently, there is nothing in NEC 70 that prevents a contractor from building and finishing a building then having the electrical work installed at a later date. Fished wiring methods are difficult to near impossible to inspect.

Related Item

- 110.12D

Submitter Information Verification

Submitter Full Name: Norman Feck

Organization: State of Colorado

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 14 14:31:02 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Norman Feck, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Norman Feck, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 153-NFPA 70-2018 [Section No. 110.12(C)]

~~(C) Cables and Conductors.~~

~~Cables and conductors installed exposed on the surfaces of ceilings and sidewalls shall be supported by the building structure in such a manner that the cables and conductors will not be damaged by normal building use. Such cables and conductors 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 and 300.11. Nonmetallic cable ties and other nonmetallic cable 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.~~

~~Informational Note No. 1:~~

~~-~~

~~Accepted industry practices are described in ANSI/NECA/BICSI 568-2006, *Standard for Installing Commercial Building Telecommunications Cabling*; ANSI/NECA/FOA 301-2009, *Standard for Installing and Testing Fiber Optic Cables*; and other ANSI-approved installation standards.~~

~~Informational Note No. 2: See 4.3.11.2.6.5 and 4.3.11.5.5.6 of NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for discrete combustible components installed in accordance with 300.22(C).~~

~~Informational Note No. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber cable properties.~~

Statement of Problem and Substantiation for Public Comment

Relocation of mechanical execution of work requirements from 725.24, 760.24, 800.24, 820.24 and 830.24 to 110.12(C) [New] is inappropriate and unnecessary for the following reasons:

- The NEC Correlating Committee (CC) accepted the action of Panel 16 to create a new Chapter 8 general article in response to Public Input from the CC-appointed Task Group to address redundant requirements in Chapter 8 (PI 2858) and accepted First Revision FR 7512 by Panel 16 resulting in proposed general Article 890. The CC further solidified this position by directing Panel 16 to renumber the new general article as Article 800 and renumber the present Article 800 as Article 805. The proposed new general Article 800 contains mechanical execution of work requirements in Section 800.24 in response to the CC-appointed Task Group Public Inputs. Having redundant requirements in Section 110.12(C) does not fulfill the objective of the Task Group to simplify redundant requirements and promote usability.
- NEC usability is better served by locating the mechanical execution of work requirements in new general Article 800 as shown in the First Draft Report. This will closely associate these requirements to the NEC sections/NEC users to which they pertain, facilitating NEC usability.
- Article 300 is an introductory article for Chapter 3 for wiring methods. Single conductors, based on 300.3(A), cannot be installed by themselves, only where part of a recognized wiring method of Chapter 3. Conductors and cabling from Articles 725, 760 and Chapter 8 would not be covered in Chapter 3 since the cables and conductors from these Articles are not wiring methods from Article 300 and Chapter 3.
- During the First Draft phase of the NEC revision cycle both CMP 3 and CMP 16 opposed deletion of mechanical execution of work requirements from the NEC sections under their purview. This action on the part of CMP 3 and CMP 16 was not considered in creating new Section 110.12(C) [FR 8484].
- New 110.12(C) [FR 8484], as well as the underlying PI 2909, contain unsubstantiated technical changes to the requirements of Sections 725.24, 760.24, 800.24, 820.24 and 830.24 (i.e., conformance to all of 300.4) and hence, FR 8484 is in violation of the Regulations Governing the Development of NFPA Standards, Section 4.3.4.1(d).

Related Item

- PI 2909 • PI 2858 • FR 7512

Submitter Information Verification

Submitter Full Name: James Brunssen

Organization: Telcordia Technologies (Ericss

Affiliation: ATIS
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jul 03 14:02:49 EDT 2018
Committee: NEC-P01

Copyright Assignment

I, James Brunssen, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am James Brunssen, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 1975-NFPA 70-2018 [Section No. 110.12(C)]

~~(C) Cables and Conductors.~~

~~Cables and conductors installed exposed on the surfaces of ceilings and sidewalls shall be supported by the building structure in such a manner that the cables and conductors will not be damaged by normal building use. Such cables and conductors 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 and 300.11. Nonmetallic cable ties and other nonmetallic cable 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.~~

~~Informational Note No. 1: Accepted industry practices are described in ANSI/NECA/BICSI 568-2006, *Standard for Installing Commercial Building Telecommunications Cabling*; ANSI/NECA/FOA 301-2009, *Standard for Installing and Testing Fiber Optic Cables*; and other ANSI-approved installation standards.~~

~~Informational Note No. 2: See 4.3.11.2.6.5 and 4.3.11.5.5.6 of NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for discrete combustible components installed in accordance with 300.22(C).~~

~~Informational Note No. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber cable properties.~~

Statement of Problem and Substantiation for Public Comment

1. Article 110.12(C) as proposed is redundant.

The proposed location of this text is within Mechanical Execution of Work. While the requirements listed within this text fall under the broad category of the title, the text refers to topics all covered within Chapter 3, General Requirements and Wiring Methods of Materials. Given that Article 90.3 already defines requirements within Chapter 1-4 as binding, except where otherwise modified by Chapter 5-7, duplication of material is unnecessary.

2. Requirements are not complete

The text of this article appears most similar to the text in Article 800.24, an article designed specifically for those cables designated as communication cables. In review of the definitions in Article 100, this type of cable is not defined. Thus, reading the letter of the Article, coaxial and optical fiber type cables are included, communication cables are not. Additionally, while it could be argued that conductor would cover all cables, wires and other materials which provide a transmission path of electrical current, there is ambiguity if this rule applies to all manner of conductor, some, or a specific conductor as defined in Article 100 (i.e., conductor, bare, conductor, covered, conductor, installed).

3. Unvetted for applicability in all instances of the Code

No documentation or other evidence was implied to have been created and reviewed which addressed the law of unintended consequences. While the move to combine all "mechanical workmanship" articles make a certain level of sense, a number of Articles being consolidated only allow some types of cabling and wiring through substitution tables. (e.g., 725, 760), where the use of said cable must comply with the rules of that article, including those regarding workmanship. These rules have been developed over time for the specific systems and while differences may be seen as minor by those outside of the specialty, their presences with specific word choice in many circumstances is not arbitrary.

4. Changes in Section citations

In the text of Article 800.24/805.24, there is specific call out to 300.43(D). The text from FR 8484 introduces a minor change, that of conformance to the entirety of 300.4. This minor change, seemingly minor introduces multiple issues, some are listed below.

a. 300.4(F) Requirement of a 1.6 mm (1/16 in) steel plate or 32 mm (1.25 in) free space running the length of any wire or cable covered by wallboard, paneling, carpet, etc. While many of these cables reside in appropriately size free space, as the voltages/currents on these type of cables are not injurious or worse, such requirements have not been needed, let only mandated.

b. 300.4(A) Allowing by inference that cables and wires of this nature can be passed through wood members increases the changes that structural members will be weakened from improper installation methods from lack of consulting structural engineers and inspection".

This allows communication and all other applicable items to now route through spaces behind panels.

5. Limitation of modification for future issues.

Currently, it could be argued that mechanical workmanship can be condensed into a "general" rule. However, that is also limiting to future revision, if and when issues arise for specific Articles, technology or application which need specialized requirements. Given the nature of topics within the purview of CMP 3 and 16, it would not be surprising

to see potential changes at the article level given Class N fire alarms, continuing evolution of data and power transmission over the same conductors, and the imminent availability of single-pair communication wiring, both for signaling and for combined data & power transmission.

6. Relocation of materials away from concentrated expertise.

CMP 1 covers the overall NEC, requiring a broad basis of knowledge. However, CMPs such as 3, 12, and 16 all have a depth of knowledge on the issues specific to the methods, media and needs within a narrower scope.

Moving materials such as workmanship out of a concentrated knowledge base may lead to future issues concerning usability and applicability. Additionally, it introduces another CMP into the technical review and comment process, jeopardizing the ability to make changes quickly and efficiently.

7. The argument of "usability"

In the deliberation of FR 8484, the reason for this change was to improve usability of Chapters 7 and 8.

A) As Chapter 8 is not bound by Article 110.12(C) per 90.3, no usability improvements have been made for Chapter 8. Rather, creation of 110.12(C) increases the chance that conflicting text is introduced between this location and 800.24, the general article for mechanical workmanship for Chapter 8.

B) People use the NEC in different ways. While the preferred method espoused would be for each individual to use it in its entirety, starting at page 1, the advent of technological search combined with "needing an answer now" relegates many users to starting within the area of need. For the electrical professional, this starts with Chapter 1-4; for user within other industries, this starts with the applicable Article and moves as needed via reference from that specific article.

While 90.1(A) does state that the Code is not intended for the untrained person, one cannot assume that the average reader has had sufficient training in the specific area. For example, it cannot be assumed that the typical electrical worker has been sufficiently trained to understand the differences between communication cables, their properties, breaking strength and other physical characteristics just like it cannot be assumed that an optical fiber installation specialist would be sufficiently trained on bonding and grounding systems within a building.

Further, given that the NEC is used by more jurisdictions than just the US, understanding the common use case and the user becomes even more paramount when contemplating making things "more usable".

Related Item

- FR 8484

Submitter Information Verification

Submitter Full Name: Jeff Silveira

Organization: Bicsi

Street Address:

City:

State:

Zip:

Submittal Date: Thu Aug 30 13:22:17 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Jeff Silveira, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Jeff Silveira, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 208-NFPA 70-2018 [Section No. 110.12(C)]****~~(C) Cables and Conductors.~~**

~~Cables and conductors installed exposed on the surfaces of ceilings and sidewalls shall be supported by the building structure in such a manner that the cables and conductors will not be damaged by normal building use. Such cables and conductors 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 and 300.11. Nonmetallic cable ties and other nonmetallic cable 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.~~

~~Informational Note No. 1: Accepted industry practices are described in ANSI/NECA/BICSI 568-2006, *Standard for Installing Commercial Building Telecommunications Cabling*; ANSI/NECA/FOA 301-2009, *Standard for Installing and Testing Fiber Optic Cables*; and other ANSI-approved installation standards.~~

~~Informational Note No. 2: See 4.3.11.2.6.5 and 4.3.11.5.5.6 of NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for discrete combustible components installed in accordance with 300.22(C).~~

~~Informational Note No. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber cable properties.~~

Statement of Problem and Substantiation for Public Comment

FR No. 8484 established a new subsection (C) in 110.12 Mechanical Execution of Work. The Committee Statement cites improving usability of Chapters 7 and 8.

New subsection (C) includes requirements for optical fiber cables. In the 2017 Code, requirements for the installation of optical fiber cables are in Article 770, Optical Fiber Cables in Chapter 7, Special Conditions. Optical fiber cables are clearly a special case in the National Electrical Code. Why would anyone want to move requirements for installing optical fiber cables into Article 110, Requirements for Electrical Installations when the optical fiber cables covered by Article 770 are not electrical cables? Before you respond, "What about composite optical fiber cables?", remember that 770.3(C) requires that "Composite optical fiber cables shall be classified as electrical cables in accordance with the type of electrical conductors. They shall be constructed, listed, and marked in accordance with the appropriate article for each type of electrical cable."

It does not improve usability to put any requirements for optical fiber cables in Article 110, Requirements for Electrical Installations. Currently, installers of optical fiber cable only need to read one article, Article 770, Optical Fiber Cables; that's simple and user-friendly.

Related Item

- FR 8484

Submitter Information Verification

Submitter Full Name: David Kiddoo

Organization: CCCA

Affiliation: Communications Cable and Connectivity Association

Street Address:

City:

State:

Zip:

Submittal Date: Fri Jul 13 08:48:04 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, David Kiddoo, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am David Kiddoo, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 234-NFPA 70-2018 [Section No. 110.12(C)]****(C) Cables and Conductors.**

Cables and conductors installed exposed on the surfaces of ceilings and sidewalls shall be supported by the building structure in such a manner that the cables and conductors will not be damaged by normal building use. Such cables and conductors 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 and 300.11. Nonmetallic cable ties and other nonmetallic cable 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.~~

Informational Note No. 1: Accepted industry practices are described in ANSI/NECA/BICSI 568-2006, *Standard for Installing Commercial Building Telecommunications Cabling*; ANSI/ NECA/FOA 301-2009, *Standard for Installing and Testing Fiber Optic Cables*; and other ANSI-approved installation standards.

Informational Note No. 2: ~~See 4.3.11.2.6.5 and 4.3.11.5.5.6 of NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for discrete combustible components installed in accordance with 300.22(C).~~ Informational Note No. 3: ~~Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber cable properties.~~

Statement of Problem and Substantiation for Public Comment

The text for new subsection 110.12(C) requires compliance with three sections of Chapter 3; 300.4, 300.11 and 300.22(C)(1).

The second sentence of 90.3 Code Arrangement states: "Chapters 1, 2, 3, and 4 apply generally." It is redundant for new subsection 110.12(C) to require compliance with any part of Chapter 3 since all Chapter 3 requirements already apply.

This Public Comment recommends the deletion of the references to Chapter 3 because they are redundant and unnecessary.

Related Item

- FR 8484

Submitter Information Verification

Submitter Full Name: Terry Peters

Organization: PLASTICS Industry Association

Affiliation: PLASTICS Industry Association

Street Address:

City:

State:

Zip:

Submission Date: Thu Jul 19 02:25:37 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Terry Peters, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Terry Peters, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 242-NFPA 70-2018 [Section No. 110.12(C)]****~~(C) Cables and Conductors.~~**

~~Cables and conductors installed exposed on the surfaces of ceilings and sidewalls shall be supported by the building structure in such a manner that the cables and conductors will not be damaged by normal building use. Such cables and conductors 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 and 300.11. Nonmetallic cable ties and other nonmetallic cable 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.~~

~~Informational Note No. 1: Accepted industry practices are described in ANSI/NECA/BICSI 568-2006, *Standard for Installing Commercial Building Telecommunications Cabling*; ANSI/NECA/FOA 301-2009, *Standard for Installing and Testing Fiber Optic Cables*; and other ANSI-approved installation standards.~~

~~Informational Note No. 2: See 4.3.11.2.6.5 and 4.3.11.5.5.6 of NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for discrete combustible components installed in accordance with 300.22(C).~~

~~Informational Note No. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber cable properties.~~

Statement of Problem and Substantiation for Public Comment

Code Making Panel 1 should reconsider and remove the new section 110.12(C) "Cables and Conductors". The requirements found in this new section are already covered in the respective cable or conductor articles. For example 330.12(1) does not allow MC Cable to be used in areas of physical damage. 330.30 instructs the user for the securement and support of the MC Cable. The referral to Cable Ties in an air handling space is already addressed in 300.22(C)(1). This new section is unnecessary and could create a conflict or correlating issue with the respective cable or conductor articles.

Related Item

- FR 8484

Submitter Information Verification

Submitter Full Name: David Kendall

Organization: Thomas & Betts Corporation

Street Address:

City:

State:

Zip:

Submittal Date: Thu Jul 19 12:02:03 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, David Kendall, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am David Kendall, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 536-NFPA 70-2018 [Section No. 110.12(C)]****(C) Cables and Conductors.**

Cables and conductors installed exposed on the surfaces of ceilings and sidewalls shall be supported by the building structure in such a manner that the cables and conductors will not be damaged by normal building use. Such cables and conductors 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 and 300.11. Nonmetallic cable ties and other nonmetallic cable 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.

Informational Note No. 1: Accepted industry practices are described in ANSI/ NECA/BICSI 568-2006, *Standard for Installing Commercial Building Telecommunications Cabling*; ~~ANSI/ NECA/~~ FOA 301-2009, *Standard for Installing and Testing Fiber Optic Cables*; and other ANSI-approved installation standards.

Informational Note No. 2: See 4.3.11.2.6.5 and 4.3.11.5.5.6 of NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for discrete combustible components installed in accordance with 300.22(C).

Informational Note No. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber cable properties.

Statement of Problem and Substantiation for Public Comment

As indicated in Public Inputs 1104, 1105, 1106, 1107 remove the reference to ANSI/NECA/BICSI 568. It has been withdrawn. ANSI/NECA/BICSI 568-2006, *Standard for Installing Commercial Building Telecommunications Cabling* has been withdrawn from ANSI and has been discontinued.

The Terra legislative text should appear as indicated below: Accepted industry practices are described in ANSI/ NECA/FOA 301-2009, *Standard for Installing and Testing Fiber Optic Cables*; and other ANSI-approved installation standards.

Related Item

- FR 8484 (PI 1104, 1105, 1106, 1107)

Submitter Information Verification

Submitter Full Name: Agnieszka Golriz

Organization: NECA

Street Address:

City:

State:

Zip:

Submission Date: Fri Aug 10 16:22:35 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Agnieszka Golriz, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Agnieszka Golriz, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 647-NFPA 70-2018 [Section No. 110.14(A)]****(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.

Terminals for more than one conductor and terminals used to connect aluminum shall be so identified.

Where stranded conductors are terminated by wire-binding screws, without the aid of crimp-on terminals, the strands shall be twisted in a counter clockwise direction as the installer faces the end of the conductor to be terminated to prevent strands from being squeezed out from under the screw.

Statement of Problem and Substantiation for Public Comment

110.14A does mandate a "thoroughly good connection" but does not prohibit the direct connection of stranded conductors under a wire binding screw unless a manufacturer prohibited it in the product instructions. The NEC board could implement this proposal to prevent poor connections made in the field, knowing splices and terminals are where faults usually occur due to an improper or flawed connection.

I believe it should be permissible to land conductors this way provided the "thoroughly good connection" is made. If the electrical code making panel finds the direct connection of a stranded conductor under a wire binding screw is unacceptable, language in this code should be added saying this so the practice could be more easily enforced as prohibited.

Related Item

- 110.14A

Submitter Information Verification

Submitter Full Name: Norman Feck

Organization: State of Colorado

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 14 14:38:45 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Norman Feck, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Norman Feck, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 649-NFPA 70-2018 [Section No. 110.14(B)]****(B) Splices.**

Conductors shall be spliced or joined with splicing devices identified for the use or by brazing, welding, or soldering with a fusible metal or alloy. Soldered splices shall first be spliced or joined so as to be mechanically and electrically secure without solder and then be soldered. All splices and joints and the free ends of conductors shall be covered with an insulation equivalent to that of the conductors or with an identified insulating device.

Wire connectors or splicing means installed on conductors for direct burial shall be listed for such use.

Terminations and splices made within 450mm (18") of the earth shall be wet location rated.

Statement of Problem and Substantiation for Public Comment

My experience in the field has shown connections made within 18" of earth (earth – not grade, not concrete) are vulnerable and will deteriorate at a rate greater than outdoor terminations made above 18".

Factors such as sprinkler systems spraying these boxes regularly, climate, or some soils being more corrosive than others, does corrode splices made in these junction boxes more so than splices made in less harsh conditions. Outlets for wall mount luminaires, for example, would not be subject to this new code text and rightfully so. If a fixture was installed correctly per 410.10(A), the terminations I generally witness are fine. It is when opening low mount outdoor junction boxes that an electrician is more likely to observe deteriorating terminations and splices, even if the boxes were installed according to 314.15.

These wet location splices and terminations follow the reasoning of 250.64(A), 250.120(B), and 406.9 in that these connections are vulnerable. I find it necessary that these wet location splices and terminations are rated for wet locations for the same reasoning as they are necessary in 314.30(C).

This new code entry would prevent disconnects, panelboards, etc. from being mounted within 18" of earth in many cases.

Related Item

- 110.14B

Submitter Information Verification

Submitter Full Name: Norman Feck

Organization: State of Colorado

Street Address:

City:

State:

Zip:

Submission Date: Tue Aug 14 15:01:23 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Norman Feck, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Norman Feck, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 2168-NFPA 70-2018 [New Section after 110.14(C)(1)]

Table 110.14(C)(1) Conductor Ampacities Associated with Equipment Temperature Rating

<u>Size AWG or kcmil</u>	<u>60°C (140°F)</u> <u>COPPER</u>	<u>75°C (167°F)</u>	<u>60°C (140°F)</u> <u>ALUMINUM OR COPPER-CLAD AL</u>	<u>75°</u>
<u>18</u>	<u>=</u>	<u>=</u>	<u>=</u>	<u>=</u>
<u>16</u>	<u>=</u>	<u>=</u>	<u>=</u>	<u>=</u>
<u>14</u>	<u>15 *</u>	<u>20</u>	<u>=</u>	<u>=</u>
<u>12</u>	<u>20 *</u>	<u>25</u>	<u>15 *</u>	<u>20</u>
<u>10</u>	<u>30 *</u>	<u>35</u>	<u>25 *</u>	<u>30</u>
<u>8</u>	<u>40 *</u>	<u>50</u>	<u>35 *</u>	<u>40</u>
<u>6</u>	<u>55 *</u>	<u>65</u>	<u>40 *</u>	<u>50</u>
<u>4</u>	<u>70 *</u>	<u>85</u>	<u>55 *</u>	<u>65</u>
<u>3</u>	<u>85 *</u>	<u>100</u>	<u>65 *</u>	<u>75</u>
<u>2</u>	<u>95 *</u>	<u>115</u>	<u>75 *</u>	<u>90</u>
<u>1</u>	<u>110 *</u>	<u>130</u>	<u>85 *</u>	<u>100</u>
<u>1/0</u>		<u>150 **</u>		<u>120</u>
<u>2/0</u>		<u>175 **</u>		<u>135</u>
<u>3/0</u>		<u>200 **</u>		<u>155</u>
<u>4/0</u>		<u>230 **</u>		<u>180</u>
<u>250</u>		<u>255 **</u>		<u>205</u>
<u>300</u>		<u>285 **</u>		<u>230</u>
<u>350</u>		<u>310 **</u>		<u>250</u>
<u>400</u>		<u>335 **</u>		<u>270</u>
<u>500</u>		<u>380 **</u>		<u>310</u>
<u>600</u>		<u>420 **</u>		<u>340</u>
<u>700</u>		<u>460 **</u>		<u>375</u>
<u>750</u>		<u>475 **</u>		<u>385</u>
<u>800</u>		<u>490 **</u>		<u>395</u>
<u>900</u>		<u>520 **</u>		<u>425</u>
<u>1000</u>		<u>545 **</u>		<u>445</u>
<u>1250</u>		<u>590 **</u>		<u>485</u>
<u>1500</u>		<u>625 **</u>		<u>520</u>
<u>1750</u>		<u>650 **</u>		<u>545</u>
<u>2000</u>		<u>665 **</u>		<u>560</u>

* Minimum ampacity when the temperature rating of the equipment termination is not known. Reference 110.14(C)(1)(a)

** Minimum ampacity when the temperature rating of the equipment termination is not known. Reference 110.14(C)(1)(b)

Statement of Problem and Substantiation for Public Comment

This table would be very helpful to the code user when determining the appropriate minimum size conductor that can be used with equipment. It contains only the conductor ampacities that are referenced in 110.14(C), so it is much simpler than attempting to use Table 310.16 and sort out which columns and rows apply and which do not. I've taught many classes on this subject, and it is confusing for even some experienced code users, so this would be a useful addition.

Related Item

- PI 927

Submitter Information Verification

Submitter Full Name: Christel Hunter

Organization: Cerro Wire

Street Address:

City:

State:

Zip:

Submittal Date: Thu Aug 30 21:40:07 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Christel Hunter, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Christel Hunter, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 1330-NFPA 70-2018 [Section No. 110.14(D)]****(D) Terminal Connection Torque.**

Tightening torque values for terminal connections shall be as indicated on equipment or in installation instructions provided by the manufacturer. An approved means shall be used to achieve the indicated torque value.

Informational Note No. 1: Examples of approved means of achieving the indicated torque values include torque tools or visual indicators that demonstrate that the proper torque has been applied.

Informational Note No. 2: - ~~Informative Annex I of UL Standard 486A-486B, Standard for Safety-Wire Connectors~~, provides torque values in the absence of manufacturer's recommendations. The equipment manufacturer should be contacted if numeric torque values are not on the equipment nor noted within the accompanying installation instructions or if the installation instructions are not available or are missing.

Informational Note No. 3: Additional information for torquing threaded connections and terminations can be found in Section 8.11 of NFPA 70B-2016, *Recommended Practice for Electrical Equipment Maintenance*.

Statement of Problem and Substantiation for Public Comment

This proposed Informational Note No.2 is recommended instead of the language currently provided as Note No. 2 in the First Draft. There are many different types of terminations today requiring specific torque values; guidance to consult Informative Annex I, of which is extracted from UL Standard 486A-486B is not an appropriate substitute for seeking out the correct information from the equipment manufacturer. Improperly torqued terminals are a major safety concern for all manufacturers and can result in overheated wires and fires.

UL standard 486A-486B provides these values for UL testing and evaluation and do not reflect the manufacturers design intent for safe use. The standard is very difficult to interpret, torque values are based on slot widths and lengths, and is intended to be interpreted by an engineer, not an installer or inspector.

To ensure for a safe installation, it is necessary that installers locate, identify and follow manufacturers' specified torque values, and that they not simply guess or use some default value out of expediency.

Related Item

- FR 8510

Submitter Information Verification

Submitter Full Name: Vince Baclawski

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 27 10:27:51 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Vince Baclawski, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Vince Baclawski, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 1511-NFPA 70-2018 [Section No. 110.14(D)]****(D) Terminal Connection Torque.**

~~Tightening torque values for terminal connections shall be as indicated. Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer. An approved means, a torque tool shall be used to achieve the indicated torque value, unless the equipment manufacturer has provided for an alternative method of achieving the required torque. Alternate methods of achieving torque shall be permitted when the method has a visual indicator that the proper torque has been applied.~~

Informational Note No. 1: Examples of ~~approved means~~ alternate methods of achieving the indicated torque values include ~~torque tools or devices such as shear bolts or breakaway style devices with~~ visual indicators that demonstrate that the proper torque has been applied.

Informational Note No. 2: Informative Annex I of UL Standard 486A-486B, *Standard for Safety-Wire Connectors*, provides torque values in the absence of manufacturer's recommendations.

Informational Note No. 3: Additional information for torquing threaded connections and terminations can be found in Section 8.11 of NFPA 70B-2016, *Recommended Practice for Electrical Equipment Maintenance*.

Statement of Problem and Substantiation for Public Comment

The proposed revisions would retain some of the language that appeared in the 2017 NEC, with the deletion of the word "calibrated" and the additional clarifying text addressing alternate methods of achieving torque. It is not clear if the first sentence of the language that appears in the First Draft is intended to create a manufacturing requirement, an installation requirement, or perhaps is just a general statement. The second sentence of the language in the First Draft is pretty wide open, and could include hand-tightening, a simple screwdriver or nut driver, or it could include the appropriate torque tool, depending on what is "approved". Putting the reference to a torque tool in the informational note places an unnecessary burden on the AHJ to justify the requirement of a torque tool, when that is the only way to measure the applied torque in the absence of an engineered alternative method.

Related Item

- PI 3418

Submitter Information Verification

Submitter Full Name: Christel Hunter

Organization: Cerro Wire

Street Address:

City:

State:

Zip:

Submittal Date: Wed Aug 29 09:47:32 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Christel Hunter, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Christel Hunter, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 260-NFPA 70-2018 [Section No. 110.14(D)]****(D) Terminal Connection Torque.**

Tightening torque values for terminal connections shall be as indicated on equipment or in installation instructions provided by the manufacturer. An approved means shall be used to achieve the indicated torque value.

Informational Note No. 1: Examples of approved means of achieving the indicated torque values include torque tools or visual indicators that demonstrate that the proper torque has been applied.

~~Informational Note No. 2: Informative Annex I of UL Standard 486A-486B, *Standard for Safety-Wire Connectors*, provides torque values in the absence of manufacturer's recommendations. The Equipment manufacturer should be contacted if tightening torque values on the equipment or accompanying instructions are not available or missing.~~

Informational Note No. 3: Additional information for torquing threaded connections and terminations can be found in Section 8.11 of NFPA 70B-2016, *Recommended Practice for Electrical Equipment Maintenance*.

Statement of Problem and Substantiation for Public Comment**Background Info -**

In 2014 NEC, the informational note referred to marked torque values or manufacturer's instructions. No references to Annex I.

It was removed in the 2017 code when the new part D for calibrated torque tools was added with still no reference to Annex I.

The 2020 proposal is making reference to Annex I and that is the problem.

Informational not No. 2 which gives guidance to consult Informative Annex I, (which is extracted from UL Standard 486A-486B) for missing tightening torque information is not a safe or appropriate substitute for seeking out the correct information from the equipment manufacturer. There are many different types of terminations today requiring specific torque values. Improperly torqued terminals are a major safety concern and can result in overheated wires and fires.

The referenced UL standard 486A-486B provides these values for UL testing and evaluation purposes only and do not reflect the manufacturers or UL's design intent for safe installation and use. The standard is very difficult to interpret, torque values are based on slot widths and lengths, and is intended to be interpreted by an engineer for testing purposes, not an installer or inspector for an installation. These test values are often very different than the recommended safe installation values.

Most manufacturers specify these values either on the product or in the instructions and can readily provide this information either through their customer service or directly on the web.

To ensure for a safe installation, it is necessary that installers locate, identify and follow manufacturers' specified torque values, and that they not simply guess or use some default value out of expediency.

Related Item

• Public Input No. 3988-NFPA 70-2017 [Section No. 110.14(D)]

• Public Input No. 4083-NFPA 70-2017 [Section No. 110.14(D)]

Submitter Information Verification

Submitter Full Name: David Lutz

Organization: Hubbell Incorporated

Street Address:

City:

State:**Zip:****Submittal Date:** Sun Jul 22 10:33:06 EDT 2018**Committee:** NEC-P01**Copyright Assignment**

I, David Lutz, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am David Lutz, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 1361-NFPA 70-2018 [Section No. 110.14 [Excluding any Sub-Sections]]

110.14 Electrical Connections . Electrical connections shall comply with the following:

(A) Conductors . Electrical connections of conductors shall comply with the following:

(1) Connector Identification. Because of different characteristics of dissimilar metals, devices such as pressure terminal or pressure splicing connectors and soldering lugs shall be identified for use with the material of the conductor and shall be properly installed and used.

~~Conductors of~~

(2) Dissimilar Metals. Conductors of dissimilar metals shall not be intermixed in a terminal or splicing connector where physical contact occurs between dissimilar conductors (such as copper and aluminum, ~~copper and copper-clad aluminum,~~ or aluminum and copper-clad aluminum), unless the device is identified for the purpose and conditions of use.

~~Materials such~~

(3) Suitability for Use. Materials such as solder, fluxes, inhibitors, and compounds, where employed, shall be suitable for the use and shall be of a type that will not adversely affect the conductors, installation, or equipment.

(4) Finely Stranded Conductors. Connectors and terminals for conductors more finely stranded than Class B and Class C stranding as shown in Chapter 9, Table 10, shall be identified for the specific conductor class or classes.

Remaining sections to be renumbered to (B) through (E).

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Westmoreland_Galvanic_Corrosion_in_CCA.pdf	Westmoreland Test Report: ASTM G71 Proves CCA and Copper NOT dissimilar	
UL_RTRT_and_WJQR_Guide_Information.pdf	UL Guide Information (UL.com) states CCA Suitable with Cu-Only Wiring Devices and Terminals due to Metal Similarity	
11.IntertekRec.pdf	From 2011, Evidence of Testing to UL 817 of Range and Dryer Cords Made with CCA wire	
UL_817_Fiinal.pdf	From 2011, UL 817 Test Report by ETL on CCA Conductor Proving CCA and Brass are Not Dissimilar	
Cordage_Photos.pdf	Photos Demonstrating CCA and Brass are Not Dissimilar Metals. 87 Consecutive Months of Atmospheric Exposure	
WestmorelandCreditials.NadCapCurrent.pdf	Westmoreland Lab Credentials	
Intetek.UL486C.SAS.103589128CRT-001A_003_.pdf	Test Report: UL 486C, CCA wire with Copper-Only Connectors at Extreme Amperage	
ASTM_B-566.pdf	Pics of ASTM B566 Copper Clad Aluminum Wire	
Bond_Integrity_in_Aluminum-Copper_Clad_Metals.pdf	Materion White Paper Describing Copper Clad Aluminum Metallurgy and Applications in General	

Statement of Problem and Substantiation for Public Comment

PUBLIC COMMENT RESPONSE:

- As its primary objective, the Bimetals Industry seeks to create one similar metal from two dissimilar metals. Due to Copper-Clad Aluminum's metallurgical bond, and the fact that 100% of the Oxygen-free Copper component

resides at the surface of the wire, Copper-Clad Aluminum and Copper are "not" dissimilar metals as substantiated by the attached Test Report by Westmoreland Materials Lab per ASTM G-71, a standard test procedure used to determine dissimilar metals by our nation's metallurgical labs. UL guide information RTRT and WJQR further substantiates this reality, as both guides published on UL.com state that CCA and Cu can terminate in wiring devices not marked CO/ALR. Cu is the only other option for wiring devices. And finally, attached to this Public Comment is an UL 486C Test Report from an NRTL (with the appropriate purview of Scope) where CCA THHN is shown to perform well in extreme over-current conditions with Copper-Only push-in connectors supplied by Ideal, Wago and Gardner&Bender. In short, Brass, Copper and CCA are all similar metals. One of the goals of CCA as a bimetal is to offer industry a light-weight alternative to single-metal copper without sacrificing the ability to terminate and perform electrically as if it were single-metal copper.

With regard to the striking of the copper to copper-clad aluminum from the Code Language Text, it should be noted that in connectors and terminals the actual contact between the conductors is copper to copper, or copper to the terminal material (brass, zinc plated steel, etc.). The aluminum core of CCA is in fact metallurgically bonded to the outer shell of oxygen free copper and that bond negates any galvanic action between the metals. Westmoreland Materials Lab performed an ASTM G-71 Dissimilar Metals Test proving that Copper-Clad Aluminum and Copper are not dissimilar metals, as less than 250 millivolts of current (less than 10 millivolts on average was measured) were measured in full electrolyte between the two metals. It also should be noted that this Code does not permit terminations of any electrical conductors, regardless of the conductor materials similarity, where electrolyte is present. In Dry Locations, electrolyte by definition, cannot be present. In damp and wet locations, however, measures are taken by this Code to create an environment where electrolyte is not present, and galvanic corrosion cannot occur. Encapsulated Connectors/Terminals, i.e., the use of oxide inhibitors at points of termination are all attempts to create an electrolyte-free location for electrical terminations "free of galvanic corrosion." In summary, the Code has provided for fail-safes to keep conductors of all metallic types safe from galvanic corrosion. In general, Code Making Panels should take pains not adjudicate Code based upon the odd misuse of a legitimate product, but rather, in accordance with the proper use.

- UL Specifically Permits Copper-Clad Aluminum Wire to Terminate with Copper-Only Wiring Devices. Existing Code Text is misleading: copper-clad aluminum has been recognized since 1971 by UL for Termination with Copper-Only wiring devices (receptacles and switches). UL would not publish this information if copper-clad aluminum were dissimilar to brass and copper. In this case, UL's guidance offers solid substantiation that copper-clad aluminum, in contact with brass and copper are not dissimilar. Allowing Cu and Cu-Clad termination in Cu-only wiring devices is publicly stated in UL's Guide Information category codes RTRT and WJQR, which can be found on UL's website, excerpt as follows (full text in attachment):

[RTRT] Receptacle Terminals

Terminals of 15 and 20 A receptacles not marked "CO/ALR" are for use with copper and copper-clad aluminum conductors only. Terminals marked "CO/ALR" are for use with aluminum, copper and copper-clad aluminum conductors.

Terminals of receptacles rated 30 A and above not marked "AL-CU" are for use with copper conductors only.

Terminals of receptacles rated 30 A and above marked "AL-CU" are for use with aluminum, copper and copper-clad aluminum conductors.

[WJQR] Snap Switches

Terminals of 15 A and 20 A switches not marked "CO/ALR" are intended for use with copper and copper-clad aluminum conductors only. Terminals marked "CO/ALR" are for use with aluminum, copper and copper-clad aluminum conductors.

From 1969 – 71, UL undertook an extensive Fact-Finding study on copper-clad aluminum wire resulting in UL's current guidance position. UL's Fact-Finding study ultimately lead to copper-clad aluminum's entrance into Code in 1971. Terminals of these devices are made from brass with a zinc-plated steel terminal screws, and are subject to all installation risks that single-metal copper conductors would be. Most commercially available wiring devices do not mark their copper-only wiring devices as being suitable for Cu-Clad (copper-clad aluminum), even though they should. The exceptions are Leviton and Legrand Pass & Seymour (two leaders in the industry), who correctly mark and identify their brass-terminal wiring devices suitable for both Copper and Cu-Clad. If a device or connector were "Listed," all should meet the common standard set by UL 486C.

- Text Clarity: The present charging text for 110.14 has in fact 4 distinct not necessarily related requirements; Conductor connectors, dissimilar metals, use of solder, and fine stranded wire. An inspector writing a correction notice and citing this part cannot simply do so without further explanation as to exactly what the non-conformance is. The revised text takes these four distinct subjects and separates them into a list format providing much greater clarity to the user and usability for enforcer to apply the Code.

- UL Specifically Permits Copper-Clad Aluminum Wire to Terminate with Copper in connectors marked "CU-AL" or "AL-CU". Existing Text is misleading to the installer. UL's general information on connectors in category code ZMVB, extract table below, (italics by this submitter) specifically allow direct contact of copper to copper clad aluminum in any connector listed as "AL-CU" or "CU-AL".

[ZMVV] Wire Connectors and Soldering Lugs

"Conductor material — Wire connectors or the unit containers are marked with the type of conductor material(s) as follows:

Marking

(or equivalent)

For Use With

"CU" Copper wire only

"AL" Aluminum wire only

"AL-CU" or "CU-AL" Copper to copper,

aluminum to aluminum,

copper to aluminum but not intermixed or in direct physical contact,

copper-clad aluminum to copper-clad aluminum,

copper to copper-clad aluminum,

aluminum to copper-clad aluminum but not intermixed or in direct physical contact

"AL-CU (intermixed - dry locations)" Copper to copper,

aluminum to aluminum,

copper to aluminum intermixed and in direct physical contact,

copper-clad aluminum to copper-clad aluminum,

copper to copper-clad aluminum,

aluminum to copper-clad aluminum and in direct physical contact

Except as otherwise noted on or in the shipping carton, aluminum conductors are not intended to be used in direct physical contact with copper and copper-clad aluminum conductors in the same connector. A wire connector for securing an aluminum wire in combination with a copper or copper-clad aluminum conductor, where physical contact occurs between the wires of different metals, is limited to dry locations only and is marked "AL-CU (intermixed - dry locations)."

The present blanket prohibition in 110.14 negates what is allowed generally by UL as well as what is allowed for devices. The text in 110.14 "unless the device is identified for the purpose and conditions of use" appears to apply to the last row for intermixing of copper or copper-clad aluminum to aluminum, where the intermixing of copper to copper-clad aluminum is generally allowed on any connector rated "AL-CU" or "CU-AL."

- The Copper Component of Copper Clad Aluminum acts as an Oxide Inhibitor at the point of termination. The material surfaces used in the termination between Copper-Clad Aluminum wire, Single-Metal Copper wire and brass are not dissimilar: Per ASTM B566, 27% of the mass of copper-clad aluminum wire is copper, all of which resides at the surface of the wire for termination purposes. 110.14 as currently written is needlessly misleading the installer by classifying copper-clad aluminum incorrectly (treating it from a termination point of view as if it were single-metal aluminum). The revised text, supported by the attached laboratory testing for galvanic activity, from Intertek and Westmoreland Materials Laboratory, guides the user to the correct understanding that the termination surface of Copper Clad Aluminum is indeed Copper, where the copper component of the bimetal is indeed the termination point, and not dissimilar to Copper or Brass (terminals are made of brass, which is an alloy of zinc or aluminum and copper). Copper Clad Aluminum, however, is in fact dissimilar to Single-Metal Aluminum, which the proposed text would treat. To not create guidance in 110.14 to the reality that copper-clad aluminum and Copper/Brass are not dissimilar is denying the industry one of the primary benefits of having a bimetal such as ASTM B566 copper-clad aluminum wire in Code. copper-clad aluminum is one of only three metals currently in existence that can be generally used for wiring installation per Code.

- UL 817 Test Report by Intertek from 2011 Clearly Demonstrates That Copper-Clad Aluminum wire and Brass Crimp Connectors are Proven Similar Metals: Please see attached ETL Test Report and Cordage Photos from 2018.

- Galvanic Corrosion Btw Dissimilar Metals Moot Point, Especially in Dry Locations: When terminating in Dry locations, an electrolyte by definition is not present, so galvanic corrosion should be of no concern. Dissimilar metals do not corrode in a galvanic sense without an electrolyte. When terminating in damp and wet locations or below grade, all terminations (copper, copper clad and aluminum) are made with oxide inhibitors and/or encapsulated terminals, making galvanic corrosion, as well, a moot point.

[Receptacles] Receptacles for Plugs and Attachment Plugs, RTRT**GENERAL**

This category covers general-use receptacles for use in wiring systems recognized by ANSI/NFPA 70, "National Electrical Code" (NEC), and outlets for use in appliances and fixtures. It also covers some attachment plugs, male inlets, and cord connectors with nonstandard slot or blade configurations which are part of a line of wiring devices including receptacles. Other similar attachment-plug devices are covered under Attachment Plugs (AXGV).

A receptacle employing an integral thermal-interruption mechanism is not intended for hospital locations or other locations where critical patient care equipment is used. Additionally, a receptacle employing an integral thermal-interruption mechanism has not been investigated for its ability to reduce the safety hazards caused by overheating and overloaded circuits

A receptacle employing an integral thermal-interruption mechanism has been investigated to confirm the manufacturer's stated thermal-interruption temperature range.

PRODUCT TYPES

Appliance, Equipment and Fixture Outlets — When an outlet is installed in equipment with a conductive mounting surface, the face of the receptacle should project a minimum of 3/32 in. and a maximum of 3/16 in. from the mounting surface.

Clock Receptacle — A flush receptacle having a recessed cord-storage space in an integral flush-device cover plate, commonly used with wall clocks.

Display Receptacle — Display receptacles are provided with a cover plate for flush-mounted wiring devices or outlet-box cover and closure plug or plugs. They are intended for use in show window floors and similar locations where the device is not likely to be subjected to scrub water. They are not intended to be used as substitutes for floor boxes, which are covered under Metallic Outlet Boxes (QCIT) and Nonmetallic Outlet Boxes (QCMZ).

Flush Receptacle — Flush receptacles are intended for mounting in or on an outlet box, an outlet-box cover or a cover plate for flush-mounted wiring devices for fixed installation on a branch circuit. They are not intended to be field mounted on outlet-box covers solely by the center cover-plate screw. They may be employed in damp and wet locations when installed in an appropriate enclosure. See Metallic Outlet Boxes (QCIT) and Nonmetallic Outlet Boxes (QCMZ) for information on outlet boxes and covers suitable for use in damp and wet locations.

Hospital Receptacle — Receptacles for hospital use in other than hazardous (classified) locations in accordance with Article 517 of the NEC are identified (1) by the marking "Hospital Only" (used to identify a specific grounding locking configuration rated 20 A, 125 V used for the connection of mobile x-ray and similar equipment), or (2) by the marking "Hospital Grade" (or "Hosp. Grade" or "HG") and a green dot on the face of the receptacle. The identification is visible during installation on the wiring system or, in the case of the appliance outlet, after installation on the utilization equipment.

Interchangeable (Modular) Receptacle — Interchangeable receptacles are flush receptacles that are assembled as single, duplex or triplex outlets in the field from a system of individual outlet modules, mounting yokes, and/or cover plates for flush-mounted wiring devices.

Isolated Ground Receptacle — Grounding-type receptacles in which the grounding terminals are purposely insulated from the mounting means of receptacles and associated metal cover plates as permitted by Section 250.146(D) (formerly Exception No. 4 to Section 250-74) of the NEC are so identified by an orange triangle marked on the face of the receptacle.

Lighted Receptacle — Lighted receptacles employ an integral lens (jewel) and electrical or electronic components that produce light. Lighted receptacles are either power-indicating type, which illuminate when power is on, or illuminating/nightlight type.

Pendant Receptacle — Pendant receptacles include an enclosure with cover plate and strain-relief means, intended to be assembled at the end of flexible cord, for use in branch-circuit applications.

Pop-out Receptacle — A retractable flush-mount receptacle intended for mounting in or on an outlet box, an outlet-box cover, or a flush device plate for fixed installation on a branch circuit. Pop-out receptacles are only intended to be installed in a wall and other vertical surfaces.

Pop-up Receptacle Assembly — An assembly consisting of a retractable flush-mount receptacle, outlet box and flush device cover plate intended for fixed installation on a branch circuit. A pop-up receptacle assembly is suitable for installation in a kitchen or bathroom countertop. They are provided with one or more receptacle outlets. The outlets are retractable for storage below a counter surface. They are intended for installation in accordance with Sections 210.52(C)(5) and 406.5(E) of the NEC.

Receptacle Providing Power to Class 2 Equipment — A flush-mounted receptacle with an integral power supply with one or more Class 2 output low-voltage connectors, a Class 2 separable conductor lead assembly, or both, intended to be installed in an outlet box.

Self-contained Receptacle — Self-contained receptacles include an enclosure and mounting means intended for flush mounting without the use of a separate flush device or other outlet box. They are intended for use with Types NM and NMC cable in accordance with the NEC, specifically, Sections 300.15(E), 334.40(C), 545.10, 550.15(I) Exception, 551.47(E) Exception No. 1 and 552.48(E) Exception No. 1, and are so identified by specific markings on the carton in which they are packed. Devices employing insulation-displacement terminals are intended for assembly with specific installation tools only. Reference must be made to the installation instructions regarding the proper tool and the number of cables (per entry) with which the devices are intended to be used.

Self-grounding Receptacle — Self-grounding receptacles have special integral means for establishing the grounding circuit between device yokes and (1) the grounded metallic flush-type boxes, or (2) the grounded nonmetallic flush-device boxes employing a grounding strap and terminal; without the use of bonding jumpers as permitted by Section 250.146(B) (formerly Exception No. 2 to Section 250-74) of the NEC. These devices are identified by the statement: "This receptacle is Listed by Underwriters Laboratories Inc. and has a special pressure spring clip to establish the grounding circuit between device yokes and (1) the grounded metallic flush-type boxes, or (2) the grounded nonmetallic flush device boxes employing a grounding strap and terminal; without the use of bonding jumpers as permitted by Section 250.146(B) of the National Electrical Code" (or equivalent wording), which may appear on the device or shipping carton.

Surface Receptacle — Surface receptacles include an enclosure and mounting means for surface mounting without the use of a separate outlet box. They are intended for connection to exposed nonmetallic-sheathed cable as permitted by Article 334 of the NEC. Some may also accept other wiring systems. Surface receptacles rated 50 A that employ enclosures of insulating materials are not intended for use in applications where they are likely to be subject to severe mechanical abuse.

Tamper-resistant Receptacle — Receptacles for use in dwelling units in accordance with the NEC, specifically, Section 406.12, or pediatric patient care areas in accordance with Article 517 of the NEC. Tamper-resistant receptacles are identified by the words "Tamper Resistant" (or the letters "TR") where they will be visible after installation with the cover plate removed. Tamper-resistant receptacles may be of the general grade, hospital grade or isolated ground type.

Weather-resistant Receptacle — Receptacles for use in wet and damp locations in accordance with Article 406 of the NEC. Weather-resistant receptacles are identified by the words "Weather Resistant" (or the letters "WR") where they will be visible after installation with the cover plate secured as intended.

TERMINALS

Terminals of 15 and 20 A receptacles not marked "CO/ALR" are for use with copper and copper-clad aluminum conductors only. Terminals marked "CO/ALR" are for use with aluminum, copper and copper-clad aluminum conductors.

Terminals of receptacles rated 30 A and above not marked "AL-CU" are for use with copper conductors only.

Terminals of receptacles rated 30 A and above marked "AL-CU" are for use with aluminum, copper and copper-clad aluminum conductors.

Terminals marked "75 C" may be wired using the ampacities for conductors rated 75°C as well as conductors rated 60°C in Table 310.15(B)(16) of the NEC.

Terminals of the wire-binding screw, setscrew, or screw-actuated back-wired clamping types are suitable for use with both solid and stranded building wires.

Terminals of a receptacle are permitted for use with certified field-installed crimped-on wire connectors or an assembly, if so identified by the manufacturer.

A receptacle may also be provided with conductor leads with factory-installed crimped-on connectors. Such connectors may be either attached to the receptacle terminal or are provided with the receptacle in the smallest unit shipping container and are suitable for use with the terminal of the receptacle.

Screwless terminal connectors of the conductor push-in type (also known as "push-in-terminals") are restricted to 15 A branch circuits and are for connection with 14 AWG solid copper wire only. They are not intended for use with aluminum or copper-clad aluminum wire, 14 AWG stranded copper wire, or 12 AWG solid or stranded copper wire. Single and duplex receptacles rated 15 and 20 A that are provided with more than one set of terminals for the connection of line and neutral conductors have been investigated to feed branch-circuit conductors connected to other outlets on a multi-outlet branch circuit, as follows:

1. Back-wire (screw-actuated clamp type) terminations with multiple wire-access holes used concurrently to terminate more than one conductor
2. Side-wire (binding screw) terminals used concurrently with their respective push-in (screwless) terminations to terminate more than one conductor

Single and duplex receptacles rated 15 and 20 A that are provided with more than one set of terminals for the connection of line and neutral conductors have not been investigated to feed branch-circuit conductors connected to other outlets on a multi-outlet branch circuit, as follows:

- Side-wire (binding screw) terminal with its associated back-wire (screw-actuated clamp type) terminal
- Multiple conductors under a single binding screw
- Multiple conductors in a single back-wire hole

Duplex receptacles rated 15 and 20 A that are provided with break-off tabs may have those tabs removed so that the two receptacles may be wired in a multi-wire branch circuit or multiple branch circuits.

HORSEPOWER RATINGS

In addition to ampere and voltage ratings, standard AC horsepower ratings corresponding to the ampere and voltage ratings for specific general-use receptacles not incorporating overcurrent protection or a switch are given in the table below. For a Design E motor rated more than 2 horsepower, it is necessary to use a receptacle having a horsepower rating not less than 1.4 times the standard AC horsepower rating. The NEMA configuration designation is included for reference. Devices of configurations other than those indicated in the table have horsepower ratings only if such ratings are marked on the device.

HORSEPOWER RATINGS FOR NEMA CONFIGURATION RECEPTACLES

Amps

Rating AC V

Rating No. of

Phase No. of

Poles

No. of Wire NEMA

Dsg HP

Rating

15	125	1	2	2	1-15, L1-15	1/2
	125	1	2	3	5-15, L5-15	1/2
	250	1	2	2	2-15 1-1/2#, %	
	250	1	2	3	6-15, L6-15	1-1/2#, %
	277	1	2	3	7-15, L7-15	2
	125/250	1	3	4	14-15	1-1/2 L-L#, %
1/2 L-N						
	250	3	3	3	11-15, L11-15	2
	250	3	3	4	15-15	2

	120/208	3	4	4	18-15	2
20	125	1	2	3	5-20, L5-20	1
	250	1	2	2	2-20, L2-20	2#, %
	250	1	2	3	6-20, L6-20	2#, %
	277	1	2	3	7-20, L7-20	2
	480	1	2	3	L8-20	3
	125/250	1	3	3	10-20, L10-20	2 L-L#, %
1 L-N						
	125/250	1	3	4	14-20, L14-20	2 L-L#, %
1 L-N						
	250	3	3	3	11-20, L11-20	3
	250	3	3	4	15-20, L15-20	3
20	480	3	3	3	L12-20	5
	480	3	3	4	L16-20	5
	120/208	3	4	4	18-20, L18-20	2
	120/208	3	4	5	L21-20	2
	277/480	3	4	4	L19-20	5
	277/480	3	4	5	L22-20	5
30	125	1	2	3	5-30, L5-30	2
	250	1	2	2	2-30	2#, %
	250	1	2	3	6-30, L6-30	2#, %
	277	1	2	3	7-30, L7-30	3
	480	1	2	3	L8-30	5
	125/250	1	3	3	10-30, L10-30	2 L-L#, %
2 L-N						
	125/250	1	3	4	14-30, L14-30	2 L-L#, %
2 L-N						
	250	3	3	3	11-30, L11-30	3
	250	3	3	4	15-30, L15-30	3
	480	3	3	3	L12-30	10
	480	3	3	4	L16-30	10
	120/208	3	4	4	18-30, L18-30	3
	120/208	3	4	5	L21-30	3
	277/480	3	4	4	L19-30	10
	277/480	3	4	5	L22-30	10
50	125	1	2	3	5-50	2
	250	1	2	3	6-50	3#, %
	277	1	2	3	7-50	5
	125/250	1	3	3	10-50	3 L-L#, %
2 L-N						
	125/250	1	3	4	14-50	3 L-L#, %
2 L-N						
	250	3	3	3	11-50	7-1/2
	250	3	3	4	15-50	7-1/2
	120/208	3	4	4	18-50	7-1/2
60	125/250	1	3		14-60	3 L-L#, %
2 L-N						
	250	3	3	4	15-60	10
	120/208	3	4	4	18-60	7-1/2

L-L#: Motor connected line-to-line

L-N: Motor connected line-to-neutral

%: Also suitable for 208 V motor applications at the indicated horsepower rating

For three-phase devices, the horsepower ratings indicated are for three-phase motor loads.

Refer to ANSI/NEMA WD 6 (2002), "Wiring Devices - Dimensional Specifications," for configurations of the NEMA designations.

PRODUCT IDENTITY

One of the following product identities appears on the product:

Attachment Plug

Attachment Plug with Overload Protection

Fuseless Attachment Plug

Plug

Recept.

Receptacle

Other product identities may be used as shown in the individual certifications.

ADDITIONAL INFORMATION

For additional information, see Receptacles (RTDV) and Electrical Equipment for Use in Ordinary Locations (AALZ).

REQUIREMENTS

The basic standard used to investigate products in this category is ANSI/UL 498, "Attachment Plugs and Receptacles."

Where indicated in the individual certifications, receptacles have additionally been investigated to Federal Specification W-C-596, "General Specification for Electrical Power Connectors."

UL MARK

The Certification Mark of UL on the product, or the UL symbol on the product and the Certification Mark on the smallest unit container in which the product is packaged is the only method provided by UL to identify products manufactured under its Certification and Follow-Up Service. The Certification Mark for these products includes the UL symbol, the words "CERTIFIED" and "SAFETY," the geographic identifier(s), and a file number.

Receptacles additionally investigated to Federal Specification W-C-596 are identified by the capital letters "F" and "S," each in a wing on either side of the UL symbol. The Federal Specification number "W-C-596F" or "W-C-596G," or the Federal Specification part number (which consists of the appropriate specification sheet and dash number described in the specification) may also be included on the product or on the smallest container in which the product is packaged.

Alternate UL Mark

The Listing Mark of UL on the product, or the UL symbol on the product and the Listing Mark on the smallest unit container in which the product is packaged is the only method provided by UL to identify products manufactured under its Listing and Follow-Up Service. The Listing Mark for these products includes the UL symbol (as illustrated in the Introduction of this Directory) together with the word "LISTED," a control number, and one of the following product names: "Attachment Plug," "Plug," "Receptacle" (or "Recept."), "Attachment Plug with Overload Protection," "Attachment Plug Fuseless," or other appropriate product name as shown in the individual Listings. Receptacles additionally investigated to Federal Specification W-C-596 are identified by the capital letters "F" and "S," each in a wing on either side of the UL symbol. The Federal Specification number "W-C-596F" or "W-C-596G," or the Federal Specification part number (which consists of the appropriate specification sheet and dash number described in the specification) may also be included on the product or on the smallest container in which the product is packaged.

UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. UL shall not incur any obligation or liability for any loss, expense or damages, including incidental or consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Guide Information.

Last Updated on 2018-03-09

The appearance of a company's name or product in this database does not in itself assure that products so identified have been manufactured under UL's Follow-Up Service. Only those products bearing the UL Mark should be considered to be Certified and covered under UL's Follow-Up Service. Always look for the Mark on the product. UL permits the reproduction of the material contained in the Online Certification Directory subject to the following conditions: 1. The Guide Information, Assemblies, Constructions, Designs, Systems, and/or Certifications (files) must be presented in their entirety and in a non-misleading manner, without any manipulation of the data (or drawings). 2. The statement "Reprinted from the Online Certifications Directory with permission from UL" must appear adjacent to the extracted material. In addition, the reprinted material must include a copyright notice in the following format: "© 2018 UL LLC".

[Switches] Snap Switches, WJQR

GENERAL

This category covers general-use snap switches, which are so constructed that they can be installed in flush device boxes or on outlet box covers or otherwise used in connection with wiring systems recognized by ANSI/NFPA 70, "National Electrical Code" (NEC).

Door switches are investigated for use only in combination with a specific switch, special switch box and cover. See Switches, Door (WLFV).

Flush snap switches investigated for use without separate outlet boxes with nonmetallic-sheathed cable, Types NM, NMC, NM-B and NMC-B cable in accordance with the NEC, are so identified by a specific marking on the carton in which they are packed.

Snap switches have not been investigated for switching a load between two alternate sources of supply. Double-throw enclosed switches (see Switches, Enclosed (WIAX)) or switches certified as transfer switches (see Transfer Switches [WPTZ] and Emergency Lighting and Power Equipment (FTBR)) should be used for this purpose.

Multi-pole, general-use snap switches have not been investigated for more than single-circuit operation unless

marked "2-circuit" or "3-circuit."

Snap switches without a grounding connection are intended for replacement use only in accordance with NEC 404.9, Exception to (B).

General-use snap switches are classified into two categories: AC-DC general use and AC general use. AC general-use switches are marked "AC" to limit their use to alternating-current circuits. AC-DC general-use switches are not so limited; no such marking is required or generally provided.

AC-DC GENERAL-USE SNAP SWITCHES

The standard amp and voltage ratings for an AC-DC general-use snap switch for controlling direct- or alternating-current circuits are given in Table I. While many of these snap switches will operate successfully on circuits that have some reactance, in general, an inductive load should not exceed one-half (50%) the amp rating of the switch at the voltage involved.

Additional ratings:

- Snap switches marked with horsepower ratings are suitable for the control of a motor in accordance with the specified horsepower and voltage ratings.
- Snap switches suitable for the control of tungsten-filament lamp loads are marked with the letter "T" and are suitable for tungsten-filament lamp load ratings of 125 V or less.
- Snap switches marked with the letter "T" are also suitable for the control of electronic ballast, self-ballasted lamp, compact fluorescent lamp, and LED driver lamp loads up to the marked amp rating of the switch at its rated voltage.

Table I

Snap Switch Ratings in Amps Corresponding to Direct- or Alternating-current Voltage Ratings

125 V	250 V	600 V
—	—	1
3*	1*	—
—	—	2
5*	2*	—
—	—	3
5* or 6*	3*	—
—	5	3
—	—	5
—	5*	—
10*	5*	—
—	10	5
—	—	10
—	10*	—
20*	10*	—
—	20	10
—	—	20
—	20*	—
30**	20	—
40*	20*	—
—	30	20
—	—	30*
—	30*	—
60*	30*	—
—	60	—

* These dual ratings may be assigned only to a three-way, four-way, two-circuit, three-circuit, or a fixture switch.

** A panelboard switch may be rated at 30 A, 125 V, without the corresponding 250 V rating.

AC-ONLY GENERAL-USE SNAP SWITCHES

An AC-only general-use snap switch has a marked amp and voltage rating, which is one of the ratings given in Table II. These switches are intended for installation in a flush device box (flush snap switch), mounting on an outlet box covers, or surface mounting (surface snap switch).

AC-only general-use snap switches rated up to 277 V AC are suitable for the control of:

- Resistive loads not exceeding the marked amp and voltage rating of the switch.
- Inductive loads not exceeding the marked amp and voltage rating of the switch.
- Electric discharge lamp loads not exceeding the marked amp and voltage rating of the switch.
- Tungsten-filament lamp loads at 120 V AC up to the full current rating of the switch.
- Electronic ballast, self-ballasted lamp, compact fluorescent lamp, and LED driver lamp loads up to 20 A, but not exceeding the amp rating of the switch at its marked voltage rating.
- Motor loads up to 80% of the amp rating of the switch, but not exceeding 2 hp.

Section 404.14 (D) of the NEC identifies a "Specific Use Snap Switch Rated for 347 Volts." These snap switches are AC general-use snap switches rated 347 V AC. They are suitable for the control of resistive, inductive (including electric discharge lamp) loads up to the full current rating of the switch. They are also suitable for the control of electronic ballast, self-ballasted lamp, compact fluorescent lamp, and LED driver lamp loads up to 20 A but not exceeding the amp rating of the switch at its rated voltage.

Table II

AC Snap Switch Ratings in Amps Corresponding to Alternating-current Voltage Ratings

120 V AC 120 to 277 V AC* 277 V AC 347 V AC

15 15 15 15

20 20 20 20

30 30 30 30

* Switches rated 120 to 277 V AC are acceptable for use on motor circuits up to the amp ratings shown, at any voltage between 120 and 277 V AC.

Snap switches rated 240 or 250 V that are intended for use on circuits involving a nominal potential to ground of 120 or 125 V, respectively, are tested on such circuits and are marked with the voltage rating "240" or "250" (no underlining). Snap switches rated 240 or 250 V that are suitable for use at full potential to ground are marked with the voltage rating (double underlining). Snap switches having voltage ratings other than 240 or 250 V are tested on circuits involving full rated potential to ground.

Terminals of 15 A and 20 A switches not marked "CO/ALR" are intended for use with copper and copper-clad aluminum conductors only. Terminals marked "CO/ALR" are for use with aluminum, copper and copper-clad aluminum conductors.

Terminals of the wire-binding screw, setscrew, or screw-actuated back-wired clamping types are suitable for use with solid building wires unless otherwise indicated either on the device or in the installation instructions.

Terminals of a flush snap switch are permitted for use with certified field-installed crimped-on wire connectors or an assembly, if so identified by the manufacturer.

A flush snap switch may also be provided with conductor leads with factory-installed crimped-on connectors. Such connectors may be either attached to the flush snap switch terminal or are provided with the flush snap switch in the smallest unit shipping container and are suitable for use with the terminal of the flush snap switch.

Screwless terminal connectors of the conductor push-in type (also known as "push-in terminals") are restricted to 15 A branch circuits and are intended for connection with 14 AWG solid copper wire only. They are not intended for use with aluminum or copper-clad aluminum wire, 14 AWG stranded copper wire, or 12 AWG solid or stranded copper wire.

Terminals of switches rated 30 A and above not marked "AL-CU" are intended for use with copper conductors only.

Terminals of switches rated 30 A and above marked "AL-CU" are for use with aluminum, copper and copper-clad aluminum conductors.

UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. UL shall not incur any obligation or liability for any loss, expense or damages, including incidental or consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Guide Information.

Last Updated on 2017-06-20

The appearance of a company's name or product in this database does not in itself assure that products so identified have been manufactured under UL's Follow-Up Service. Only those products bearing the UL Mark should be considered to be Certified and covered under UL's Follow-Up Service. Always look for the Mark on the product. UL permits the reproduction of the material contained in the Online Certification Directory subject to the following conditions: 1. The Guide Information, Assemblies, Constructions, Designs, Systems, and/or Certifications (files) must be presented in their entirety and in a non-misleading manner, without any manipulation of the data (or drawings). 2. The statement "Reprinted from the Online Certifications Directory with permission from UL" must appear adjacent to the extracted material. In addition, the reprinted material must include a copyright notice in the following format: "© 2018 UL LLC".

Related Item

- 2112

Submitter Information Verification

Submitter Full Name: Peter Graser

Organization: Copperweld

Street Address:

City:

State:

Zip:

Submission Date: Mon Aug 27 13:53:25 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Peter Graser, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Peter Graser, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Metallurgical Laboratory Report

Customer:	Multiple		
Subject:	Galvanic Corrosion in CCA		
Date:	8/9/18		

Analysis By:	Bill Lewey - Metallurgist
Authored By:	Bill Lewey - Metallurgist
Requested By:	Peter Graser

Hypothesis/Purpose:

Hypothesis: When properly connected in an electrical circuit, CCA will act like a solid copper conductor with no galvanic corrosion occurring as a result of the metallurgical bond of the bimetal.

The purpose of this test is to determine the effects of galvanic corrosion in CCA when coupled with copper in an electrolyte solution by measuring the galvanic voltage that occurs between the two metals. Reference tests are made between known similar and dissimilar metals in order to bring scale and perspective to the results.

Test Method

A test was conducted by **Westmoreland Mechanical Testing & Research Inc.** (third party metallurgical and materials testing lab) to determine if galvanic corrosion would occur when CCA is connected to pure copper in an electrolyte solution. The test method used was based on ASTM G71-81(2014) and a description of the test is provided in the attached test report.

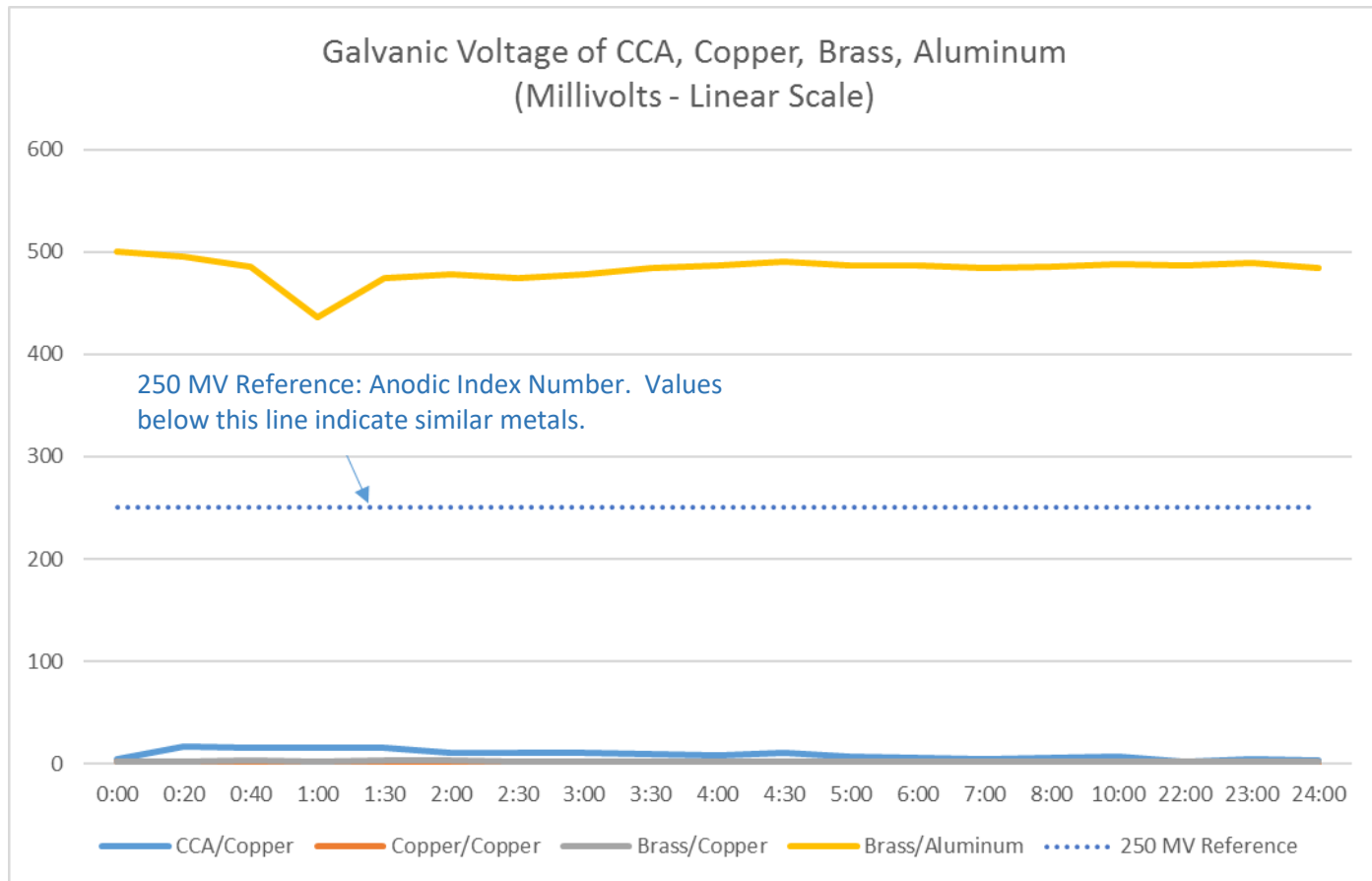
Copperweld conducted additional tests per ASTM G71-81(2014) using a copper/copper connection, a copper/brass connection and an aluminum/brass connection for comparison. Copperweld's tests were conducted using the same method used by Westmoreland.

Results of the testing are shown in the table and graph below.

Conclusion

The galvanic voltage measured between CCA and copper connected in an electrolyte solution was found to be only slightly higher than the voltage measured between a copper/copper connection and a copper/brass connection. The voltage measured between dissimilar aluminum/brass was more than 50 times higher than the CCA and copper.

CCA was shown to perform galvanically similar to single-metal copper.



Lab Galvanic Connection	Westmoreland CCA/Copper	Copperweld Copper/Copper	Copperweld Brass/Copper	Copperweld Brass/Aluminum
Time(Hr:Min)	Galvanic Current (mV)	Galvanic Current (mV)	Galvanic Current (mV)	Galvanic Current (mV)
0:00	4.43	2.48	2.44	499.89
0:20	16.47	2.21	2.32	496.03
0:40	15.42	1.03	2.55	486.17
1:00	15.26	1.75	2.46	436.62
1:30	15.27	0.62	2.64	474.96
2:00	11.01	0.52	2.68	478.6
2:30	10.15	0.95	2.48	475.06
3:00	11.02	0.57	2.47	478.29
3:30	9.81	0.66	2.4	483.96
4:00	8.58	1.22	2.24	487.13
4:30	10.12	1.58	2.15	490.85
5:00	6.98	0.93	2.28	486.3
6:00	5.75	0.95	2.06	487.1
7:00	4.75	0.59	2.09	485.01
8:00	4.97	0.47	2.13	485.98
10:00	6.93	0.56	2.1	488.5
22:00	1.52	0.74	2.14	486.91
23:00	3.81	0.68	2.1	489.63
24:00	3.45	0.77	2.11	484.59
Average Voltage	8.72	1.01	2.30	483.24
Weight Loss	.002 gm	.0015 gm	.0011 gm	.0012 gm
Visual Exam	Slight discoloration, no corrosion visible	Slight discoloration, no corrosion visible	Slight discoloration, no corrosion visible	Slight discoloration, no corrosion visible



Westmoreland Mechanical Testing & Research, Inc.
P.O. Box 388; 221 Westmoreland Drive
Youngstown, PA 15696-0388 U.S.A.
Telephone: 724-537-3131 Fax: 724-537-3151
Website: www.wmtr.com E-Mail: admin@wmtr.com
WMT&R is a technical leader in the material testing industry

06 August 2018

Copperweld Bimetallies
254 Cotton Mill Road
Fayetteville, TN 37334

Page 1 of 1

WMT&R Report 8-70626
P.O. No. 042640
WMT&R Quote No. QN183134

Attention: Bill Lewey

Subject: Galvanic corrosion testing of submitted sample per ASTM G71-81(2014) and purchase order requirements.

Introduction: One (1) lot, consisting of one (1) 9 gauge copper clad aluminum wire and one (1) flat copper strip, was received at Westmoreland Mechanical Testing and Research, Incorporated, for galvanic corrosion testing per ASTM G71-81 (2014) and purchase order requirements. Prior to exposure, both parts were cleaned with reagent alcohol and the copper clad aluminum wire was weighed. The copper clad aluminum anode was bent in a U shape and positioned in the electrolyte solution such that a thirty (30) cm length of wire was exposed. The flat copper cathode was positioned such that 35 cm² of surface area was exposed. The parts were positioned one (1) cm apart. The parts were exposed to a 3.5% NaCl in deionized water solution for a continuous period of 24 hours. The galvanic voltage generated was measured initially and periodically throughout the test. Upon completion of the test, a final voltage was measured, the specimens were cleaned, the copper clad aluminum wire was weighed, and the specimens were given a visual examination.

Results:

CORROSION – Galvanic Corrosion Testing per ASTM G71-81 (2014) and Purchase Order Requirements

REQUIREMENTS: Report

(Test Log No. 725BQH)

No corrosion was visible on the surface of the copper clad aluminum anode.

Weight loss 0.002g

Time (Hr:Min)	Galvanic Current (mV)
0:00	4.43
0:20	16.47
0:40	15.42
1:00	15.26
1:30	15.27
2:00	11.01
2:30	10.15
3:00	11.02
3:30	9.81
4:00	8.58
4:30	10.12
5:00	6.98
6:00	5.75
7:00	4.75
8:00	4.97
10:00	6.93
22:00	1.52
23:00	3.81
24:00	3.45

If you have any questions concerning this report, please feel free to contact me. If I am unavailable, you may also speak with Mr. Andrew M. Wisniewski, Metallographic/Chemical Analysis Manager.
At your service

Scott Sylvester
Assistant Analytical Manager

C:\P\SSAB
K:\DRAWINGS-AND\W\COFFERWELD\8-70626

NOTE: THE RECORDING OF FALSE, FICTITIOUS, OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.
THIS CERTIFICATE OR REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL, WITHOUT THE WRITTEN APPROVAL OF WMT&R, INC.

Testing Specialists for Aerospace, Automotive, and Material Testing Fields
Locations in Youngstown, PA U.S.A. – Tel. (724) 537-3131 and
Banbury, Oxon U.K. – Tel. +44 (0) 1295 261211

[Receptacles] Receptacles for Plugs and Attachment Plugs, RTRT

GENERAL

This category covers general-use receptacles for use in wiring systems recognized by ANSI/NFPA 70, "National Electrical Code" (NEC), and outlets for use in appliances and fixtures. It also covers some attachment plugs, male inlets, and cord connectors with nonstandard slot or blade configurations which are part of a line of wiring devices including receptacles. Other similar attachment-plug devices are covered under Attachment Plugs (**AXGV**).

A receptacle employing an integral thermal-interruption mechanism is not intended for hospital locations or other locations where critical patient care equipment is used. Additionally, a receptacle employing an integral thermal-interruption mechanism has not been investigated for its ability to reduce the safety hazards caused by overheating and overloaded circuits.

A receptacle employing an integral thermal-interruption mechanism has been investigated to confirm the manufacturer's stated thermal-interruption temperature range.

PRODUCT TYPES

Appliance, Equipment and Fixture Outlets — When an outlet is installed in equipment with a conductive mounting surface, the face of the receptacle should project a minimum of 3/32 in. and a maximum of 3/16 in. from the mounting surface.

Clock Receptacle — A flush receptacle having a recessed cord-storage space in an integral flush-device cover plate, commonly used with wall clocks.

Display Receptacle — Display receptacles are provided with a cover plate for flush-mounted wiring devices or outlet-box cover and closure plug or plugs. They are intended for use in show window floors and similar locations where the device is not likely to be subjected to scrub water. They are not intended to be used as substitutes for floor boxes, which are covered under Metallic Outlet Boxes (**QCIT**) and Nonmetallic Outlet Boxes (**QCMZ**).

Flush Receptacle — Flush receptacles are intended for mounting in or on an outlet box, an outlet-box cover or a cover plate for flush-mounted wiring devices for fixed installation on a branch circuit. They are not intended to be field mounted on outlet-box covers solely by the center cover-plate screw. They may be employed in damp and wet locations when installed in an appropriate enclosure. See Metallic Outlet Boxes (**QCIT**) and Nonmetallic Outlet Boxes (**QCMZ**) for information on outlet boxes and covers suitable for use in damp and wet locations.

Hospital Receptacle — Receptacles for hospital use in other than hazardous (classified) locations in accordance with Article 517 of the NEC are identified (1) by the marking "Hospital Only" (used to identify a specific grounding locking configuration rated 20 A, 125 V used for the connection of mobile x-ray and similar equipment), or (2) by the marking "Hospital Grade" (or "Hosp. Grade" or "HG") and a green dot on the face of the receptacle. The identification is

visible during installation on the wiring system or, in the case of the appliance outlet, after installation on the utilization equipment.

Interchangeable (Modular) Receptacle — Interchangeable receptacles are flush receptacles that are assembled as single, duplex or triplex outlets in the field from a system of individual outlet modules, mounting yokes, and/or cover plates for flush-mounted wiring devices.

Isolated Ground Receptacle — Grounding-type receptacles in which the grounding terminals are purposely insulated from the mounting means of receptacles and associated metal cover plates as permitted by Section 250.146(D) (formerly Exception No. 4 to Section 250-74) of the NEC are so identified by an orange triangle marked on the face of the receptacle.

Lighted Receptacle — Lighted receptacles employ an integral lens (jewel) and electrical or electronic components that produce light. Lighted receptacles are either power-indicating type, which illuminate when power is on, or illuminating/nightlight type.

Pendant Receptacle — Pendant receptacles include an enclosure with cover plate and strain-relief means, intended to be assembled at the end of flexible cord, for use in branch-circuit applications.

Pop-out Receptacle — A retractable flush-mount receptacle intended for mounting in or on an outlet box, an outlet-box cover, or a flush device plate for fixed installation on a branch circuit. Pop-out receptacles are only intended to be installed in a wall and other vertical surfaces.

Pop-up Receptacle Assembly — An assembly consisting of a retractable flush-mount receptacle, outlet box and flush device cover plate intended for fixed installation on a branch circuit. A pop-up receptacle assembly is suitable for installation in a kitchen or bathroom countertop. They are provided with one or more receptacle outlets. The outlets are retractable for storage below a counter surface. They are intended for installation in accordance with Sections 210.52(C)(5) and 406.5(E) of the NEC.

Receptacle Providing Power to Class 2 Equipment — A flush-mounted receptacle with an integral power supply with one or more Class 2 output low-voltage connectors, a Class 2 separable conductor lead assembly, or both, intended to be installed in an outlet box.

Self-contained Receptacle — Self-contained receptacles include an enclosure and mounting means intended for flush mounting without the use of a separate flush device or other outlet box. They are intended for use with Types NM and NMC cable in accordance with the NEC, specifically, Sections 300.15(E), 334.40(C), 545.10, 550.15(I) Exception, 551.47(E) Exception No. 1 and 552.48(E) Exception No. 1, and are so identified by specific markings on the carton in which they are packed. Devices employing insulation-displacement terminals are intended for assembly with specific installation tools only. Reference must be made to the installation instructions regarding the proper tool and the number of cables (per entry) with which the devices are intended to be used.

Self-grounding Receptacle — Self-grounding receptacles have special integral means for establishing the grounding circuit between device yokes and (1) the grounded metallic flush-type boxes, or (2) the grounded nonmetallic flush-device boxes employing a grounding strap and terminal; without the use of bonding jumpers as permitted by Section 250.146(B) (formerly Exception No. 2 to Section 250-74) of the NEC. These devices are identified by the statement: "This receptacle is Listed by Underwriters Laboratories Inc. and has a special pressure spring clip to establish the grounding circuit between device yokes and (1) the grounded metallic flush-type boxes, or (2) the grounded nonmetallic flush device boxes employing a grounding strap and terminal; without the use of bonding jumpers as permitted by Section 250.146(B) of the National Electrical Code" (or equivalent wording), which may appear on the device or shipping carton.

Surface Receptacle — Surface receptacles include an enclosure and mounting means for surface mounting without the use of a separate outlet box. They are intended for connection to exposed nonmetallic-sheathed cable as permitted by Article 334 of the NEC. Some may also accept other wiring systems. Surface receptacles rated 50 A that employ enclosures of insulating materials are not intended for use in applications where they are likely to be subject to severe mechanical abuse.

Tamper-resistant Receptacle — Receptacles for use in dwelling units in accordance with the NEC, specifically, Section 406.12, or pediatric patient care areas in accordance with Article 517 of the NEC. Tamper-resistant receptacles are identified by the words "Tamper Resistant" (or the letters "TR") where they will be visible after installation with the cover plate removed. Tamper-resistant receptacles may be of the general grade, hospital grade or isolated ground type.

Weather-resistant Receptacle — Receptacles for use in wet and damp locations in accordance with Article 406 of the NEC. Weather-resistant receptacles are identified by the words "Weather Resistant" (or the letters "WR") where they will be visible after installation with the cover plate secured as intended.

TERMINALS

Terminals of 15 and 20 A receptacles not marked "CO/ALR" are for use with copper and copper-clad aluminum conductors only. Terminals marked "CO/ALR" are for use with aluminum, copper and copper-clad aluminum conductors.

Terminals of receptacles rated 30 A and above not marked "AL-CU" are for use with copper conductors only. Terminals of receptacles rated 30 A and above marked "AL-CU" are for use with aluminum, copper and copper-clad aluminum conductors.

Terminals marked "75 C" may be wired using the ampacities for conductors rated 75°C as well as conductors rated 60°C in Table 310.15(B)(16) of the NEC.

Terminals of the wire-binding screw, setscrew, or screw-actuated back-wired clamping types are suitable for use with both solid and stranded building wires.

Terminals of a receptacle are permitted for use with certified field-installed crimped-on wire connectors or an assembly, if so identified by the manufacturer.

A receptacle may also be provided with conductor leads with factory-installed crimped-on connectors. Such connectors may be either attached to the receptacle terminal or are provided with the receptacle in the smallest unit shipping container and are suitable for use with the terminal of the receptacle.

Screwless terminal connectors of the conductor push-in type (also known as "push-in-terminals") are restricted to 15 A branch circuits and are for connection with 14 AWG solid copper wire only. They are not intended for use with aluminum or copper-clad aluminum wire, 14 AWG stranded copper wire, or 12 AWG solid or stranded copper wire.

Single and duplex receptacles rated 15 and 20 A that are provided with more than one set of terminals for the connection of line and neutral conductors have been investigated to feed branch-circuit conductors connected to other outlets on a multi-outlet branch circuit, as follows:

1. Back-wire (screw-actuated clamp type) terminations with multiple wire-access holes used concurrently to terminate more than one conductor
2. Side-wire (binding screw) terminals used concurrently with their respective push-in (screwless) terminations to terminate more than one conductor

Single and duplex receptacles rated 15 and 20 A that are provided with more than one set of terminals for the connection of line and neutral conductors have not been investigated to feed branch-circuit conductors connected to other outlets on a multi-outlet branch circuit, as follows:

- Side-wire (binding screw) terminal with its associated back-wire (screw-actuated clamp type) terminal
- Multiple conductors under a single binding screw
- Multiple conductors in a single back-wire hole

Duplex receptacles rated 15 and 20 A that are provided with break-off tabs may have those tabs removed so that the two receptacles may be wired in a multi-wire branch circuit or multiple branch circuits.

HORSEPOWER RATINGS

In addition to ampere and voltage ratings, standard AC horsepower ratings corresponding to the ampere and voltage ratings for specific general-use receptacles not incorporating overcurrent protection or a switch are given in the table below. For a Design E motor rated more than 2 horsepower, it is necessary to use a receptacle having a horsepower rating not less than 1.4 times the standard AC horsepower rating. The NEMA configuration designation is included for reference. Devices of configurations other than those indicated in the table have horsepower ratings only if such ratings are marked on the device.

HORSEPOWER RATINGS FOR NEMA CONFIGURATION RECEPTACLES

Amps Rating	AC V Rating	No. of Phase	No. of Poles	No. of Wire	NEMA Dsg	HP Rating
15	125	1	2	2	1-15, L1-15	1/2
	125	1	2	3	5-15, L5-15	1/2
	250	1	2	2	2-15	1-1/2#, %
	250	1	2	3	6-15, L6-15	1-1/2#, %
	277	1	2	3	7-15, L7-15	2
	125/250	1	3	4	14-15	1-1/2 L-L#, % 1/2 L-N
	250	3	3	3	11-15, L11-15	2
	250	3	3	4	15-15	2
	120/208	3	4	4	18-15	2
20	125	1	2	3	5-20, L5-20	1
	250	1	2	2	2-20, L2-20	2#, %
	250	1	2	3	6-20, L6-20	2#, %
	277	1	2	3	7-20, L7-20	2
	480	1	2	3	L8-20	3
	125/250	1	3	3	10-20, L10-20	2 L-L#, % 1 L-N
	125/250	1	3	4	14-20, L14-20	2 L-L#, % 1 L-N
	250	3	3	3	11-20, L11-20	3
	250	3	3	4	15-20, L15-20	3
20	480	3	3	3	L12-20	5
	480	3	3	4	L16-20	5
	120/208	3	4	4	18-20, L18-20	2
	120/208	3	4	5	L21-20	2
	277/480	3	4	4	L19-20	5
	277/480	3	4	5	L22-20	5

30	125	1	2	3	5-30, L5-30	2
	250	1	2	2	2-30	2#, %
	250	1	2	3	6-30, L6-30	2#, %
	277	1	2	3	7-30, L7-30	3
	480	1	2	3	L8-30	5
	125/250	1	3	3	10-30, L10-30	2 L-L#, % 2 L-N
	125/250	1	3	4	14-30, L14-30	2 L-L#, % 2 L-N
	250	3	3	3	11-30, L11-30	3
	250	3	3	4	15-30, L15-30	3
	480	3	3	3	L12-30	10
	480	3	3	4	L16-30	10
	120/208	3	4	4	18-30, L18-30	3
	120/208	3	4	5	L21-30	3
	277/480	3	4	4	L19-30	10
	277/480	3	4	5	L22-30	10
50	125	1	2	3	5-50	2
	250	1	2	3	6-50	3#, %
	277	1	2	3	7-50	5
	125/250	1	3	3	10-50	3 L-L#, % 2 L-N
	125/250	1	3	4	14-50	3 L-L#, % 2 L-N
	250	3	3	3	11-50	7-1/2
	250	3	3	4	15-50	7-1/2
	120/208	3	4	4	18-50	7-1/2
60	125/250	1	3		14-60	3 L-L#, % 2 L-N
	250	3	3	4	15-60	10

	120/208	3	4	4	18-60	7-1/2
L-L#: Motor connected line-to-line						
L-N: Motor connected line-to-neutral						
%: Also suitable for 208 V motor applications at the indicated horsepower rating						

For three-phase devices, the horsepower ratings indicated are for three-phase motor loads.

Refer to ANSI/NEMA WD 6 (2002), "Wiring Devices - Dimensional Specifications," for configurations of the NEMA designations.

PRODUCT IDENTITY

One of the following product identities appears on the product:

Attachment Plug

Attachment Plug with Overload Protection

Fuseless Attachment Plug

Plug

Recept.

Receptacle

Other product identities may be used as shown in the individual certifications.

ADDITIONAL INFORMATION

For additional information, see Receptacles (**RTDV**) and Electrical Equipment for Use in Ordinary Locations (**AALZ**).

REQUIREMENTS

The basic standard used to investigate products in this category is **ANSI/UL 498**, "Attachment Plugs and Receptacles."

Where indicated in the individual certifications, receptacles have additionally been investigated to Federal Specification W-C-596, "General Specification for Electrical Power Connectors."

UL MARK

The Certification Mark of UL on the product, or the UL symbol on the product and the Certification Mark on the smallest unit container in which the product is packaged is the only method provided by UL to identify products manufactured under its Certification and Follow-Up Service. The **Certification Mark** for these products includes the UL symbol, the words "CERTIFIED" and "SAFETY," the geographic identifier(s), and a file number.

Receptacles additionally investigated to Federal Specification W-C-596 are identified by the capital letters "F" and "S," each in a wing on either side of the UL symbol. The Federal Specification number "W-C-596F" or "W-C-596G," or the Federal Specification part number (which consists of the appropriate specification sheet and dash number described in the specification) may also be included on the product or on the smallest container in which the product is packaged.

Alternate UL Mark

The Listing Mark of UL on the product, or the UL symbol on the product and the Listing Mark on the smallest unit container in which the product is packaged is the only method provided by UL to identify products manufactured under its Listing and Follow-Up Service. The Listing Mark for these products includes the UL symbol (as illustrated in the Introduction of this Directory) together with the word "LISTED," a control number, and one of the following product names: "Attachment Plug," "Plug," "Receptacle" (or "Recept."), "Attachment Plug with Overload Protection," "Attachment Plug Fuseless," or other appropriate product name as shown in the individual Listings.

Receptacles additionally investigated to Federal Specification W-C-596 are identified by the capital letters "F" and "S," each in a wing on either side of the UL symbol. The Federal Specification number "W-C-596F" or "W-C-596G," or the Federal Specification part number (which consists of the appropriate specification sheet and dash number described in the specification) may also be included on the product or on the smallest container in which the product is packaged.

UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. UL shall not incur any obligation or liability for any loss, expense or damages, including incidental or consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Guide Information.

Last Updated on 2018-03-09

The appearance of a company's name or product in this database does not in itself assure that products so identified have been manufactured under UL's Follow-Up

Service. Only those products bearing the UL Mark should be considered to be Certified and covered under UL's Follow-Up Service. Always look for the Mark on the product.

UL permits the reproduction of the material contained in the Online Certification Directory subject to the following conditions: 1. The Guide Information, Assemblies, Constructions, Designs, Systems, and/or Certifications (files) must be presented in their entirety and in a non-misleading manner, without any manipulation of the data (or drawings). 2. The statement "Reprinted from the Online Certifications Directory with permission from UL" must appear adjacent to the extracted material. In addition, the reprinted material must include a copyright notice in the following format: "© 2018 UL LLC".

[Switches] Snap Switches, WJQR

GENERAL

This category covers general-use snap switches, which are so constructed that they can be installed in flush device boxes or on outlet box covers or otherwise used in connection with wiring systems recognized by ANSI/NFPA 70, "National Electrical Code" (NEC).

Door switches are investigated for use only in combination with a specific switch, special switch box and cover. See Switches, Door ([WLFV](#)).

Flush snap switches investigated for use without separate outlet boxes with nonmetallic-sheathed cable, Types NM, NMC, NM-B and NMC-B cable in accordance with the NEC, are so identified by a specific marking on the carton in which they are packed.

Snap switches have not been investigated for switching a load between two alternate sources of supply. Double-throw enclosed switches (see Switches, Enclosed ([WIAX](#))) or switches certified as transfer switches (see Transfer Switches [[WPTZ](#)] and Emergency Lighting and Power Equipment ([FTBR](#))) should be used for this purpose.

Multi-pole, general-use snap switches have not been investigated for more than single-circuit operation unless marked " 2-circuit" or "3-circuit."

Snap switches without a grounding connection are intended for replacement use only in accordance with NEC 404.9, Exception to (B).

General-use snap switches are classified into two categories: AC-DC general use and AC general use. AC general-use switches are marked "AC" to limit their use to alternating-current circuits. AC-DC general-use switches are not so limited; no such marking is required or generally provided.

AC-DC GENERAL-USE SNAP SWITCHES

The standard amp and voltage ratings for an AC-DC general-use snap switch for controlling direct- or alternating-current circuits are given in Table I. While many of these snap switches will operate successfully on circuits that have some reactance, in general, an inductive load should not exceed one-half (50%) the amp rating of the switch at the voltage involved.

Additional ratings:

- Snap switches marked with horsepower ratings are suitable for the control of a motor in accordance with the specified horsepower and voltage ratings.
- Snap switches suitable for the control of tungsten-filament lamp loads are marked with the letter "T" and are suitable for tungsten-filament lamp load ratings of 125 V or less.

- Snap switches marked with the letter " T" are also suitable for the control of electronic ballast, self-ballasted lamp, compact fluorescent lamp, and LED driver lamp loads up to the marked amp rating of the switch at its rated voltage.

Table I

Snap Switch Ratings in Amps Corresponding to Direct- or Alternating-current Voltage Ratings

125 V	250 V	600 V
—	—	1
3*	1*	—
—	—	2
5*	2*	—
—	—	3
5* or 6*	3*	—
—	5	3
—	—	5
—	5*	—
10*	5*	—
—	10	5
—	—	10
—	10*	—
20*	10*	—
—	20	10
—	—	20
—	20*	—
30**	20	—
40*	20*	—
—	30	20
—	—	30*

—	30*	—
60*	30*	—
—	60	—
* These dual ratings may be assigned only to a three-way, four-way, two-circuit, three-circuit, or a fixture switch.		
** A panelboard switch may be rated at 30 A, 125 V, without the corresponding 250 V rating.		

AC-ONLY GENERAL-USE SNAP SWITCHES

An AC-only general-use snap switch has a marked amp and voltage rating, which is one of the ratings given in Table II. These switches are intended for installation in a flush device box (flush snap switch), mounting on an outlet box covers, or surface mounting (surface snap switch).

AC-only general-use snap switches rated up to 277 V AC are suitable for the control of:

- Resistive loads not exceeding the marked amp and voltage rating of the switch.
- Inductive loads not exceeding the marked amp and voltage rating of the switch.
- Electric discharge lamp loads not exceeding the marked amp and voltage rating of the switch.
- Tungsten-filament lamp loads at 120 V AC up to the full current rating of the switch.
- Electronic ballast, self-ballasted lamp, compact fluorescent lamp, and LED driver lamp loads up to 20 A, but not exceeding the amp rating of the switch at its marked voltage rating.
- Motor loads up to 80% of the amp rating of the switch, but not exceeding 2 hp.

Section 404.14 (D) of the NEC identifies a "Specific Use Snap Switch Rated for 347 Volts." These snap switches are AC general-use snap switches rated 347 V AC. They are suitable for the control of resistive, inductive (including electric discharge lamp) loads up to the full current rating of the switch. They are also suitable for the control of electronic ballast, self-ballasted lamp, compact fluorescent lamp, and LED driver lamp loads up to 20 A but not exceeding the amp rating of the switch at its rated voltage.

Table II

AC Snap Switch Ratings in Amps Corresponding to Alternating-current Voltage Ratings

120 V AC	120 to 277 V AC*	277 V AC	347 V AC
15	15	15	15
20	20	20	20

30	30	30	30
* Switches rated 120 to 277 V AC are acceptable for use on motor circuits up to the amp ratings shown, at any voltage between 120 and 277 V AC.			

Snap switches rated 240 or 250 V that are intended for use on circuits involving a nominal potential to ground of 120 or 125 V, respectively, are tested on such circuits and are marked with the voltage rating "240" or "250" (no underlining). Snap switches rated 240 or 250 V that are suitable for use at full potential to ground are marked with the voltage

rating 240 or 250 (double underlining). Snap switches having voltage ratings other than 240 or 250 V are tested on circuits involving full rated potential to ground.

Terminals of 15 A and 20 A switches not marked "CO/ALR" are intended for use with copper and copper-clad aluminum conductors only. Terminals marked "CO/ALR" are for use with aluminum, copper and copper-clad aluminum conductors.

Terminals of the wire-binding screw, setscrew, or screw-actuated back-wired clamping types are suitable for use with solid building wires unless otherwise indicated either on the device or in the installation instructions.

Terminals of a flush snap switch are permitted for use with certified field-installed crimped-on wire connectors or an assembly, if so identified by the manufacturer.

A flush snap switch may also be provided with conductor leads with factory-installed crimped-on connectors. Such connectors may be either attached to the flush snap switch terminal or are provided with the flush snap switch in the smallest unit shipping container and are suitable for use with the terminal of the flush snap switch.

Screwless terminal connectors of the conductor push-in type (also known as "push-in terminals") are restricted to 15 A branch circuits and are intended for connection with 14 AWG solid copper wire only. They are not intended for use with aluminum or copper-clad aluminum wire, 14 AWG stranded copper wire, or 12 AWG solid or stranded copper wire.

Terminals of switches rated 30 A and above not marked "AL-CU" are intended for use with copper conductors only. Terminals of switches rated 30 A and above marked "AL-CU" are for use with aluminum, copper and copper-clad aluminum conductors.

UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. UL shall not incur any obligation or liability for any loss, expense or damages, including incidental or consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Guide Information.

Last Updated on 2017-06-20

The appearance of a company's name or product in this database does not in itself assure that products so identified have been manufactured under UL's Follow-Up Service. Only those products bearing the UL Mark should be considered to be Certified and covered under UL's Follow-Up Service. Always look for the Mark on the product.

UL permits the reproduction of the material contained in the Online Certification Directory subject to the following conditions: 1. The Guide Information, Assemblies, Constructions, Designs, Systems, and/or Certifications (files) must be presented in their entirety and in a non-misleading manner, without any manipulation of the data (or drawings). 2. The statement "Reprinted from the Online Certifications Directory with permission from UL" must appear adjacent to the extracted material. In addition, the reprinted material must include a copyright notice in the following format: "© 2018 UL LLC".



INVOICE

Bill To :
CommScope Bimetals
Accounts Payable
723 Gardenside Circle
Marietta GA 30067
USA

Ship To :
CommScope Bimetals
Peter Graser
723 Gardenside Circle
Marietta GA 30067
USA

Invoice No. :	1001510639
Invoice Date :	29-Apr-2011
Original Invoice Date :	29-Apr-2011
Intertek Job ID :	US20309-0001802
GIN# :	G100366212
Customer Number :	109655
Payment Terms :	Prepayment before job start
Due Date :	
Client Ref Nos :	Peter Graser
Intertek Quote No. :	500292165

For account questions, please call (713) 543-3600

For billing questions, please call 607-753-6711

Fed ID No. 13-0668365

Remittance by Post :
Intertek Testing Services NA,
Inc.
P.O. Box #405176
Atlanta, GA 30384-5176
USA

Electronic Remittance :
Bank of America
100 West 33rd Street
New York, NY 10001
Swift Code: BOFAUS3N
Bank Id: 111000012
Bank Acct: 3756431629

Reference : Evaluation of Dryer and Range Cords was performed by
Michael Amaro from 03/23/2011 - 04/09/2011.

Report 100366212CRT-001 was issued on 04/20/2011.

Description	Price	Ext Price
UL 817 - Issue:2001/03/16 Ed:11 Rev:2009/10/05 UL Standard for Safety Cord Sets and Power-Supply Cords	5,000.00	5,000.00
UL 858 - Issued:2005/04/12 Ed:15 Rev:2006/04/14 UL Standard for Safety Household Electric Ranges	400.00	400.00

DEPOSIT : -5,400.00

SUBTOTAL : 0.00

TOTAL AMOUNT DUE :	USD	0.00
--------------------	-----	------

** REFERENCE INVOICE NO. ON ALL REMITTANCES ** Thank You for Your Business!



3933 US Route 11
Cortland, NY. 13045

Telephone: 607-753-6711
Facsimile: 607-758-6661
www.intertek-etlsemko.com

April 13, 2011

Mr. Peter Graser
Commscope Inc
723 Gardenside Circle
Marietta, GA 30067 USA

Intertek Test Report: 100366212CRT-001

Dear Peter Graser:

Intertek has completed our testing and evaluation of the Power Cables to the indicated requirements of **UL 817, 11th Ed. 03/16/2001: Cord Sets and Power Supply Cords and UL 858 15th Ed. 04/12/2005 Standard for safety Household Electric Ranges.** The test samples were received on 3/20/2011 in working condition. The evaluation was performed at Intertek, Cortland, NY, on 3/28/2011 through 4/10/2011. The results of these tests are as indicated as follows:

Standard	Clause	Test Completed	Pass / Fail
UL 817	81	Conductor Secureness	Pass
UL 817	82	Security of Blades test	Pass
UL 817	88	Dielectric Voltage-Withstand Test	Pass
UL 817	95	Terminal Blade Pull Force Test	Pass
UL 858	55	Terminal Blade Connection Resistance	Pass

The Power Cables were found to be in compliance with the indicated requirements of **UL 817, 11th Ed. 03/16/2001: Cord Sets and Power Supply Cords and UL 858 15th Ed. 04/12/2005 Standard for safety Household Electric Ranges.** This Test Report concludes the work anticipated for this phase of your project under Intertek quote number 500292165. If there are any questions regarding this report please contact the undersigned at 607-758-6523.

Tested by

Michael Amaro
Engineering Team Leader

Reviewed by

Eric Burns
Project Engineer



Page 1 of 14

This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only the sample tested. This report by itself does not imply that the material, product or service is or has ever been under an Intertek certification program.

Transcribed Test Data

Client: Electrolux Engineer: Mike Amaro 
Job No.: G100366212 Tested By: Christopher Duhan  Date: 04/11/2011
Product: Power Cords 2 models Reviewed By: Eric Burns  Date: _____
Model No.: Power Cables UL 817, 11th Ed. 03/16/2001: Cord Sets and Power
Standard(s): Supply Cords and UL 858 15th Ed. 04/12/2005
Standard for safety Household Electric Ranges
Sample Control Number(s): _____

Tests to be Performed					
Required	Page	Standard	Clause	Test Description	Pass/Fail
NA	1	NA	NA	Report	NA
NA	2	NA	NA	Tests to be Performed	NA
NA	3	NA	NA	Test Equipment	NA
NA	4	NA	NA	Product Photos	NA
(X)	6	UL 817	81	Conductor Secureness	Pass
(X)	7	UL 817	82	Security of Blades test	Pass
(X)	8	UL 817	88	Dielectric Voltage-Withstand Test	Pass
(X)	9	UL 817	95	Terminal Blade Pull Force Test	Pass
(X)	10	UL 858	61	Strain Relief Test	N/A
(X)	11	UL 858	55	Terminal Blade Connection Resistance	Pass



Intertek Test Data Sheets

Page 3 of 14

Transcribed Test Data

Client: Electrolux Engineer: Mike Amaro 
Job No.: G100366212 Tested By: Christopher Duhan  Date: 04/11/2011
Product: Power Cords 2 models Reviewed By: Eric Burns  Date: _____
Model No.: Power Cables UL 817, 11th Ed. 03/16/2001: Cord Sets and Power
Standard(s): Supply Cords and UL 858 15th Ed. 04/12/2005
Sample Control Number(s): _____ Standard for safety Household Electric Ranges

Test Equipment							
#	ITS #	Description	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
1	T1196	Environment Monitor	Control Company	99760-00	72041527	03-16-2011	03-16-2012
2	S200S	Force Gauge	Shimpo	FGE-100	E958H046	09-17-2010	09-17-2011
3	N1280	Digital Calipers	Mitutoyo	CD-S6"	10022885	05-28-2010	05-28-2011
4	V304	Hypot Tester	Associated Research	03670	9331173	03-16-2011	03-16-2012
5	N1024	Stopwatch	Sper Scientific	810032	N1024	08-30-2010	08-30-2011
6	G042S	Ground Impedance Tester	Hypatia	309	0323	09-17-2010	09-17-2011
7	S222S	Scale	Acculab	SV-30	0318AP021	04-30-2010	04-30-2011



Intertek Test Data Sheets

Transcribed Test Data

Client: Electrolux Engineer: Mike Amaro 
Job No.: G100366212 Tested By: Christopher Duhan  Date: 04/11/2011
Product: Power Cords 2 models Reviewed By: Eric Burns  Date: _____
Model No.: Power Cables UL 817, 11th Ed. 03/16/2001: Cord Sets and Power
Standard(s): Supply Cords and UL 858 15th Ed. 04/12/2005
Sample Control Number(s): _____ Standard for safety Household Electric Ranges

Product Photos:

--	--

Transcribed Test Data

Client: Electrolux Engineer: Mike Amaro 
 Job No.: G100366212 Tested By: Christopher Duhan  Date: 04/11/2011
 Product: Power Cords 2 models Reviewed By: Eric Burns  Date: _____
 Model No.: Power Cables UL 817, 11th Ed. 03/16/2001: Cord Sets and Power
 Standard(s): Supply Cords and UL 858 15th Ed. 04/12/2005
Standard for safety Household Electric Ranges
 Sample Control Number(s): _____

Conductor Secureness Test (UL 817, Section 81):

Pass: X Fail: _____

Test Purpose:

To test the samples ability to withstand a pull force when applied to the conductor and element (male pin or female contact).

Test Parameters:

Test Sample:	6 of each
Conductor Size:	
Pull Force:	20lbf
Test Time:	1 minute

Test Results:

Sample	Connection Tested	Results	Pass/Fail
9325-A	Cord	No pullout	Pass
9325-B	Cord	No pullout	Pass
9325-C	Cord	No pullout	Pass
9325-D	Cord	No pullout	Pass
9325-E	Cord	No pullout	Pass
9325-F	Cord	No pullout	Pass
9326-A	Cord	No pullout	Pass
9326-B	Cord	No pullout	Pass
9326-C	Cord	No pullout	Pass
9326-D	Cord	No pullout	Pass
9326-E	Cord	No pullout	Pass
9326-F	Cord	No pullout	Pass

To Comply:

The conductor and element (male pin or female contact) connection shall not separate when a pulling force is applied.

Intertek Comments:

☒	The product complies with all applicable requirements of this test.
☐	The product does not comply with the requirements of this test.
Test Date: 03/31/2011 Tested By: Christopher Duhan	

Environmental Conditions During Testing: Humidity: 25% rh Pressure: 966 hpa Ambient: 22°C

Equipment Used (See page 2 for details):

1	7								
---	---	--	--	--	--	--	--	--	--

Transcribed Test Data

Client: Electrolux Engineer: Mike Amaro
 Job No.: G100366212 Tested By: Christopher Duhan Date: 04/11/2011
 Product: Power Cords 2 models Reviewed By: Eric Burns Date: _____
 Model No.: Power Cables Standard(s): UL 817, 11th Ed. 03/16/2001: Cord Sets and Power Supply Cords and UL 858 15th Ed. 04/12/2005
 Sample Control Number(s): _____

Security of Blades (UL 817, Section 82):

Pass: X Fail: _____

Test Purpose:

To verify the will not displace with specified force applied

Test Parameters:

Pull Force:	20lbf
Pull Force Direction:	Perpendicular to the plane of the cord entry hole.
Sample	6 of each cord type
Test Time:	2 minute
	To determine that an attachment plug or current tap complies with 82.1, the fitting is to be wired in the intended manner and then supported on a horizontal steel plate with the blades or pins, or both, projecting downward through a single hole sufficiently just large enough to permit the blades or pins, or both, to pass through it. A weight that exerts 20 lbf (89 N) is to be supported by each blade or pin in succession no more than 2.4mm displacement allowed.

Test Results:

Sample	Pin/Blade tested	Force applied	Duration	Displacement	Pass/Fail
9325-A	L1	20.76 lbs	2 minutes	None	Pass
	L2	20.76 lbs	2 minutes	None	Pass
	L3	20.76 lbs	2 minutes	None	Pass
	GND	20.76 lbs	2 minutes	None	Pass
9325-B	L1	20.76 lbs	2 minutes	None	Pass
	L2	20.76 lbs	2 minutes	None	Pass
	L3	20.76 lbs	2 minutes	None	Pass
	GND	20.76 lbs	2 minutes	None	Pass
9325-C	L1	20.76 lbs	2 minutes	None	Pass
	L2	20.76 lbs	2 minutes	None	Pass
	L3	20.76 lbs	2 minutes	None	Pass
	GND	20.76 lbs	2 minutes	None	Pass
9325-D	L1	20.76 lbs	2 minutes	None	Pass
	L2	20.76 lbs	2 minutes	None	Pass
	L3	20.76 lbs	2 minutes	None	Pass
	GND	20.76 lbs	2 minutes	None	Pass
9325-E	L1	20.76 lbs	2 minutes	None	Pass
	L2	20.76 lbs	2 minutes	None	Pass
	L3	20.76 lbs	2 minutes	None	Pass
	GND	20.76 lbs	2 minutes	None	Pass
9326-F	L1	20.76 lbs	2 minutes	None	Pass
	L2	20.76 lbs	2 minutes	None	Pass
	L3	20.76 lbs	2 minutes	None	Pass
	GND	20.76 lbs	2 minutes	None	Pass

Environmental Conditions During Testing: Humidity: 25% rh Pressure: 960 hpa Ambient: 21°C

Equipment Used (See page 2 for details): 1 3 5 7 _____

Transcribed Test Data

Client: Electrolux Engineer: Mike Amaro 
Job No.: G100366212 Tested By: Christopher Duhan  Date: 04/11/2011
Product: Power Cords 2 models Reviewed By: Eric Burns  Date: _____
Model No.: Power Cables UL 817, 11th Ed. 03/16/2001: Cord Sets and Power Supply Cords and UL 858 15th Ed. 04/12/2005
Standard(s): Standard for safety Household Electric Ranges
Sample Control Number(s): _____

Test Results:					
Sample	Pin/Blade tested	Force applied	Duration	Displacement	Pass/Fail
9326-A	L1	20.76 lbs	2 minutes	None	Pass
	L2	20.76 lbs	2 minutes	None	Pass
	L3	20.76 lbs	2 minutes	None	Pass
	GND	20.76 lbs	2 minutes	None	Pass
9326-B	L1	20.76 lbs	2 minutes	None	Pass
	L2	20.76 lbs	2 minutes	None	Pass
	L3	20.76 lbs	2 minutes	None	Pass
	GND	20.76 lbs	2 minutes	None	Pass
9326-C	L1	20.76 lbs	2 minutes	None	Pass
	L2	20.76 lbs	2 minutes	None	Pass
	L3	20.76 lbs	2 minutes	None	Pass
	GND	20.76 lbs	2 minutes	None	Pass
9326-D	L1	20.76 lbs	2 minutes	None	Pass
	L2	20.76 lbs	2 minutes	None	Pass
	L3	20.76 lbs	2 minutes	None	Pass
	GND	20.76 lbs	2 minutes	None	Pass
9326-E	L1	20.76 lbs	2 minutes	None	Pass
	L2	20.76 lbs	2 minutes	None	Pass
	L3	20.76 lbs	2 minutes	None	Pass
	GND	20.76 lbs	2 minutes	None	Pass
9326-F	L1	20.76 lbs	2 minutes	None	Pass
	L2	20.76 lbs	2 minutes	None	Pass
	L3	20.76 lbs	2 minutes	None	Pass
	GND	20.76 lbs	2 minutes	None	Pass

To Comply:

The blade cannot displace more than 2.4mm

Intertek Comments:

X The product complies with all applicable requirements of this test.

The product does not comply with the requirements of this test.

Test Date: 04/05-04/07/2011 Tested By: Christopher Duhan

Environmental Conditions During Testing: Humidity: 25% rh Pressure: 960 hpa Ambient: 21°C

Equipment Used (See page 2 for details): 1 3 5 7

Transcribed Test Data

Client: Electrolux Engineer: Mike Amaro
 Job No.: G100366212 Tested By: Christopher Duhan Date: 04/11/2011
 Product: Power Cords 2 models Reviewed By: Eric Burns Date: _____
 Model No.: Power Cables Standard(s): UL 817, 11th Ed. 03/16/2001: Cord Sets and Power Supply Cords and UL 858 15th Ed. 04/12/2005
 Sample Control Number(s): _____

Dielectric Voltage Withstand Test (UL 817, Section 88):
Pass: X **Fail:** _____

Test Purpose:			
To test the product’s ability to withstand, without breakdown, the application of a high voltage shock.			
Test Parameters:			
Test Voltage:	1480		
Test Frequency:	60HZ		
Test Time:	1 minute		
Test Results:			
Sample	Area Tested	Results	Pass/Fail
9325-A	L1-L2	No breakdown	Pass
	L1-L3	No breakdown	Pass
	L1-Gnd	No breakdown	Pass
	L2-L3	No breakdown	Pass
	L2-Gnd	No breakdown	Pass
	L3-Gnd	No breakdown	Pass
9325-B	L1-L2	No breakdown	Pass
	L1-L3	No breakdown	Pass
	L1-Gnd	No breakdown	Pass
	L2-L3	No breakdown	Pass
	L2-Gnd	No breakdown	Pass
	L3-Gnd	No breakdown	Pass
9325-C	L1-L2	No breakdown	Pass
	L1-L3	No breakdown	Pass
	L1-Gnd	No breakdown	Pass
	L2-L3	No breakdown	Pass
	L2-Gnd	No breakdown	Pass
	L3-Gnd	No breakdown	Pass
9325-D	L1-L2	No breakdown	Pass
	L1-L3	No breakdown	Pass
	L1-Gnd	No breakdown	Pass
	L2-L3	No breakdown	Pass
	L2-Gnd	No breakdown	Pass
	L3-Gnd	No breakdown	Pass
9325-E	L1-L2	No breakdown	Pass
	L1-L3	No breakdown	Pass
	L1-Gnd	No breakdown	Pass
	L2-L3	No breakdown	Pass
	L2-Gnd	No breakdown	Pass
	L3-Gnd	No breakdown	Pass
9325-F	L1-L2	No breakdown	Pass
	L1-L3	No breakdown	Pass
	L1-Gnd	No breakdown	Pass
	L2-L3	No breakdown	Pass
	L2-Gnd	No breakdown	Pass

Environmental Conditions During Testing: Humidity: 25% rh Pressure: 966 hpa Ambient: 22°C

Equipment Used (See page 2 for details): 1 4 _____

Transcribed Test Data

Client: Electrolux Engineer: Mike Amaro 
Job No.: G100366212 Tested By: Christopher Duhan  Date: 04/11/2011
Product: Power Cords 2 models Reviewed By: Eric Burns  Date: _____
Model No.: Power Cables Standard(s): **UL 817, 11th Ed. 03/16/2001: Cord Sets and Power Supply Cords and UL 858 15th Ed. 04/12/2005**
Sample Control Number(s): _____

	L3-Gnd	No breakdown	Pass
Test Results:			
Sample	Area Tested	Results	Pass/Fail
9326-A	L1-L2	No breakdown	Pass
	L1-L3	No breakdown	Pass
	L1-Gnd	No breakdown	Pass
	L2-L3	No breakdown	Pass
	L2-Gnd	No breakdown	Pass
	L3-Gnd	No breakdown	Pass
9326-B	L1-L2	No breakdown	Pass
	L1-L3	No breakdown	Pass
	L1-Gnd	No breakdown	Pass
	L2-L3	No breakdown	Pass
	L2-Gnd	No breakdown	Pass
	L3-Gnd	No breakdown	Pass
9326-C	L1-L2	No breakdown	Pass
	L1-L3	No breakdown	Pass
	L1-Gnd	No breakdown	Pass
	L2-L3	No breakdown	Pass
	L2-Gnd	No breakdown	Pass
	L3-Gnd	No breakdown	Pass
9326-D	L1-L2	No breakdown	Pass
	L1-L3	No breakdown	Pass
	L1-Gnd	No breakdown	Pass
	L2-L3	No breakdown	Pass
	L2-Gnd	No breakdown	Pass
	L3-Gnd	No breakdown	Pass
9326-E	L1-L2	No breakdown	Pass
	L1-L3	No breakdown	Pass
	L1-Gnd	No breakdown	Pass
	L2-L3	No breakdown	Pass
	L2-Gnd	No breakdown	Pass
	L3-Gnd	No breakdown	Pass
9326-F	L1-L2	No breakdown	Pass
	L1-L3	No breakdown	Pass
	L1-Gnd	No breakdown	Pass
	L2-L3	No breakdown	Pass
	L2-Gnd	No breakdown	Pass
	L3-Gnd	No breakdown	Pass

To Comply:

There shall be no breakdown.

Intertek Comments:

☒ The product complies with all applicable requirements of this test.

☐ The product does not comply with the requirements of this test.

Environmental Conditions During Testing: Humidity: 25% rh Pressure: 966 hpa Ambient: 22°C

Equipment Used (See page 2 for details):

1	4								
---	---	--	--	--	--	--	--	--	--



Transcribed Test Data

Client:Electrolux

Job No.:G100366212

Product:Power Cords 2 models

Model No.:Power Cables

Sample Control Number(s):

Engineer:Mike Amaro

Tested By:Christopher Duhan

Reviewed By:Eric Burns

Standard(s):

UL 817, 11th Ed. 03/16/2001: Cord Sets and Power Supply Cords and UL 858 15th Ed. 04/12/2005

Standard for safety Household Electric Ranges

Date: 04/11/2011

Date:

Test Date: 03/31/2011

Tested By: Christopher Duhan

Environmental Conditions During Testing:

Humidity:25% rh

Pressure:966 hpa

Ambient:22°C

Equipment Used (See page 2 for details):

1

4

Transcribed Test Data

Client: Electrolux Engineer: Mike Amaro
 Job No.: G100366212 Tested By: Christopher Duhan Date: 04/11/2011
 Product: Power Cords 2 models Reviewed By: Eric Burns Date: _____
 Model No.: Power Cables Standard(s): UL 817, 11th Ed. 03/16/2001: Cord Sets and Power Supply Cords and UL 858 15th Ed. 04/12/2005
 Sample Control Number(s): _____

Terminal Blade Pull Force (UL 817, Section 95):

Pass: X Fail: _____

Test Purpose:

To determine that the blade are mounted securely when heated.

Test Parameters:

Each of six representative attachment plugs or current taps molded to a length of cord no more than 6 inches (152.4 mm) long is to have a line scribed on both sides and both edges of the blades to indicate the point where the blade enters the device body. Each attachment plug or current tap is then to be securely mounted so that the line blades are positioned downward through a circular hole (diameter just large enough to allow the line blades and any grounding pin to pass through) in a 1/4 inch (6.4 mm) thick steel plate mounted horizontally within an air circulating oven that has been heated to 60°C (140°F). After the fittings have been positioned, a weight that exerts 10 lbf (44.5 N) is to be attached to each of the individual line blades. The oven is then to be maintained at 60°C (140°F) for 4 hours after which the weights are to be removed and the attachment plugs or current taps taken from the oven and allowed to cool to room temperature. The displacement of the blades from their original position shall then be determined as described in 95.4.

Temperature 60C

The distance from the scribed lines, on each of the sides and both edges of the blades, to the face is to be measured after the thermal conditioning. The average of the four measurements for each blade shall be used to determine compliance with the 1/16 inch (1.6 mm) maximum displacement requirement.

Test Results:

Sample	Blade/Pin	Force Applied	Duration	Direction of Pull	Distance Displaced	Pass/Fail
9325-A	L1	10.77 lbs	4 hours	Down	No displacement	Pass
	L2	10.65 lbs	4 hours	Down	No displacement	Pass
	L3	10.66 lbs	4 hours	Down	No displacement	Pass
	Gnd	10.51 lbs	4 hours	Down	No displacement	Pass
9325-B	L1	10.77 lbs	4 hours	Down	No displacement	Pass
	L2	10.65 lbs	4 hours	Down	No displacement	Pass
	L3	10.66 lbs	4 hours	Down	No displacement	Pass
	Gnd	10.51 lbs	4 hours	Down	No displacement	Pass
9325-C	L1	10.77 lbs	4 hours	Down	No displacement	Pass
	L2	10.65 lbs	4 hours	Down	No displacement	Pass
	L3	10.66 lbs	4 hours	Down	No displacement	Pass
	Gnd	10.51 lbs	4 hours	Down	No displacement	Pass
9325-D	L1	10.77 lbs	4 hours	Down	No displacement	Pass
	L2	10.65 lbs	4 hours	Down	No displacement	Pass
	L3	10.66 lbs	4 hours	Down	No displacement	Pass
	Gnd	10.51 lbs	4 hours	Down	No displacement	Pass
9325-E	L1	10.77 lbs	4 hours	Down	No displacement	Pass
	L2	10.65 lbs	4 hours	Down	No displacement	Pass
	L3	10.66 lbs	4 hours	Down	No displacement	Pass
	Gnd	10.51 lbs	4 hours	Down	No displacement	Pass
9325-F	L1	10.77 lbs	4 hours	Down	No displacement	Pass
	L2	10.65 lbs	4 hours	Down	No displacement	Pass

Environmental Conditions During Testing: Humidity: 39% rh Pressure: 957 hpa Ambient: 60°C

Equipment Used (See page 2 for details): 1 3 5 7 _____

Transcribed Test Data

Client: Electrolux Engineer: Mike Amaro
Job No.: G100366212 Tested By: Christopher Duhan Date: 04/11/2011
Product: Power Cords 2 models Reviewed By: Eric Burns Date: _____
Model No.: Power Cables Standard(s): UL 817, 11th Ed. 03/16/2001: Cord Sets and Power Supply Cords and UL 858 15th Ed. 04/12/2005
Sample Control Number(s): _____

	L3	10.66 lbs	4 hours	Down	No displacement	Pass
	Gnd	10.51 lbs	4 hours	Down	No displacement	Pass
Test Results:						
Sample	Blade/Pin	Force Applied	Duration	Direction of Pull	Distance Displaced	Pass/Fail
9326-A	L1	10.77 lbs	4 hours	Down	No displacement	Pass
	L2	10.65 lbs	4 hours	Down	No displacement	Pass
	L3	10.66 lbs	4 hours	Down	No displacement	Pass
	Gnd	10.51 lbs	4 hours	Down	No displacement	Pass
9326-B	L1	10.77 lbs	4 hours	Down	No displacement	Pass
	L2	10.65 lbs	4 hours	Down	No displacement	Pass
	L3	10.66 lbs	4 hours	Down	No displacement	Pass
	Gnd	10.51 lbs	4 hours	Down	No displacement	Pass
9326-C	L1	10.77 lbs	4 hours	Down	No displacement	Pass
	L2	10.65 lbs	4 hours	Down	No displacement	Pass
	L3	10.66 lbs	4 hours	Down	No displacement	Pass
	Gnd	10.51 lbs	4 hours	Down	No displacement	Pass
9326-D	L1	10.77 lbs	4 hours	Down	No displacement	Pass
	L2	10.65 lbs	4 hours	Down	No displacement	Pass
	L3	10.66 lbs	4 hours	Down	No displacement	Pass
	Gnd	10.51 lbs	4 hours	Down	No displacement	Pass
9326-E	L1	10.77 lbs	4 hours	Down	No displacement	Pass
	L2	10.65 lbs	4 hours	Down	No displacement	Pass
	L3	10.66 lbs	4 hours	Down	No displacement	Pass
	Gnd	10.51 lbs	4 hours	Down	No displacement	Pass
9326-F	L1	10.77 lbs	4 hours	Down	No displacement	Pass
	L2	10.65 lbs	4 hours	Down	No displacement	Pass
	L3	10.66 lbs	4 hours	Down	No displacement	Pass
	Gnd	10.51 lbs	4 hours	Down	No displacement	Pass

To Comply:

The blade shall not displace more than 1/16 of an inch.

Intertek Comments:

X The product complies with all applicable requirements of this test.

The product does not comply with the requirements of this test.

Test Date: 04/07-04/12

Tested By: Christopher Duhan

Environmental Conditions During Testing: Humidity: 39% rh Pressure: 957 hpa Ambient: 60°C

Equipment Used (See page 2 for details): 1 3 5 7

Transcribed Test Data

Client: Electrolux Engineer: Mike Amaro 
Job No.: G100366212 Tested By: Christopher Duhan  Date: 04/11/2011
Product: Power Cords 2 models Reviewed By: Eric Burns  Date: _____
Model No.: Power Cables UL 817, 11th Ed. 03/16/2001: Cord Sets and Power Supply Cords and UL 858 15th Ed. 04/12/2005
Standard(s): Standard for safety Household Electric Ranges
Sample Control Number(s): _____

Strain Relief Test (UL 858, Section 61):

Pass: _____ Fail: _____

Test Purpose:

To test the construction of the strain relief of a cord fitting.

Test Parameters:

Pull Force:	
Pull Force Direction:	Perpendicular to the plane of the cord entry hole.
Means of Pull Force:	Apply weights to create the pull force
Test Time:	1 minute

Test Results:

Sample	Results	Pass/Fail
9325-A		
9325-B		
9325-C		
9325-D		
9325-E		
9325-F		
9326-A		
9326-B		
9326-C		
9326-D		
9326-E		
9326-F		

To Comply:

A pull exerted on a cord shall not be transmitted directly to the terminals of a fitting.

Intertek Comments:

☐	The product complies with all applicable requirements of this test.
☐	The product does not comply with the requirements of this test.
Test Date:	Tested By:

Environmental Conditions During Testing: _____ Humidity: 25% rh Ambient: 22°C

Equipment Used (See page 2 for details):

1	7								
---	---	--	--	--	--	--	--	--	--

Transcribed Test Data

Client: Electrolux Engineer: Mike Amaro 
 Job No.: G100366212 Tested By: Christopher Duhan  Date: 04/11/2011
 Product: Power Cords 2 models Reviewed By: Eric Burns  Date: _____
 Model No.: Power Cables UL 817, 11th Ed. 03/16/2001: Cord Sets and Power Supply Cords and UL 858 15th Ed. 04/12/2005
 Standard(s): Standard for safety Household Electric Ranges
 Sample Control Number(s): _____

Terminal Blade Connection Resistance (UL 858, Section 55):

Pass: X Fail: _____

Test Purpose:

Verify the resistance at of the cord does not exceed 25mohms on each line

Test Parameters:

Sample qty	6 of each conductor
Max Resistance	25mOhms

Test Results:

Resistance Measured

Sample	L1	L2	L3	GND	Max allowed	Pass/Fail
9325-A	9.57	8.40	7.92	8.42	25mohms	Pass
9325-B	7.96	8.57	7.00	9.25	25mohms	Pass
9325-C	7.87	9.74	6.71	8.09	25mohms	Pass
9325-D	8.53	8.92	8.29	9.61	25mohms	Pass
9325-E	8.04	8.37	8.99	7.86	25mohms	Pass
9325-F	9.58	9.00	9.57	9.21	25mohms	Pass
9326-A	4.47	4.82	4.55	7.77	25mohms	Pass
9326-B	4.43	5.97	4.67	7.50	25mohms	Pass
9326-C	4.37	7.61	6.15	6.04	25mohms	Pass
9326-D	5.59	7.13	4.35	5.96	25mohms	Pass
9326-E	4.70	7.03	4.34	5.95	25mohms	Pass
9326-F	4.56	8.10	5.90	8.76	25mohms	Pass

To Comply:

No line shall have a resistance over 25mOhms

Intertek Comments:

X The product complies with all applicable requirements of this test.

_____ The product does not comply with the requirements of this test.

Test Date: 03/31/2011 Tested By: Christopher Duhan

Environmental Conditions During Testing: _____ Humidity: 25% rh Ambient: 22°C

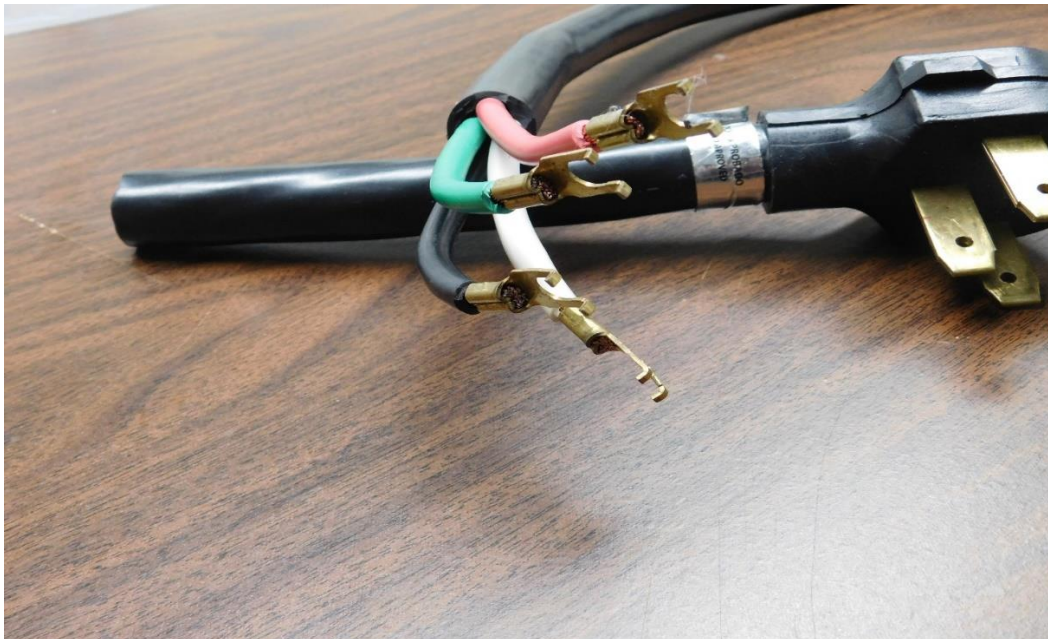
Equipment Used (See page 2 for details): 1 7 _____

2011 ETL Testing: Cu-Clad Cordage Tested By INTERTEK Per UL 817



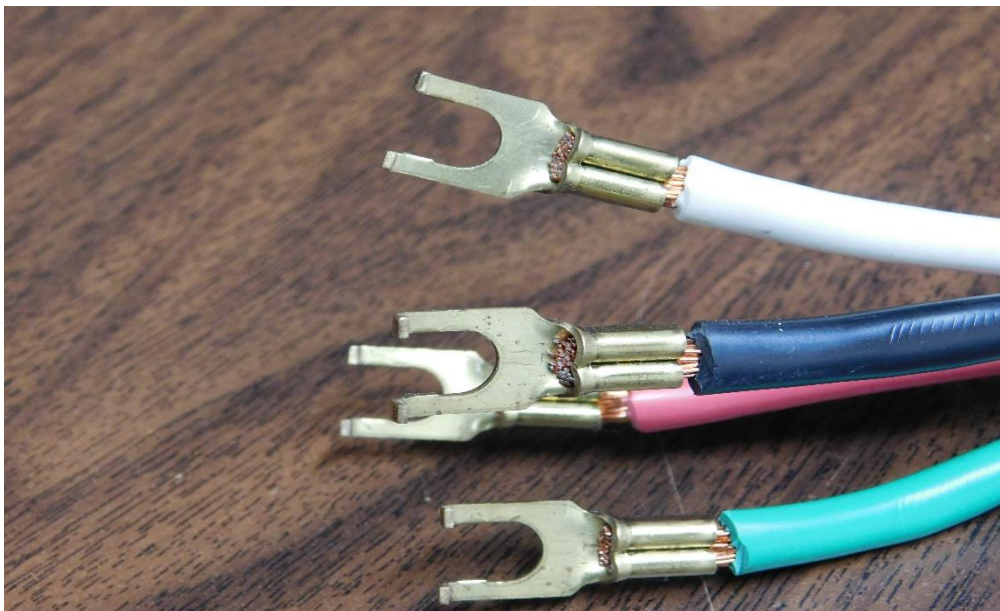
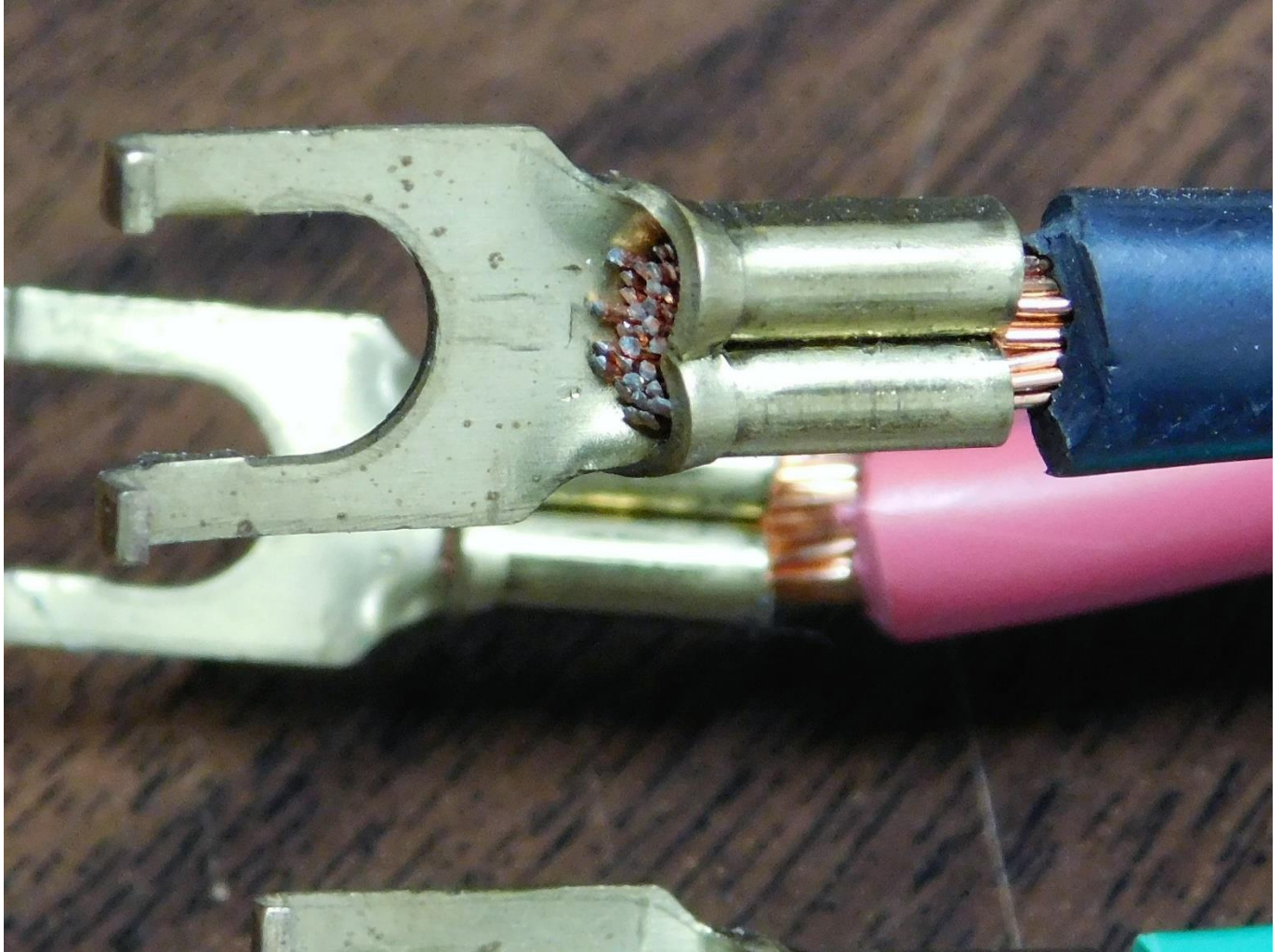
Appearance of
Cord Terminals
in August 2018

After 87 Consecutive Months of Connection to Brass Crimp Terminals, CCA Wire Samples Show Zero Galvanic Corrosion or loosening due to Atmospheric Conditions



Galvanic Corrosion is Not Evident between Brass and CCA Because the Two Metals are Not Dissimilar

2011 ETL Testing: Cu-Clad Cordage Tested By INTERTEK Per UL 817



Appearance of
Cord Terminals
in August 2018
after 87
Consecutive
Months of
Connection:
Zero Galvanic
Corrosion
Because CCA
and Brass are
not dissimilar



This certificate is granted and awarded by the authority of the Nadcap Management Council to:

Westmoreland Mechanical Testing and Research, Inc.

*221 Westmoreland Drive
Youngstown, PA 15696
United States*

This certificate demonstrates conformance and recognition of accreditation for specific services, as listed in www.eAuditNet.com on the Qualified Manufacturers List (QML), to the revision in effect at the time of the audit for:

Materials Testing

Certificate Number: 3445178573
Expiration Date: 30 April 2020

*Joseph G. Pinto
Executive Vice President and Chief Operating Officer*



SCOPE OF ACCREDITATION

Materials Testing

Westmoreland Mechanical Testing and Research, Inc.
221 Westmoreland Drive
Youngstown, PA 15696

This certificate expiration is updated based on periodic audits. The current expiration date and scope of accreditation are listed at: www.eAuditNet.com - Online QML (Qualified Manufacturer Listing).

In recognition of the successful completion of the PRI evaluation process, accreditation is granted to this facility to perform the following:

AC7101/1 Rev F - Nadcap Audit Criteria for Materials Testing Laboratories – General Requirements for All Laboratories (to be used on/after 14 Sept 2014)

AC7101/2 Rev D - Nadcap Audit Criteria for Materials Test Laboratories – Chemical Analysis (to be used on audits on/after 22 March 2015)

(F) Atomic or Optical Emission Spectroscopy (AES or OES)

(F2) Atomic Emission Spectroscopy – Inductively Coupled Plasma (ICP–OES/AES)

(F3) Atomic Emission Spectroscopy – Spark/Arc (S/A–OES)

(G) Elemental Analysis (Combustion or Fusion)

(G1) – Carbon

(G2) – Hydrogen

(G3) – Nitrogen

(G4) – Oxygen

(G5) – Sulfur

(V) Mass Spectrometry

(W) Atomic Absorption

(W2) Graphite Furnace (GFAA)

Specify the Alloy Base for Accreditation

Al Base

Co Base

Cu Base

Fe Base

Ni Base

Ti Base

**AC7101/3 Rev C - Nadcap Audit Criteria for Materials Test Laboratories – Mechanical Testing
(to be used on/after 28 August, 2011)**

- (A) Room Temperature Tensile
- (A1) Room Temperature Tensile with Elastic (Young's) Modulus
- (B) Elevated Temperature Tensile
- (C) Stress Rupture
- (CT) Compression Testing
- (KR) Curve (Resistance to Fracture) Testing
- (N) Impact
- (O) High Cycle Fatigue
- (P) Fracture Toughness
- (XA) Creep
- (XE) Crack Propagation/Crack Growth Testing
- (XN) Bend Testing
- (Y) Low Cycle Fatigue

**AC7101/4 Rev F - Nadcap Audit Criteria for Materials Test Laboratories – Metallography and
Microindentation Hardness (to be used on/after 14 August, 2016)**

- (L0) Metallographic Evaluation
- (L1) Microindentation (Interior)
- (L10) Near Surface Examinations – Carburization / Decarburization
- (L11) Grain Size
- (L2) Near Surface Examinations – Alloy Depletion
- (L3) Near Surface Examinations – Oxidation/Corrosion
- (L4) Near Surface Examinations – Casting (Mold) Reactions Layers
- (L5) Near Surface Examinations – Microindentation (Surface–Case Depth)
- (L6) Near Surface Examinations – Nitriding
- (L7) Near Surface Examinations – IGA, IGO
- (L8) Near Surface Examinations – Alpha Case: Wrought Titanium
- (L9) Near Surface Examinations – Alpha Case: Cast Titanium
- (XL) Macro Examination

**AC7101/5 Rev D - Nadcap Audit Criteria for Materials Test Laboratories – Hardness Testing
(Macro) (to be used on audits on/after 22 March 2015)**

- (M1) Brinell Hardness
- (M2) Rockwell Hardness
- (M3) Vickers Hardness

**AC7101/6 Rev C - Nadcap Audit Criteria for Materials Test Laboratories – Corrosion (to be
used on/after 28 August, 2011)**

- (Q) Corrosion (General)

(Q1) Stress Corrosion

AC7101/7 Rev D - Nadcap Audit Criteria for Materials Test Laboratories – Mechanical Testing Specimen Preparation (to be used on audits on/after 15 May 2016)

(Z) Standard Specimen Machining

(Z1) Low Stress Grinding

(Z2) Low Stress Grinding and Polishing

(Z3) Cast Specimens

(Z4) Special Preparation

AC7101/9 Rev B - Nadcap Audit Criteria for Materials Test Laboratories – Specimen Heat Treating (to be used on/after 28 August, 2011 and before 15 January 2017)

AC7101/11 Rev C - Nadcap Audit Criteria for Materials Test Laboratories – Fastener Testing (to be used on audits on/after 25 October 2015)

(10) Stress Rupture

(11) Fatigue

(13) Shear Strength – Double Shear

(14) Stress Durability – Internal Threads

(15) Torque – TensionAxial

(18) Tensile Test – Elevated TempTensile

(40L10) Metallography – Decarburization / Carburization

(40L2) Metallography – Alloy Depletion

(40L25) Metallography – Grain Size

(40L3) Metallography – Oxidation / Corrosion

(40L7) Metallography – IGA / IGO

(40L8) Metallography –Alpha Case: Wrought Titanium

(5) Stress Durability – External Threads

(6–L5) Hardness – Microindentation Hardness

(6–M2) Hardness – Rockwell

(6–M3) Hardness – Vickers

(8–A) Tensile Test – Axial Tensile

(8–P) Tensile Test – Proof Load (nuts / screws)

(8–W) Tensile Test – Wedge Tensile

(Q) Corrosion – Salt Spray

(QF) Corrosion – Copper Sulfate

ISO/IEC - Currently accredited by an ILAC approved source

Lab Type - Lab Type

Independent



This certificate is granted and awarded by the authority of the Nadcap Management Council to:

Westmoreland Mechanical Testing and Research, Inc.

*14 Bayhill Drive
Latrobe, PA 15650
United States*

This certificate demonstrates conformance and recognition of accreditation for specific services, as listed in www.eAuditNet.com on the Qualified Manufacturers List (QML), to the revision in effect at the time of the audit for:

Materials Testing

Certificate Number: 11237178572
Expiration Date: 30 April 2020

*Joseph G. Pinto
Executive Vice President and Chief Operating Officer*



SCOPE OF ACCREDITATION

Materials Testing

Westmoreland Mechanical Testing and Research, Inc.

14 Bayhill Drive
Latrobe, PA 15650

This certificate expiration is updated based on periodic audits. The current expiration date and scope of accreditation are listed at: www.eAuditNet.com - Online QML (Qualified Manufacturer Listing).

In recognition of the successful completion of the PRI evaluation process, accreditation is granted to this facility to perform the following:

AC7101/1 Rev F - Nadcap Audit Criteria for Materials Testing Laboratories – General Requirements for All Laboratories (to be used on/after 14 Sept 2014)

AC7101/3 Rev C - Nadcap Audit Criteria for Materials Test Laboratories – Mechanical Testing (to be used on/after 28 August, 2011)

(C) Stress Rupture

(XA) Creep

AC7101/7 Rev D - Nadcap Audit Criteria for Materials Test Laboratories – Mechanical Testing Specimen Preparation (to be used on audits on/after 15 May 2016)

(Z) Standard Specimen Machining

(Z1) Low Stress Grinding

AC7101/9 Rev C - Nadcap Audit Criteria for Materials Test Laboratories – Specimen Heat Treating (to be used on/after 15 January 2017)

ISO/IEC - Currently accredited by an ILAC approved source

Lab Type - Lab Type

Independent

TEST LETTER REPORT

Copperweld Bimetallics, LLC Test Report

SCOPE OF WORK

PERFORMANCE TESTING – PRODUCT TYPE PER STANDARD

REPORT NUMBER

103589128CRT-001A

ISSUE DATE

[REVISED DATE]

27-Aug-2018

28-Aug-2018

PAGES

14

This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.

TEST LETTER REPORT

27-Aug-2018

Intertek Report No.: 103589128CRT-001A

Intertek Project No.: G103589128

Mr. Peter Graser
Copperweld Bimetallics, LLC
215 Centerview Drive
Suite 360
Brentwood, TN 37027

Ph: (770) 952-6445
email: pgraser@copperweld.com

Subject: Static Heating test of Push-in Wire Connectors on CCA Conductors in accordance with
Claus 9.12 Spring-action sequence per UL 486C.

Dear Mr. Peter Graser,

This letter report represents the results to-date of our evaluation of the above referenced
product(s) to the requirements contained in the following standard:

UL 486C / CSA C22.2 No. 188-18 – Splicing Wire Connectors, Seventh Edition, Dated
January 26, 2018

SECTION 1 **SUMMARY**

This investigation was authorized by signed proposal number Qu-00894894, dated 29-June-
2018. A production sample was received on 26-June-2018 and tested from 23-Jul-2018 to 27-
Aug-2018 at the Intertek Cortland facility.

TEST LETTER REPORT

SECTION 2 TESTING

Below is a summary of the tests and results for the entire test period. The test data appears at the end of this report in the Appendix.

Performance testing was carried out in accordance with UL486C, Clause 9.12 Spring-action sequence.

Three test circuits were built in the sizes 14AWG, 12AWG, and 10AWG, each circuit containing Copperweld CCA THHN wire and 3 three specimens each of push-in wire connectors manufactured by Ideal, Wago, and Gardner and Bender, as available. This setup is a deviation from the standard which requires connectors to be tested separately on individual circuits.

Test currents (20A for 14AWG, 30A for 12AWG and 50A for 10AWG) were selected in accordance with client request rather than per Table 6 static heating columns in UL486C, and additional setup criteria indicated in Clause 9.1 of UL486C will not be used. Test currents were monitored periodically with a clamp style meter.

Ambient thermocouples were placed at least two feet out from the connectors under test, and approximately 3 feet apart, the number of ambient thermocouples is reduced due to the size of the apparatus.

Connector thermocouples are placed on the input and output side of each connector with a reference conductor between each set of three connectors.

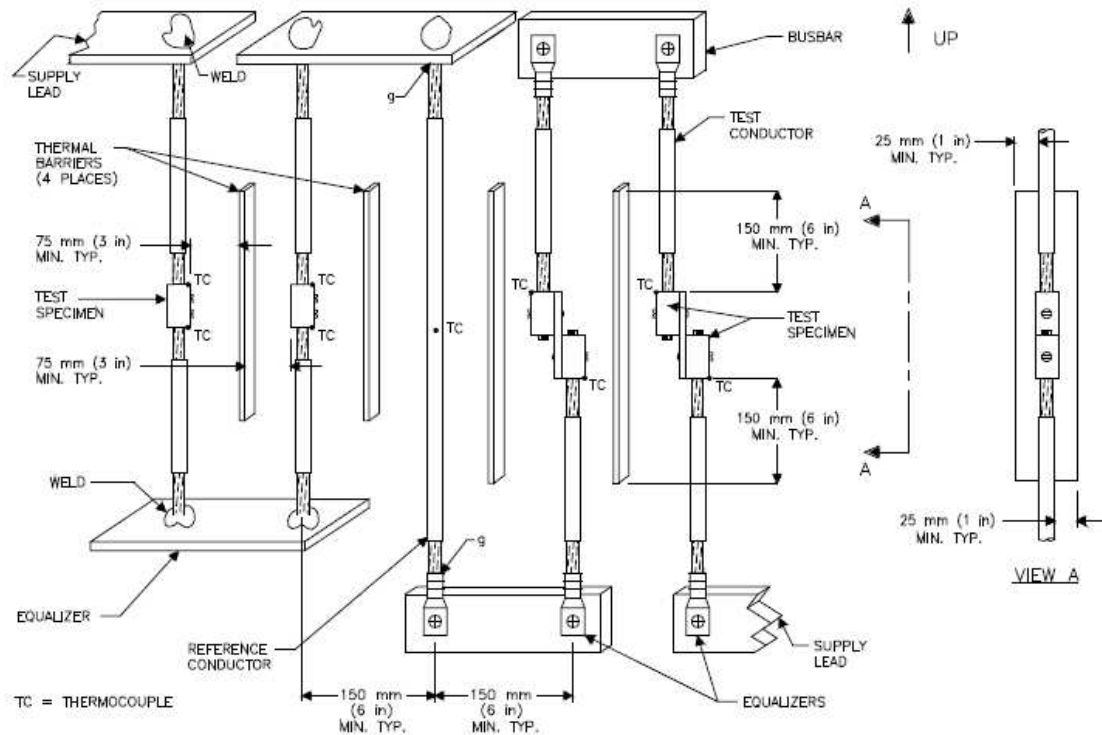
The apparatus is set up in complete compliance with Figure 2 on the next page, no other deviations from the standard were made.

Calibration Information:

Item #	Equipment Type	Asset #	Calibration Due
1	Fluke 365 True RMS Clamp Meter	M262	04/06/2019
2	Fluke Hydra Temperature Recorder	T1152	04/20/2019
3	Fluke Hydra Temperature Recorder	U080	07/16/2019
4	Fluke Hydra Temperature Recorder	T834S	02/13/2019
5	Fluke Hydra Temperature Recorder	T1565	09/27/2018

TEST LETTER REPORT

Figure 2
Vertical arrangement of specimen for current-cycling test
(Clause 9.1.10.7)



TEST LETTER REPORT

SECTION 3 PHOTOGRAPHS

10AWG Wire with IDEAL and WAGO connectors

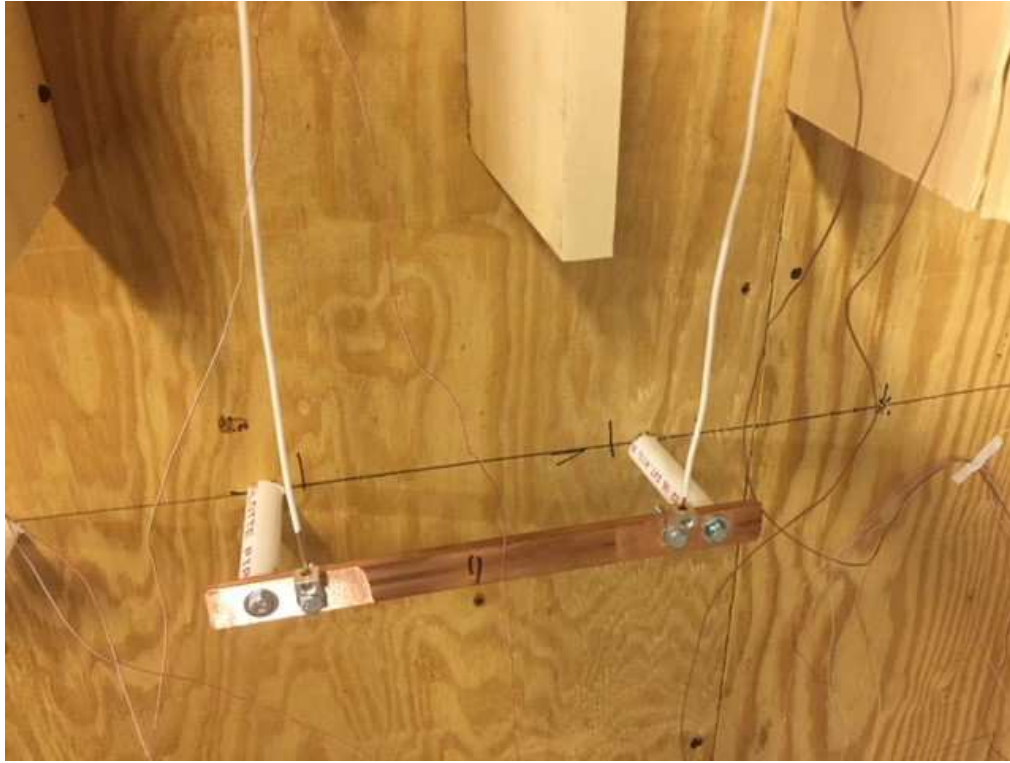


Complete Setup with 12 AWG Wire and Ideal, Wago, Gardner and Bender Connectors

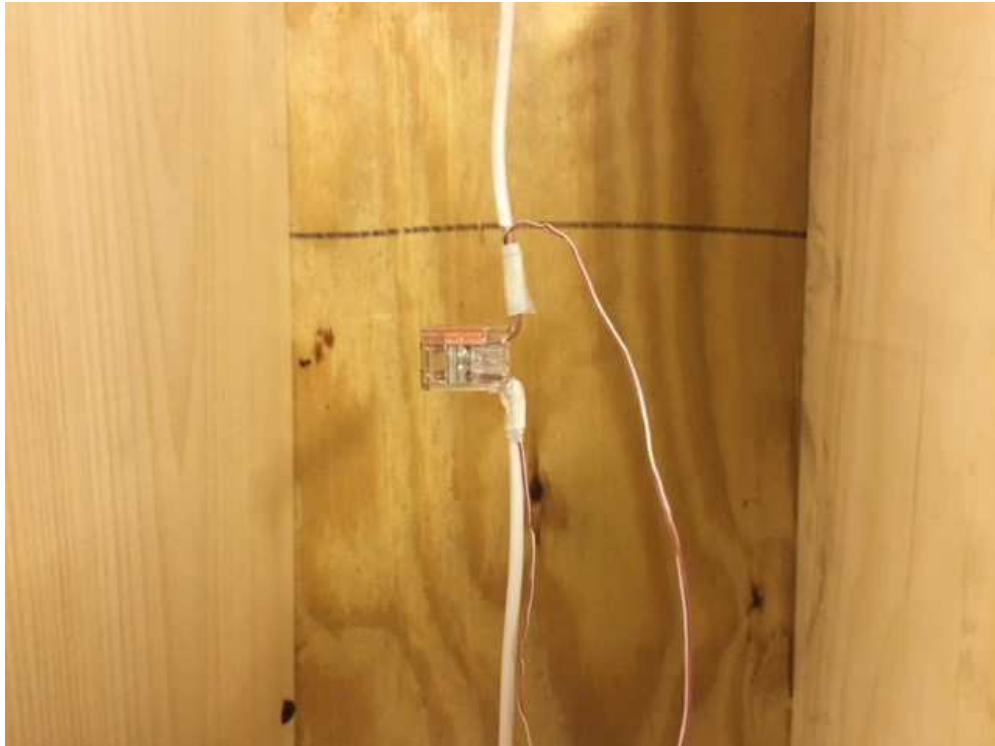


TEST LETTER REPORT

Typical 12 x 1 x ¼" Bus Bar with PVC Standoffs and Mechanical Lugs



Typical Connector, Gardner and Bender Shown, TC attached within 1/2" of the connector on supply and return side



TEST LETTER REPORT

SECTION 4

PROJECT STATUS & ACTION

One set of thermocouples did not record results on the first day of testing on one of the data recorders in use. Intertek performed a full 31 days of testing to capture a minimum of 30 days these thermocouples in question, at the request of the client.

One ambient thermocouple stopped recording at the end of the last day of testing, on the Ideal connectors for the 20A test setup. Data is recorded as “No Data” due to this malfunction. The seven remaining thermocouples reading ambient temperature show normal results.

All testing is now complete.

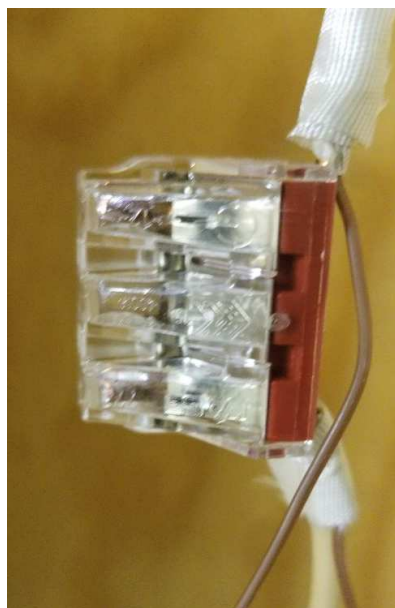
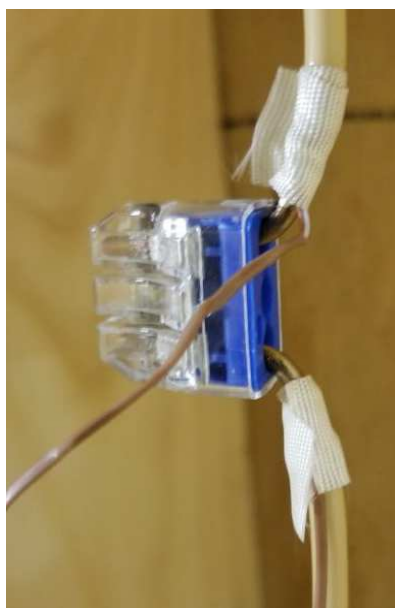
SECTION 5

CONCLUSION

The results contained in this report are to be evaluated by the client. This data is not to be used for certification of these products.

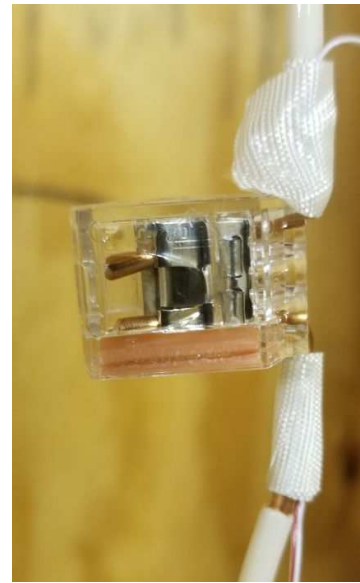
Upon completion of the test, there was no visible damage to any of the connectors contained within this report. There was however a visible change to the coloration of the insulation on the conductors involved in the 50A test on the 10 AWG conductors; no other conductors involved in the test exhibited this discoloration. The consistent temperatures recorded during the test, indicate that there is no evidence of arcing at the connectors.

10 AWG Connectors (Left to Right: Ideal, Wago):

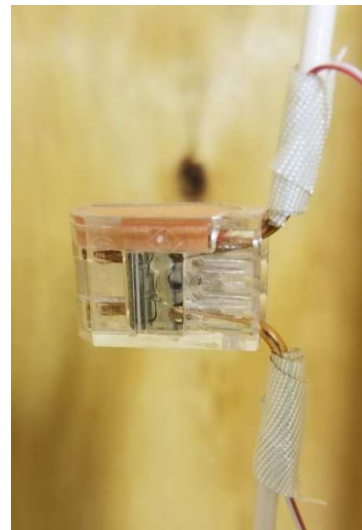
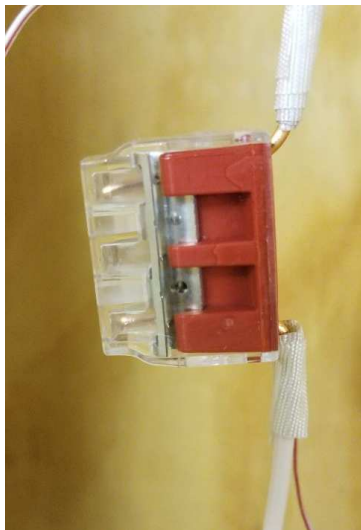


TEST LETTER REPORT

12 AWG Connectors (Left to right: Ideal, Wago, Gardner and Bender):

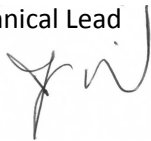


14 AWG Connectors (Left to right: Ideal, Wago, Gardner and Bender):



TEST LETTER REPORT

If there are any questions regarding the results contained in this report, or any of the other services offered by Intertek, please do not hesitate to contact your dedicated Intertek Project Manager.

Completed by:	Joshua O'Connor	Reviewed by:	James Diescher
Title:	Engineering Team Lead	Title:	Technical Lead
Signature:		Signature:	
Date:	08/28/2018	Date:	08/28/2018

Please note: this Letter Report does not represent authorization for the use of any Intertek certification marks.

Revision History

08/28/2018: Added information in the conclusions about the condition of the connectors and conductors at the end of the test. Added example pictures of each connector for each test setup at the completion of the test.

TEST LETTER REPORT

APPENDIX

MAX TEMP (50A, °C)																																					
Manu.	Conn.	TC #	23-Jul	24-Jul	25-Jul	26-Jul	27-Jul	28-Jul	29-Jul	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug	4-Aug	5-Aug	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	11-Aug	12-Aug	13-Aug	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug	20-Aug	21-Aug	22-Aug	23-Aug	24-Aug	25-Aug	
IDEAL	1	1	104.82	101.00	100.66	99.70	98.60	98.79	98.82	98.52	97.64	98.16	97.79	97.82	97.16	97.85	97.85	98.06	97.49	97.63	97.64	97.06	96.68	97.02	96.45	96.65	97.49	Power Outage				98.90	96.25	97.02	96.45	96.40	96.40
		2	83.92	81.32	81.26	80.73	80.09	80.76	80.48	80.18	79.64	80.31	79.79	79.55	79.49	80.47	79.93	80.34	80.07	79.59	79.50	79.27	79.02	78.94	78.79	78.94	79.93					80.77	78.35	78.70	78.40	78.30	78.26
	2	3	90.28	90.79	91.78	90.78	90.16	91.16	91.82	90.89	91.38	91.08	91.32	91.26	90.70	90.75	92.09	92.63	92.46	92.58	91.78	91.17	91.46	91.99	91.87	91.58	92.43					92.03	91.35	91.57	91.57	91.17	91.48
		4	77.14	77.62	78.16	77.92	77.83	78.34	77.99	77.93	78.12	78.28	78.10	78.06	77.93	77.76	79.17	79.25	79.16	79.14	78.74	78.29	78.55	78.53	78.67	78.38	79.24					78.86	78.68	78.79	78.53	78.25	78.37
	3	5	89.40	88.00	88.06	87.39	87.14	87.66	87.95	87.41	87.60	87.22	87.75	87.22	86.90	86.69	87.59	88.87	88.31	88.06	87.62	87.42	87.39	87.85	87.47	87.94	88.26					87.35	87.09	86.96	87.18	86.77	86.46
		6	92.73	91.58	92.06	91.46	91.54	91.75	92.33	92.00	92.01	91.28	91.62	91.88	90.90	90.83	92.07	93.37	92.96	92.68	92.04	91.75	92.20	92.29	92.00	92.57	92.69					92.26	91.65	91.54	92.05	91.31	91.72
	Ref	7	86.70	86.98	87.33	87.63	87.71	87.57	88.23	88.32	88.19	87.94	88.14	88.45	88.04	88.34	88.47	90.28	89.05	89.39	89.32	88.39	89.12	89.10	88.61	88.89	88.95					88.30	88.79	88.18	88.82	87.86	87.96
WAGO	4	8	81.37	80.88	80.74	80.56	80.08	79.93	79.18	79.02	78.45	79.39	79.33	79.00	79.07	79.55	79.65	79.63	79.81	79.52	78.93	77.99	78.56	78.44	78.10	78.43	78.26					79.39	77.75	77.91	77.48	76.92	77.02
		9	87.95	87.91	88.06	88.05	87.56	87.44	87.70	87.40	86.31	87.10	87.04	86.49	86.47	86.60	87.34	86.86	87.23	87.05	86.03	84.97	85.43	85.51	84.84	84.26	83.99					87.60	82.66	82.59	83.04	82.02	81.62
		10	87.19	87.84	87.90	88.43	87.66	87.34	86.86	86.11	86.57	87.48	87.70	87.54	87.20	87.45	87.88	87.92	88.00	86.61	86.52	85.52	85.46	85.47	85.73	86.22	86.18					87.75	85.60	85.48	85.31	85.87	85.36
	5	11	82.99	83.08	82.87	82.89	82.67	82.08	81.59	80.97	81.03	81.96	82.48	81.96	81.56	81.82	82.39	82.34	82.33	81.56	80.99	80.17	80.20	80.27	80.35	80.94	80.77					81.80	79.82	79.83	79.33	79.68	79.62
		12	85.43	85.05	85.09	85.12	84.61	84.80	84.10	83.59	83.47	84.12	84.26	84.58	84.16	84.36	84.31	84.97	84.57	84.23	83.86	83.73	83.34	83.49	83.12	84.01	83.75					84.34	83.84	83.04	83.06	83.41	83.41
		6	13	89.14	88.21	88.76	88.48	88.17	88.23	87.82	87.01	87.15	87.56	87.82	88.05	88.09	87.89	88.53	88.38	88.30	88.18	87.92	88.06	87.42	87.56	87.31	87.99		87.42				88.68	87.93	86.71	86.83	88.01
	Ref	14	88.72	89.64	91.45	90.71	91.45	91.75	91.57	91.95	91.31	90.84	92.18	92.33	92.35	91.99	92.78	92.10	93.57	93.63	92.06	91.81	92.52	93.07	92.84	94.56	92.34					91.83	91.48	91.76	90.88	91.75	92.01

MIN TEMP (50A, °C)																																					
Manu.	Conn.	TC #	23-Jul	24-Jul	25-Jul	26-Jul	27-Jul	28-Jul	29-Jul	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug	4-Aug	5-Aug	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	11-Aug	12-Aug	13-Aug	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug	20-Aug	21-Aug	22-Aug	23-Aug	24-Aug	25-Aug	
IDEAL	1	1	22.29	95.90	95.73	93.01	91.23	93.56	92.72	93.94	92.48	90.88	92.40	92.03	91.11	91.39	90.62	91.45	91.51	91.06	89.73	93.36	91.73	91.20	89.59	91.80	90.50	Power Outage				88.57	89.43	88.66	87.20	89.04	88.91
		2	22.78	75.58	76.48	74.61	74.09	74.86	73.01	75.43	74.83	73.38	74.29	74.35	73.76	73.98	73.51	74.34	73.20	72.76	72.79	75.75	73.99	71.52	71.85	73.85	73.60					70.57	71.15	71.60	70.77	72.03	72.00
		3	22.32	86.68	86.59	86.16	86.30	86.08	83.75	86.01	85.92	86.01	86.10	86.12	86.44	86.39	86.00	87.18	85.73	86.73	84.95	86.06	85.97	85.69	84.59	86.34	86.40					86.41	84.28	82.96	83.55	86.01	86.60
		4	23.01	73.41	74.53	73.82	73.74	73.90	71.63	74.62	74.23	73.44	74.07	74.11	74.11	74.10	73.74	74.07	73.55	74.16	73.04	75.59	74.45	72.99	72.67	75.16	74.60					73.70	71.28	72.09	72.66	74.55	74.63
	2	5	22.81	82.43	83.23	81.87	81.43	81.93	82.40	83.10	83.04	81.18	81.53	82.37	82.07	81.62	80.99	81.31	82.41	83.19	83.08	83.34	83.08	83.36	82.56	82.89	81.89		83.00	80.76	80.45	78.26	82.23	82.20			
		6	22.78	88.40	88.90	87.84	87.42	88.03	87.74	88.31	88.04	87.25	87.44	88.02	87.65	87.71	87.08	88.31	88.13	88.39	87.65	87.47	88.14	87.58	88.05	88.04	87.82		87.69	86.02	85.31	86.77	86.95				
	3	7	22.80	81.99	82.99	82.63	83.18	82.18	83.80	84.81	83.61	82.84	83.48	83.28	83.82	83.52	82.89	82.37	84.23	85.36	85.18	85.16	84.67	85.61	84.25	85.09	83.40		85.03	84.55	82.60	82.30	84.22	84.61			
		Ref	8	22.80	76.69	76.90	75.55	75.53	75.70	76.45	76.09	75.90	74.84	75.21	75.08	75.48	74.30	73.94	74.72	75.67	75.74	76.09	75.53	75.31	75.63	75.48	75.29		73.59	75.39	75.23	74.02	73.67	74.40	74.30		
WAGO	4	9	22.75	83.28	83.55	82.80	83.07	82.84	83.59	82.50	82.47	81.84	82.09	81.47	81.66	81.43	80.58	81.16	81.56	81.90	81.02	81.21	80.95	80.60	80.67	79.89	78.46	78.59	78.57	76.50	76.81	77.42	78.12				
		10	22.75	82.20	82.69	81.78	82.24	82.32	82.49	81.70	82.03	81.84	81.99	81.63	81.98	81.22	81.81	81.26	82.31	82.46	82.27	82.11	82.40	82.79	82.36	81.77	81.11	81.76	81.86	80.13	80.89	82.58	82.28				
	5	11	22.70	78.01	77.83	76.59	77.48	77.09	77.56	77.03	77.05	76.60	76.94	76.43	76.92	75.85	76.32	75.92	77.07	77.78	77.22	77.46	77.68	77.94	77.27	76.76	75.78	76.67	77.06	75.06	74.97	77.20	77.02				
		12	22.73	79.80	79.49	79.39	79.38	79.26	79.13	78.50	78.95	78.66	78.39	78.53	78.81	77.70	78.11	78.08	78.59	79.55	79.11	79.58	80.09	80.23	79.47	79.04	78.20	80.03	80.00	77.96	78.62	80.09	80.09				
	6	13	22.70	83.65	83.07	83.06	82.47	82.70	81.87	82.49	82.24	82.41	82.51	82.69	82.38	82.30	82.45	82.67	82.99	83.63	82.82	83.27	83.53	82.79	82.66	83.04	82.52	83.28	82.88	81.04	81.24	83.12	83.10				
		Ref	14	22.75	83.42	83.49	83.33	83.15	83.16	84.08	83.31	83.25	83.72	83.44	84.10	83.54	83.30	83.76	83.49	84.07	85.48	84.55	84.60	84.76	86.01	86.22	84.12	83.95	85.18	86.83	84.58	85.39	86.90	86.05			

AVE TEMP (50A, °C)																																						
Manu.	Conn.	TC #	23-Jul	24-Jul	25-Jul	26-Jul	27-Jul	28-Jul	29-Jul	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug	4-Aug	5-Aug	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	11-Aug	12-Aug	13-Aug	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug	20-Aug	21-Aug	22-Aug	23-Aug	24-Aug	25-Aug		
IDEAL	1	1	99.09	97.98	98.38	96.49	96.29	96.22	96.29	96.62	95.90	94.68	94.80	95.19	94.67	94.22	93.82	94.56	95.24	94.85	95.27	95.51	94.83	95.38	94.79	94.84	93.99	Power Outage		94.89	94.26	94.24	94.20	94.00	93.87			
		2	78.62	77.88	78.84	77.46	77.72	77.86	77.92	78.29	77.87	76.79	76.90	77.39	76.91	76.46	76.14	76.80	77.45	77.10	77.47	77.66	76.99	77.46	76.86	77.13	76.46			77.03	76.21	76.26	76.30	76.08	75.89			
		3	87.84	88.16	88.53	88.23	88.08	88.11	88.28	89.15	88.37	87.83	87.96	88.17	88.13	88.01	88.27	88.92	88.91	88.76	89.17	89.46	89.14	89.83	89.40	88.87	88.33			89.35	89.23	89.23	89.66	89.13	89.13			
		4	74.75	75.56	76.47	75.77	76.01	76.19	76.27	76.75	76.46	75.81	76.07	76.44	76.22	76.03	75.97	76.52	77.05	76.92	77.14	77.29	76.93	77.37	76.97	76.95	76.55			77.40	77.13	77.02	77.23	76.91	76.87			
		5	85.18	85.31	86.02	84.86	84.92	85.09	85.23	85.58	85.08	84.29	84.65	84.97	84.72	84.37	84.00	84.77	85.68	85.51	85.55	85.51	85.35	85.90	85.44	85.27	84.63			85.15	85.01	84.98	85.35	84.70	84.57			
		6	89.99	89.95	90.10	89.68	89.52	89.54	89.60	89.92	89.43	89.14	89.38	89.37	89.34	89.25	89.24	89.79	90.18	90.00	89.89	89.87	90.32	89.99	89.55	89.44			89.70	89.75	89.67	90.16	89.29	89.23				
		Ref	7	83.50	85.01	86.15	85.57	85.88	86.06	86.26	86.37	85.89	86.32	86.57	86.42	86.21	85.84	86.43	87.54	87.24	87.07	86.83	86.84	87.13	86.83	86.82	86.54			86.65	86.66	86.39	86.75	86.16	86.09			
		WAGO	4	8	78.35	79.13	79.27	78.39	78.35	78.06	77.90	77.38	77.23	77.29	77.47	77.56	77.44	77.45	77.14	77.46	78.23	77.77	77.39	76.77	76.84	76.80	76.83		76.98	76.73	Power Outage		76.63	76.32	76.04	75.97	75.51	75.42
				9	84.58	85.48	86.36	85.50	85.75	85.54	85.61	85.08	84.72	84.50	84.67	84.86	84.45	84.21	83.69	84.00	84.92	84.05	83.52	82.87	82.82	82.80	82.74		82.61	81.91			80.89	80.74	80.41	80.61	79.86	79.65
				10	83.91	85.12	86.05	85.11	85.40	85.17	85.01	84.69	84.79	84.74	85.01	85.30	85.06	84.91	84.51	84.81	85.92	84.94	84.53	84.03	84.08	84.17	84.11		84.43	84.03			84.44	84.26	83.59	83.64	83.85	83.81
5	11		80.26	80.70	81.22	80.18	80.42	80.17	79.78	79.44	79.60	79.51	79.76	80.01	79.81	79.68	79.25	79.58	80.47	79.72	79.44	79.06	78.99	79.14	78.99	79.44	78.90		78.97	78.61		77.87	77.75	78.20	78.18			
	12		82.32	82.81	83.38	82.23	82.52	82.39	81.93	81.68	81.73	81.45	81.71	82.35	82.02	81.68	81.38	81.71	82.58	82.39	81.91	81.77	81.72	81.78	81.45	81.81	80.94		82.08	81.76		80.74	80.37	81.44	81.64			
6	13		85.70	86.01	86.62	85.59	85.98	85.86	85.30	84.99	85.27	85.14	85.34	85.96	85.64	85.22	85.48	86.23	86.10	85.59	85.45	85.37	85.27	85.02	85.68	85.04		85.73	85.16	83.85		83.47	84.99	85.23				
	Ref		14	84.72	85.98	87.39	86.49	86.92	87.91	88.34	89.19	88.00	86.86	87.38	88.68	88.21	87.26	87.03	87.49	88.69	89.53	89.36	89.39	89.47	90.37	89.71	89.12	87.38		88.84		89.23	88.46	87.94	88.82	89.13		

MAX TEMP (30A, °C)																																					
Manu.	Conn.	TC #	23-Jul	24-Jul	25-Jul	26-Jul	27-Jul	28-Jul	29-Jul	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug	4-Aug	5-Aug	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	11-Aug	12-Aug	13-Aug	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug	20-Aug	21-Aug	22-Aug	23-Aug	24-Aug	25-Aug	
IDEAL	7	15	68.57	62.14	61.07	60.48	60.15	59.65	59.37	58.88	59.40	59.21	59.03	59.59	59.52	59.65	59.99	60.38	60.45	59.45	59.20	58.92	58.77	58.79	58.81	58.92	59.54	Power Outage				59.22	59.20	59.03	57.81	58.09	58.50
		16	70.43	68.41	67.93	68.09	68.43	67.89	67.69	67.60	68.16	68.53	68.28	68.40	68.92	69.05	69.48	69.99	69.51	68.90	68.62	68.40	68.22	68.39	68.44	68.78	69.62		69.42	69.18	69.09	67.95	68.09	68.48			
		17	80.39	65.87	64.23	64.36	64.12	64.12	63.84	63.72	63.63	63.62	63.27	63.19	63.31	63.70	64.09	64.17	63.63	62.92	62.82	62.44	62.19	62.22	61.94	62.91	62.70		61.81	61.15	61.09	59.86	59.84	60.07			
	8	18	85.75	73.23	72.38	72.61	72.10	71.52	71.15	70.74	71.21	71.51	70.95	71.21	71.18	71.59	71.92	71.56	71.49	70.52	70.30	69.77	69.93	70.05	70.06	70.05	70.87		69.84	69.72	69.64	68.99	68.71	68.62			
		19	65.78	64.66	64.04	64.77	64.75	63.82	63.62	63.56	63.54	63.56	63.63	63.38	63.44	63.94	64.33	64.51	64.62	63.36	63.50	63.00	63.26	63.48	63.70	63.34	63.57		63.36	63.25	62.99	62.38	62.04	61.95			
	9	20	66.27	65.63	64.73	65.12	65.13	64.40	63.75	63.91	63.97	64.18	64.01	63.92	63.94	64.15	64.53	64.88	64.45	63.56	63.36	63.26	63.32	63.22	63.41	63.25	63.63		63.27	63.16	63.19	62.11	61.91	62.00			
		Ref	21	67.20	67.35	66.97	67.88	67.89	67.24	67.55	67.53	67.24	66.93	67.88	67.56	67.55	67.87	68.14	68.77	68.16	68.30	68.23	67.37	68.14	67.45	68.48	67.70		67.67	68.10	68.36	67.75	67.62	67.07	67.07		
WAGO	10	22	65.17	64.36	64.07	64.63	64.25	63.61	63.37	63.14	62.95	62.40	63.08	63.02	63.03	63.12	63.70	63.99	63.60	63.24	63.14	62.71	62.44	62.43	62.68	62.38	62.81					62.04	61.98	61.88	61.51	61.12	61.12
		23	68.15	67.25	66.94	67.10	66.98	66.28	65.89	65.83	65.73	65.47	65.73	65.81	65.53	65.73	66.41	66.67	66.20	65.39	65.46	64.95	64.75	64.86	64.97	64.77	65.26		64.25	64.38	64.25	63.67	63.45	63.45			
		24	65.42	64.44	64.92	64.86	64.90	64.75	64.43	64.46	64.20	64.16	64.51	64.42	64.44	64.71	65.24	65.05	64.99	64.41	64.53	64.13	63.94	63.86	63.69	63.81	64.36		63.36	63.76	63.50	63.13	63.11	63.11			
	11	25	64.28	61.42	61.21	61.24	61.13	60.69	60.29	60.28	60.01	60.01	60.27	60.29	60.44	59.64	59.79	59.84	59.96	59.49	59.24	58.74	58.55	58.60	58.17	58.42	58.97		57.57	57.58	57.45	57.45	56.89	56.89			
		26	64.38	63.89	64.46	64.34	64.05	63.46	63.45	63.50	63.01	62.61	63.23	63.18	63.08	63.01	63.75	63.17	63.81	62.80	63.06	62.42	61.96	62.39	61.92	62.32	62.88		61.77	61.14	60.99	60.83	60.72	60.72			
	12	27	67.34	67.23	67.54	67.26	67.17	67.19	66.53	66.41	65.93	65.99	66.46	66.16	66.28	66.03	66.53	66.53	66.88	66.02	65.95	65.53	65.04	65.08	65.23	65.31	66.17		64.83	64.29	64.23	64.03	63.79	63.79			
		Ref	28	60.36	60.63	61.31	61.58	61.70	61.36	60.77	60.95	60.41	60.41	61.25	61.03	61.14	60.78	61.20	61.14	61.63	60.92	61.26	60.79	60.38	60.18	60.48	60.56		60.90	60.27	60.70	60.18	59.65	59.69	59.69		
Gardner Bender	13	29	62.68	62.96	63.23	62.97	63.25	62.90	62.67	62.94	62.30	62.38	62.95	62.66	63.07	62.67	63.11	62.55	63.57	63.03	62.65	62.57	62.16	62.00	62.31	62.55	62.56		61.79	61.47	61.62	61.09	60.97	60.97			
		30	64.06	64.02	64.43	64.32	64.44	64.32	64.04	64.15	63.91	63.98	64.28	64.22	64.51	64.26	64.75	64.44	65.41	64.22	64.25	64.16	63.74	63.55	64.06	64.11	64.33		63.81	63.81	63.91	63.13	63.08	63.08			
		31	67.09	66.75	67.66	67.43	67.57	67.25	67.46	67.18	66.81	66.98	67.50	67.36	67.36	67.46	67.60	67.32	68.12	67.12	67.60	67.16	66.68	66.65	67.04	67.10	67.15	67.34	66.88	67.05	66.51	66.23	66.23				
	14	32	No Data	67.16	67.72	67.56	67.82	67.27	67.57	67.43	66.98	67.55	67.95	67.50	67.50	67.33	67.63	67.41	68.28	67.21	67.96	67.42	66.89	66.79	67.33	67.49	67.43	67.86	66.79	66.94	66.31	66.25	66.25				
		33	No Data	68.57	68.92	68.71	68.94	68.61	68.47	68.64	68.06	68.67	68.83	68.89	68.52	68.42	68.78	68.61	68.92	67.98	68.57	68.39	67.78	67.47	68.01	68.15	67.96	68.29	67.33	67.37	66.91	66.81	66.81				
	15	34	No Data	65.91	65.94	65.52	65.62	65.33	65.00	64.92	64.42	64.83	65.17	65.19	64.34	64.53	64.76	64.51	64.68	63.67	64.28	64.26	63.49	63.09	63.76	63.87	63.44	63.23	62.80	62.35	61.87	61.92	61.92				
		Ref	35	No Data	65.03	65.01	64.45	64.81	64.77	64.45	64.50	64.22	64.68	64.79	64.49	64.74	64.36	64.70	64.42	65.08	64.28	64.36	64.39	64.27	63.92	63.98	64.55	64.63	64.18	64.33	64.26	63.69	63.50	63.50			

MIN TEMP (30A, °C)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
Manu.	Conn.	TC #	23-Jul	24-Jul	25-Jul	26-Jul	27-Jul	28-Jul	29-Jul	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug	4-Aug	5-Aug	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	11-Aug	12-Aug	13-Aug	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug	20-Aug	21-Aug	22-Aug	23-Aug	24-Aug	25-Aug																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
IDEAL	7	15	22.77	57.58	56.18	55.47	56.17	56.05	54.30	56.03	54.67	55.31	54.34	54.49	56.15	55.24	55.12	54.89	55.83	55.52	53.60	56.59	55.37	54.74	56.06	54.83	54.52	Power Outage																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											</

MAX TEMP (20A, °C)																																					
Manu.	Conn.	TC #	23-Jul	24-Jul	25-Jul	26-Jul	27-Jul	28-Jul	29-Jul	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug	4-Aug	5-Aug	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	11-Aug	12-Aug	13-Aug	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug	20-Aug	21-Aug	22-Aug	23-Aug	24-Aug	25-Aug	
IDEAL	16	36	No Data	62.13	61.46	60.56	60.29	60.59	59.48	59.07	58.70	58.95	58.83	58.72	58.61	58.78	58.97	59.81	58.95	58.60	57.88	57.27	57.12	57.72	57.02	57.49	58.02	Power Outage				55.94	56.39	55.77	54.77	54.71	54.52
		37	No Data	61.55	61.48	60.69	60.29	60.42	59.33	58.77	58.49	59.20	58.83	58.91	58.80	58.85	59.36	60.28	58.72	58.39	57.21	57.18	56.89	56.21	56.79	57.72	57.67					56.06	55.89	55.26	55.12	54.70	54.71
		38	No Data	53.15	53.64	52.80	52.67	53.02	52.45	52.11	52.09	52.60	52.50	52.54	52.74	52.96	53.10	53.16	52.74	53.18	52.53	51.91	51.67	51.18	51.62	52.10	52.53					52.03	51.42	52.15	51.49	50.43	50.66
		39	No Data	53.55	53.88	53.02	53.33	53.47	52.88	52.47	52.77	53.33	53.18	53.27	53.13	53.11	53.64	53.92	53.68	53.27	53.14	52.67	52.14	51.76	52.10	52.54	53.11					52.15	51.65	52.10	51.53	50.89	51.19
	40	No Data	58.52	58.37	57.97	57.89	58.17	58.29	57.23	57.63	57.96	57.56	57.85	57.78	58.40	58.14	58.80	58.13	58.01	57.80	57.28	56.80	56.33	57.45	57.09	57.96					57.14	56.87	57.52	57.04	56.10	55.62	
	18	41	56.13	55.83	55.29	55.13	55.00	55.35	55.29	54.68	54.99	55.53	54.95	55.10	55.40	55.49	55.95	56.23	55.65	55.32	55.43	54.40	54.26	54.25	54.91	54.95	55.22				55.24	55.27	55.11	55.20	54.01	53.78	
	Ref	42	56.42	56.74	56.50	56.62	56.33	56.28	56.37	56.22	55.96	56.23	56.48	56.54	56.60	56.96	57.50	58.27	57.01	56.53	56.28	55.38	55.46	55.50	55.62	56.07	57.18				56.25	56.25	55.48	55.38	54.02	53.94	
WAGO	19	43	53.75	53.87	53.82	54.10	53.50	53.57	53.50	52.85	53.41	53.48	53.44	53.31	53.17	53.72	54.38	54.62	54.30	54.03	53.64	53.09	52.91	52.87	53.25	53.21	54.05	Power Outage				53.32	53.22	53.29	52.33	51.90	51.89
		44	55.89	55.65	55.78	55.82	55.25	55.40	55.26	54.84	55.04	55.27	55.32	54.92	54.82	55.36	56.26	56.63	56.03	55.85	54.97	54.46	54.50	54.34	54.62	54.71	56.00					54.68	54.77	54.47	53.68	53.04	53.04
	20	45	52.99	52.56	52.37	52.78	52.28	52.39	51.91	51.41	52.14	51.95	52.12	51.92	51.77	52.32	52.70	53.38	53.05	52.99	52.06	51.45	51.56	51.28	51.61	52.00	52.99					51.71	51.64	51.68	51.02	50.29	50.59
		46	57.96	57.96	58.00	58.20	57.49	57.50	57.34	56.82	56.96	56.99	57.24	57.16	56.95	57.64	57.95	58.84	58.49	58.11	57.46	56.50	56.58	56.79	56.97	56.85	58.01					56.80	56.91	56.95	56.39	55.60	55.52
	21	47	53.18	53.28	53.38	53.69	53.55	53.35	53.31	52.74	53.21	53.00	53.30	53.27	52.91	53.47	53.94	54.55	54.36	54.40	53.55	53.10	53.19	53.37	53.15	53.33	54.35					53.02	52.94	52.99	52.49	52.10	51.88
48		55.56	56.03	55.79	56.28	55.54	55.68	55.56	55.06	55.50	55.52	55.63	55.69	55.57	56.12	56.31	57.52	56.93	56.43	55.72	55.31	55.22	55.68	55.18	55.82	57.01				55.40	55.08	55.32	55.19	54.29	54.10		
	Ref	49	59.88	59.48	59.52	59.78	59.74	59.54	59.32	58.76	59.02	59.55	59.43	59.60	59.70	60.14	60.29	61.11	60.15	60.55	59.73	58.64	59.01	59.14	58.71	59.67	60.63				59.49	57.94	57.98	57.35	57.49	57.67	
Gardner Bender	22	50	59.35	59.42	59.95	60.32	60.10	59.65	59.22	59.17	59.70	59.58	59.53	59.91	59.58	60.30	60.72	61.01	61.32	61.23	60.14	59.45	59.70	60.72	60.05	60.38	61.19				59.47	59.21	59.74	58.66	58.40	58.24	
		51	61.96	61.58	61.77	62.22	61.85	61.58	60.92	60.99	61.25	61.51	61.27	61.81	61.27	62.80	62.52	63.28	62.56	62.82	61.88	61.01	60.90	62.66	62.00	62.71	63.59				61.36	60.54	61.33	59.95	59.91	59.67	
	23	52	66.06	66.79	68.72	70.24	70.50	70.99	70.27	69.62	69.82	69.78	69.56	69.39	68.80	69.02	68.78	69.45	69.11	69.08	68.03	66.70	66.93	68.02	67.48	67.56	67.48				65.92	65.69	65.37	64.75	64.53	64.40	
		53	64.35	65.25	66.55	68.23	68.67	68.51	67.96	67.56	67.49	67.69	67.29	67.03	66.68	66.49	66.51	66.98	66.88	66.84	65.76	64.83	64.73	65.30	65.00	65.00	65.02				63.50	63.06	63.04	62.42	62.02	61.88	
	24	54	55.36	54.87	55.50	56.30	55.60	55.79	55.48	55.15	55.71	55.81	55.94	55.96	55.13	56.22	56.19	56.60	57.05	57.12	56.81	54.97	56.06	56.35	56.19	56.09	56.92				55.52	54.86	54.79	54.18	54.23	54.17	
55		56.03	55.91	56.35	57.15	56.61	56.65	56.36	55.93	56.44	56.83	56.78	56.76	56.16	57.08	57.02	57.72	57.82	58.08	57.58	55.95	56.97	57.32	57.03	56.86	57.98				56.51	55.73	55.96	55.38	55.18	55.26		
	Ref	56	57.85	57.34	58.14	58.45	58.11	58.29	57.80	57.79	58.00	58.26	58.49	58.19	57.91	58.52	58.96	59.31	59.46	59.75	58.73	58.07	58.74	58.89	58.86	59.32				58.52	58.03	57.79	57.42	57.41	57.28		

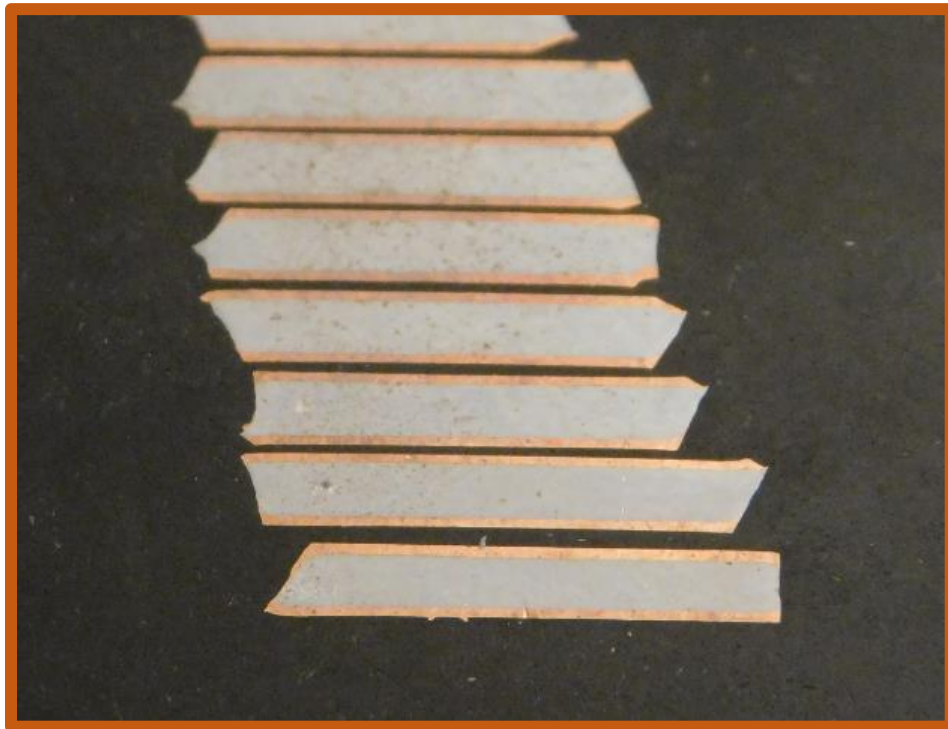
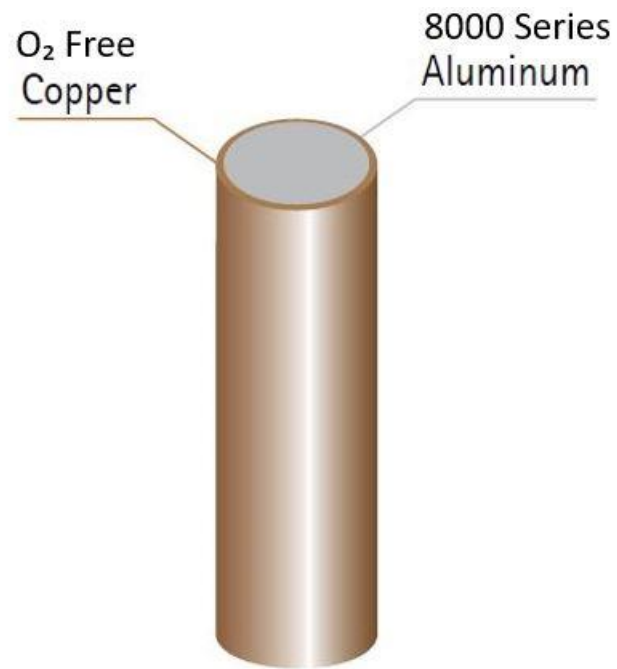
MIN TEMP (20A, °C)																																					
Manu.	Conn.	TC #	23-Jul	24-Jul	25-Jul	26-Jul	27-Jul	28-Jul	29-Jul	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug	4-Aug	5-Aug	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	11-Aug	12-Aug	13-Aug	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug	20-Aug	21-Aug	22-Aug	23-Aug	24-Aug	25-Aug	
IDEAL	16	36	No Data	59.35	58.63	57.86	57.56	57.20	56.72	56.52	55.94	56.36	56.49	56.26	56.20	56.30	56.63	56.66	56.30	55.87	55.43	54.74	54.82	54.93	54.79	55.20	55.26	Power Outage				54.14	53.70	52.99	52.13	52.45	52.29
		37	No Data	57.79	57.06	56.48	56.14	55.91	55.38	55.24	55.21	55.24	55.15	55.20	55.05	55.24	55.58	55.58	55.34	54.86	54.43	53.72	53.84	53.79	53.38	54.02	54.44					53.12	52.87	52.22	51.82	51.65	51.61
		38	No Data	49.75	49.98	49.67	49.75	49.31	49.02	48.63	49.23	49.38	49.51	49.41	49.51	50.28	50.34	50.40	50.06	49.63	49.53	49.25	48.51	48.91	48.37	49.05	49.95					48.12	48.34	48.27	47.40	47.43	47.71
	17	39	No Data	50.82	50.92	50.31	49.90	49.96	49.24	49.84	50.10	50.56	49.98	50.29	50.27	50.79	51.28	50.99	50.57	49.91	49.81	49.54	48.94	49.36	48.70	49.30	50.66					48.65	48.64	48.11	47.65	47.82	48.16
		40	No Data	55.18	55.29	54.75	54.41	54.78	53.98	54.16	53.99	54.52	54.21	54.25	54.66	54.96	55.24	55.12	53.62	54.03	53.64	53.63	52.40	53.14	52.87	52.99	54.58					53.13	52.93	53.08	52.44	52.17	52.41
		18	41	22.86	52.29	52.65	52.48	52.14	52.15	51.89	51.58	52.03	51.88	52.19	52.23	52.31	52.52	53.15	53.36	52.73	51.94	52.08	51.26	51.32	51.46	50.98	51.87		52.47				51.54	51.62	50.85	51.01	50.33
	Ref	42	22.88	52.07	53.43	52.73	52.59	52.26	52.30	52.58	52.32	53.09	53.11	52.81	51.80	52.71	51.32	53.41	52.17	52.87	51.55	52.17	51.97	52.11	52.48	52.22					52.56	51.63	51.30	51.25	50.30	50.80	
WAGO	19	43	22.90	50.19	51.07	49.83	50.72	51.22	50.90	51.03	51.03	51.32	50.99	51.53	51.32	50.32	50.18	49.22	50.40	51.92	51.73	51.02	51.08	51.13	51.25	51.43	50.34					51.31	50.96	50.69	50.04	49.93	50.16
		44	22.88	51.23	52.25	50.87	51.42	52.09	52.41	52.35	51.81	52.44	51.92	52.60	52.11	51.11	50.86	49.83	50.85	53.18	52.77	51.85	52.01	51.90	52.07	52.15	51.13					52.07	51.60	51.56	50.79	50.53	50.61
		45	22.88	48.73	49.44	48.31	48.85	49.19	48.74	49.27	49.56	49.69	49.07	49.80	49.36	47.50	47.44	47.56	48.58	50.38	49.96	49.51	49.51	49.52	49.61	49.98	48.48					49.70	49.40	49.33	48.42	48.46	48.58
	20	46	22.90	53.18	54.28	53.41	54.27	54.09	53.31	54.01	54.41	54.55	53.91	54.38	54.23	52.66	52.79	52.77	53.34	55.14	54.94	54.69	54.80	54.11	54.50	54.71	53.17					54.70	54.38	54.57	53.62	53.36	53.76
		47	22.86	48.90	49.92	49.34	49.38	49.73	49.55	49.88	50.21	50.20	48.87	50.15	50.08	48.36	48.97	48.64	49.93	51.04	50.75	50.99	50.82	51.28	51.08	51.13	49.94					50.66	51.01	51.08	50.49	49.96	50.68
	21	48	22.85	50.05	50.83	50.24	50.67	50.80	50.55	51.55	52.03	51.66	49.48	51.39	51.07	49.69	50.11	49.68	50.86	52.18	51.95	52.44	52.70	52.49	52.07	52.61	51.19					52.51	52.75	52.82	52.29	51.15	51.94
Gardner Bender	Ref	49	22.85	52.31	53.12	52.11	52.79	53.02	53.25	53.67	54.19	53.43	51.96	53.91	53.11	51.78	51.67	52.72	53.34	54.64	53.62	54.57	54.76	54.82	55.01	54.57	53.48				54.76	54.54	54.22	53.79	53.82	54.81	
	50	22.82	53.04	53.91	53.59	54.27	54.49	54.33	54.51	54.63	54.22	54.16	54.86	54.70	53.55	53.28	53.89	54.27	55.96	55.18	55.14	55.77	55.23	56.24	55.22	55.05				56.33	55.73	55.79	56.51	55.47	56.24		
	22	51	22.69	53.66	54.11	53.97	54.71	55.02	54.91	55.14	55.52	54.80	54.58	55.20	55.27	53.57	52.89	54.15	54.33	56.56	55.70	55.37	56.50	56.21	56.91	55.79	55.09				56.40	56.89	56.66	57.25	56.09	56.53	
		52	22.70	59.15	60.30	61.39	63.00	63.46	63.42	63.63	63.43	62.55	62.30	62.46	62.06	60.52	60.60	60.90	60.69	62.22	61.00	61.81	61.94	61.57	61.16	60.35	59.99				61.06	60.99	60.05	61.57	60.52	61.33	
	23	53	22.70	57.96	59.48	60.06	61.63	61.74	60.48	61.87	61.59	61.08	60.51	60.61	59.86	59.36	59.35	59.25	59.30	59.88	59.48	59.78	59.81	59.47	59.70	58.40	58.65				58.92	58.37	58.28	59.16	58.30	59.14	
		54	22.69	48.53	48.73	48.85	49.31	49.08	49.33	49.87	49.51	49.40	49.07	49.17	49.49	48.35	48.21	49.38	49.25	50.09	49.37	50.31	50.26	50.98	50.13	50.68	49.76				50.34	50.89	50.78	50.81	50.87	50.56	
	24	55	22.67	48.93	49.19	49.36	49.47	49.69	49.29	50.17	49.76	49.93	49.61	49.42	50.01	48.98	48.83	49.55	49.62	51.01	50.24	50.57	50.60	51.09	50.52	50.91	50.31				50.62	51.03	51.01	52.23	51.43	51.51	
	Ref	56	22.67	50.30	50.45	50.53	50.97	50.51	50.98	51.60	50.90	51.36	51.00	51.29	51.42	50.75	51.16	51.15	51.30	52.26	51.60	51.74	51.74	52.88	52.04	52.03	51.84				52.01	53.03	53.29	52.89	52.51	53.01	

MAX TEMP (Ambient, °C)																																				
Manu.	Conn.	TC #	23-Jul	24-Jul	25-Jul	26-Jul	27-Jul	28-Jul	29-Jul	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug	4-Aug	5-Aug	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	11-Aug	12-Aug	13-Aug	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug	20-Aug	21-Aug	22-Aug	23-Aug	24-Aug	25-Aug
50A																																				
IDEAL	1-3	1	23.37	23.48	23.45	23.95	23.75	23.61	23.47	23.24	23.33	23.51	23.61	23.55	23.58	23.74	24.22	24.47	24.45	24.44	24.16	23.67	23.68	23.65	23.62	23.84	24.15	24.10	23.45	23.10	23.61	23.43	23.42	22.93	22.84	22.87
WAGO	4-6	2	23.80	23.31	23.32	23.82	23.57	23.47	23.33	23.14	23.19	23.30	23.42	23.41	23.42	23.61	24.07	24.32	24.36	24.36	24.03	23.64	23.56	23.52	23.50	23.66	23.99	24.00	23.43	23.05	23.52	23.34	23.39	22.80	22.77	22.74
30A																																				
IDEAL	7-9	3	23.43	23.19	23.10	23.47	23.40	23.23	23.13	22.93	22.95	23.15	23.23	23.24	23.21	23.43	23.92	24.16	24.20	24.11	23.85	23.38	23.36	23.37	23.31	23.44	23.79	23.77	23.39	22.97	23.29	23.26	23.31	22.77	22.49	22.50
WAGO	10-12	4	23.59	23.19	23.13	23.49	23.41	23.26	23.11	22.92	22.96	23.18	23.27	23.24	23.25	23.51	23.98	24.25	24.16	24.08	23.84	23.38	23.33	23.33	23.28	23.40	23.85	23.80	23.38	22.97	23.23	23.22	23.28	22.75	22.51	22.49
Gardner Bender	13-15	5	23.66	23.21	23.15	23.67	23.49	23.31	23.12	22.92	23.06	23.21	23.30	23.28	23.25	23.56	24.04	24.38	24.19	24.08	23.84	23.37	23.28	23.35	23.27	23.44	24.01	23.82	23.43	23.12	23.21	23.18	23.24	22.73	22.47	22.46
20A																																				
IDEAL	16-18	6	23.58	23.28	23.22	23.76	23.53	23.36	23.16	23.03	23.10	23.31	23.37	23.38	23.38	23.65	24.11	24.30	24.28	24.21	23.93	23.48	23.35	23.44	23.36	23.54	23.97	23.92	23.43	23.10	23.28	23.17	23.23	22.72	22.55	No Data
WAGO	19-21	7	23.66	23.28	23.24	23.61	23.50	23.35	23.17	22.99	23.05	23.27	23.35	23.36	23.37	23.62	24.10	24.25	24.24	24.13	23.89	23.46	23.37	23.44	23.33	23.49	23.83	23.94	23.42	23.02	23.27	23.18	23.22	22.68	22.60	22.59
Gardner Bender	22-24	8	23.70	23.23	23.22	23.55	23.46	23.32	23.15	22.95	23.02	23.26	23.34	23.33	23.36	23.59	24.06	24.22	24.22	24.12	23.85	23.43	23.33	23.41	23.30	23.43	23.83	23.91	23.41	22.98	23.26	23.15	23.17	22.64	22.55	22.54

MIN TEMP (Ambient, °C)																																				
Manu.	Conn.	TC #	23-Jul	24-Jul	25-Jul	26-Jul	27-Jul	28-Jul	29-Jul	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug	4-Aug	5-Aug	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	11-Aug	12-Aug	13-Aug	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug	20-Aug	21-Aug	22-Aug	23-Aug	24-Aug	25-Aug
50A																																				
IDEAL	1-3	1	22.86	23.21	23.18	23.24	23.38	23.21	23.09	23.04	22.91	23.06	23.28	23.23	23.27	23.39	23.69	24.13	24.13	23.99	23.67	23.31	23.28	23.39	23.31	23.36	23.63	23.42	22.87	22.71	22.65	23.16	22.61	22.37	22.37	22.49
WAGO	4-6	2	23.07	23.11	23.07	23.12	23.27	23.11	22.98	22.90	22.81	22.96	23.17	23.13	23.14	23.30	23.58	23.99	24.05	23.89	23.62	23.26	23.19	23.31	23.18	23.21	23.47	23.40	22.81	22.66	22.60	23.09	22.58	22.32	22.29	22.40
30A																																				
IDEAL	7-9	3	22.96	22.95	22.88	22.94	23.12	22.92	22.78	22.74	22.64	22.77	23.00	22.95	22.96	23.12	23.43	23.87	23.89	23.66	23.35	23.07	23.06	23.05	23.00	23.06	23.27	23.34	22.77	22.60	22.55	22.90	22.58	22.28	22.18	22.28
WAGO	10-12	4	22.96	22.99	22.92	22.97	23.15	22.94	22.78	22.71	22.66	22.82	23.03	22.98	22.99	23.13	23.47	23.91	23.92	23.68	23.32	23.06	23.07	23.05	23.01	23.03	23.27	23.35	22.79	22.63	22.55	22.89	22.61	22.26	22.21	22.28
Gardner Bender	13-15	5	22.98	22.99	22.91	22.99	23.15	22.94	22.78	22.71	22.64	22.84	23.01	22.98	22.99	23.13	23.50	23.95	23.90	23.66	23.34	23.06	23.06	23.03	22.98	23.03	23.30	23.37	22.82	22.70	22.57	22.87	22.58	22.21	22.19	22.27
20A																																				
IDEAL	16-18	6	23.06	23.04	23.00	23.05	23.24	23.03	22.82	22.79	22.71	22.95	23.11	23.05	23.07	23.21	23.61	24.07	24.02	23.74	23.44	23.15	23.10	23.16	23.05	23.09	23.37	23.39	22.83	22.70	22.54	22.95	22.55	22.20	22.22	No Data
WAGO	19-21	7	23.07	23.04	22.96	23.03	23.23	23.00	22.81	22.75	22.66	22.92	23.08	23.02	23.04	23.18	23.59	24.04	24.00	23.72	23.42	23.06	23.03	23.16	23.04	23.07	23.35	23.39	22.82	22.67	22.52	22.91	22.54	22.20	22.16	22.26
Gardner Bender	22-24	8	23.06	23.04	22.93	22.98	23.21	22.96	22.79	22.73	22.64	22.89	23.04	23.01	23.01	23.16	23.56	24.00	24.00	23.72	23.36	23.03	23.01	23.11	23.00	23.03	23.30	23.36	22.79	22.65	22.51	22.89	22.50	22.15	22.11	22.22

AVE TEMP (Ambient, °C)																																				
Manu.	Conn.	TC #	23-Jul	24-Jul	25-Jul	26-Jul	27-Jul	28-Jul	29-Jul	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug	4-Aug	5-Aug	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	11-Aug	12-Aug	13-Aug	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug	20-Aug	21-Aug	22-Aug	23-Aug	24-Aug	25-Aug
50A																																				
IDEAL	1-3	1	23.23	23.31	23.29	23.44	23.51	23.41	23.26	23.16	23.07	23.28	23.41	23.40	23.42	23.58	23.99	24.28	24.29	24.18	23.92	23.57	23.47	23.51	23.43	23.58	23.86	23.69	23.24	22.92	23.29	23.28	23.14	22.73	22.68	22.69
WAGO	4-6	2	23.19	23.22	23.17	23.33	23.39	23.29	23.17	23.04	22.95	23.16	23.28	23.27	23.30	23.48	23.90	24.17	24.19	24.09	23.84	23.51	23.39	23.40	23.34	23.45	23.73	23.64	23.22	22.89	23.20	23.20	23.06	22.64	22.59	22.60
30A																																				
IDEAL	7-9	3	23.04	23.05	22.99	23.15	23.23	23.09	22.95	22.82	22.76	22.99	23.10	23.09	23.11	23.30	23.75	24.00	23.99	23.84	23.60	23.26	23.17	23.16	23.10	23.22	23.53	23.55	23.16	22.83	22.99	23.03	22.89	22.51	22.41	22.40
WAGO	10-12	4	23.06	23.07	23.02	23.18	23.26	23.11	22.96	22.83	22.78	23.02	23.13	23.11	23.13	23.33	23.78	24.04	24.01	23.83	23.60	23.27	23.18	23.17	23.10	23.24	23.56	23.56	23.16	22.84	23.00	23.01	22.88	22.50	22.40	22.40
Gardner Bender	13-15	5	23.07	23.08	23.02	23.20	23.26	23.12	22.96	22.82	22.78	23.03	23.14	23.11	23.13	23.34	23.80	24.07	24.02	23.84	23.59	23.24	23.16	23.15	23.08	23.25	23.59	23.59	23.22	22.91	23.00	22.98	22.85	22.46	22.37	22.37
20A																																				
IDEAL	16-18	6	23.18	23.17	23.09	23.26	23.35	23.23	23.04	22.92	22.86	23.13	23.23	23.22	23.24	23.46	23.94	24.20	24.17	23.95	23.71	23.34	23.23	23.25	23.16	23.36	23.68	23.65	23.20	22.90	23.06	23.04	22.89	22.47	22.43	No Data
WAGO	19-21	7	23.20	23.18	23.09	23.26	23.35	23.21	23.03	22.90	22.83	23.11	23.22	23.19	23.22	23.44	23.92	24.18	24.14	23.93	23.68	23.33	23.21	23.25	23.17	23.32	23.65	23.64	23.20	22.88	23.03	23.03	22.91	22.49	22.45	22.45
Gardner Bender	22-24	8	23.18	23.17	23.08	23.25	23.33	23.18	23.01	22.86	22.81	23.10	23.20	23.17	23.20	23.42	23.89	24.14	24.11	23.90	23.64	23.29	23.18	23.21	23.13	23.29	23.61	23.62	23.19	22.87	23.00	23.00	22.88	22.46	22.41	22.40

ASTM B-566, Copper Clad Aluminum Wire



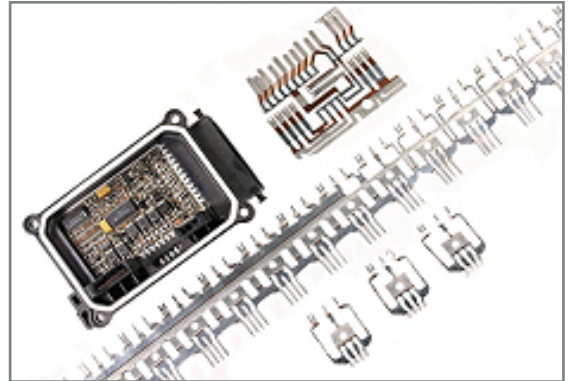
Copper is a thick bonded oxide inhibitor, and 8000 series Aluminum is as thermally stable as ETP Copper. The metallurgical bond of CCA prevents galvanic corrosion between the metals.

Bond Integrity in Aluminum-Copper Clad Metals

Aluminum clad copper (Al/Cu) or copper clad aluminum (Cu/Al) composite metals have been widely used for over 40 years. These mature and well tested clad metal systems are used industrially in a variety of applications. The inherent properties and behavior of both copper and aluminum combine to provide unique performance advantages. Copper's electrical and thermal conductivity along with its solderability make it a critical industrial metal. The characteristics of aluminum also provide above average thermal and electrical conductivity, low density and a stable oxide layer. A common application in our daily life is cookware where either Cu/Al or Cu/Al/Stainless Steel clad metals are used to make premium pots and pans.

Industrial applications include electrical power protection. Here Cu/Al clad metal systems have been used for buss bar and circuit breaker devices. More than 300,000 pounds of thin copper clad aluminum metals are produced each year for global power safety devices.

In the automotive industry, aluminum is clad over copper alloys in either inlay or overlay techniques. The aluminum acts as a bond pad location for wire bonding of hybrid circuits. Volumes of Aluminum inlays approach 2 million pounds per year and are used extensively in domestic and European automotive electronics. Hybrid leadframes made from copper/aluminum are used extensively in anti-lock braking, steering control and air bag control systems. The effect of under-the-hood temperatures on the Cu/Al interface was extensively studied over the past several decades. The stability of the interface below 250° C has been well documented. Figure 2 illustrates this data. The Copper Aluminum system has performed very robustly in a variety of automotive applications where service temperature ranges are typically from -40° C to 150° C.



Copper clad aluminum materials are also used for thermal management in automotive and computer applications. Components such as heat fins and heat exchangers rely on thin copper skins for solderability while aluminum provides a low-cost, lightweight substrate.

The following table provides an estimate of Al/Cu clad metal production servicing a variety of industrial applications over the past 5 years.

Clad Products	Applications	lbs. / 5yrs.	Applications
Al Inlay Copper Alloys	85	9,000,000	Wire bond leadframes for auto hybrid circuits
Copper clad Aluminum	30	300,000	Heat sink and heat exchanger components
Cu overlay on Al	13	1,500,000	Bus bar components

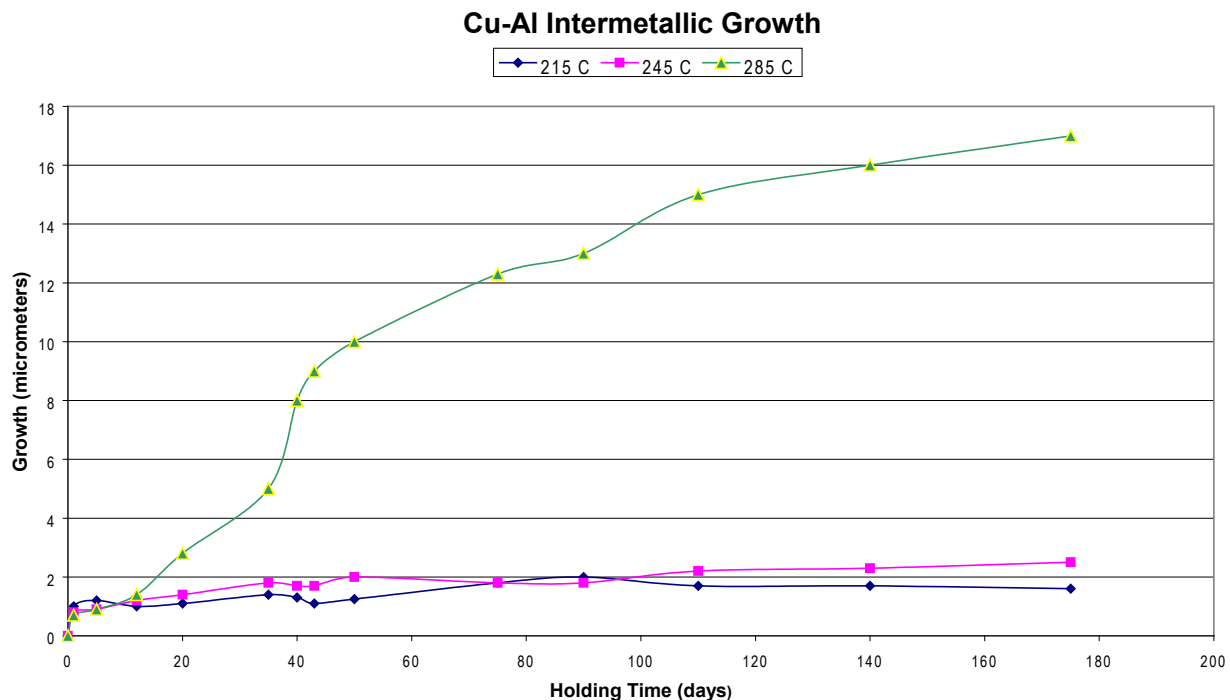
Al/Cu clad metal systems are most commonly produced by continuous roll-bonding technologies. This can be conducted either at ambient temperature or via hot bonding. Most commonly this bonding is carried out without external heating similar to the process used to produce U.S. currency. Ambient temperature bonding is followed by a carefully controlled annealing process providing thermal diffusion at the interface and the creation of reliable bond integrity between Al and Cu. Subsequent rolling and processing to finish size serves to further strengthen the interface.

Excellent metallurgical adhesion between Cu and Al layers is achieved through the controlled formation of a thin intermetallic compound layer. The picture to the right shows the interface between Al and Cu in an Al/Cu clad metal manufactured via the cold bonding process.



Al/Cu clad systems have been successfully utilized in electrical and electronic components worldwide. Designers should avoid applications where components will be exposed to prolonged exposure to excessive heat (above 250° C) or to very high temperatures such as those generated during arc welding.

The number of applications utilizing Cu/Al clad products continues to expand. This is based upon decades of reliable engineered performance in many challenging designs.



MATERION TECHNICAL MATERIALS

5 Wellington Road
 Lincoln, RI 02865
 phone: 401.333.1700 fax: 401.333.2848
www.materion.com/technicalmaterials



Public Comment No. 1316-NFPA 70-2018 [Section No. 110.16(B)]

(B) Service Equipment.

In other than dwelling units, in addition to the requirements in 110.16(A), a permanent label shall be field or factory applied to service equipment rated 1200 amps or more. The label shall meet the requirements of 110.21(B) and contain the following information:

- (1) Nominal system voltage
- (2) Available fault current at the service overcurrent protective devices
- (3) ~~The clearing time of service overcurrent protective devices based on the available fault current at the service equipment~~
- (4) ~~The date the label was applied~~

~~Exception: Service equipment labeling shall not be required if an~~

- (1) An arc flash label

is

- (1) applied in accordance with acceptable industry practice.
- (2) The date the label was applied

Informational Note No. 1: NFPA 70E -2018, Standard for Electrical Safety in the Workplace , provides guidance, such as determining severity of potential exposure, planning safe work practices, arc flash labeling, and selecting personal protective equipment.

Informational Note No. 2: ANSI Z535.4-2011, *Product Safety Signs and Labels*, provides guidelines for the design of safety signs and labels for application to products.

Informational Note No. 3: Acceptable industry practices for equipment labeling are described in *NFPA 70E-2018, Standard for Electrical Safety in the Workplace*. This standard provides specific criteria for developing arc-flash labels for equipment that provides nominal system voltage, incident energy levels, arc-flash boundaries, minimum required levels of personal protective equipment, and so forth.

Statement of Problem and Substantiation for Public Comment

I am only requesting that the clearing time be deleted in list item 3 and that the exception that allows for an arc flash label installed in accordance with acceptable industry practice be made into positive text and replace list item 3.

It is extremely difficult for industry to understand the concept of clearing time on service equipment. What will users of the code do with this information. First the user must understand 70E, then they must understand how to determine the clearing time of the specific overcurrent device within the panel. What happens if there are six mains within the panel. Should the user provide six clearing times?

Either the panel should delete list item 3 or the panel should take the language from the exception and move it to list item 3. It is more practical and clear to the user to place an arc flash label based on the information contained in 70E then to require the clearing time.

Related Item

- PI-2155

Submitter Information Verification

Submitter Full Name: David Hittinger

Organization: IEC

Affiliation: Independent Electrical Contractors

Street Address:

City:**State:****Zip:****Submittal Date:** Sun Aug 26 21:16:33 EDT 2018**Committee:** NEC-P01**Copyright Assignment**

I, David Hittinger, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am David Hittinger, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 1329-NFPA 70-2018 [Section No. 110.21]****110.21 Marking.****(A) Equipment Markings.****(1) General.**

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.

(2) Reconditioned Equipment.

Reconditioned equipment shall be marked with the name, trademark, or other descriptive marking by which the organization responsible for reconditioning the electrical equipment can be identified, along with the date of the reconditioning.

Reconditioned equipment shall be identified as "reconditioned" and ~~approval~~ the original listing mark removed. Approval of the reconditioned equipment shall not be based solely on the equipment's original listing.

Exception: In industrial occupancies, where conditions of maintenance and supervision ensure that only qualified persons service the equipment, the markings indicated in 110.21(A)(2) shall not be required for equipment that is reconditioned by the owner or operator as part of a regular equipment maintenance program.

Informational Note No. 1: Industry standards are available for application of reconditioned and refurbished equipment. Normal servicing of equipment that remains within a facility should not be considered reconditioning or refurbishing.

Informational Note No. 2: The term "reconditioned" may be interchangeable with the terms "rebuilt," "refurbished," or "remanufactured."

(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 warn of the hazards using effective words, colors, symbols, or any combination thereof.

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 handwritten.

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

- (3) The label shall be of sufficient durability to withstand the environment involved.

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.

Statement of Problem and Substantiation for Public Comment

The listing label applied when the equipment is manufactured is only for the equipment as it left the factory.

Related Item

- PI 2935

Submitter Information Verification

Submitter Full Name: Vince Baclawski

Organization: Nema

Street Address:**City:****State:****Zip:****Submittal Date:** Mon Aug 27 10:17:11 EDT 2018**Committee:** NEC-P01**Copyright Assignment**

I, Vince Baclawski, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Vince Baclawski, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 1454-NFPA 70-2018 [Section No. 110.21(A)(2)]****(2) Reconditioned Equipment.**

Reconditioned equipment shall be marked with the name, trademark, or other descriptive marking by which the organization responsible for reconditioning the electrical equipment can be identified, along with the date of the reconditioning.

Reconditioned equipment shall be identified as “reconditioned” ~~and approval~~ and the original listing mark removed or obliterated. Approval of the reconditioned equipment shall not be based solely on the equipment’s original listing. Reconditioned equipment does not satisfy the requirement for listed equipment, unless the equipment is listed as reconditioned equipment.

Exception: In industrial occupancies, where conditions of maintenance and supervision ensure that only qualified persons service the equipment, the markings indicated in 110.21(A)(2) shall not be required for equipment that is reconditioned by the owner or operator as part of a regular equipment maintenance program.

Informational Note No. 1: Industry standards are available for application of reconditioned and refurbished equipment. Normal servicing of equipment that remains within a facility should not be considered reconditioning or refurbishing.

Informational Note No. 2: The term “reconditioned” may be interchangeable with the terms “rebuilt,” “refurbished,” or “remanufactured.”

Informational Note no. 3: Equipment listed as reconditioned equipment has been reevaluated to the latest edition of the product standards by a qualified NRTL, the original listing mark removed, and a new listing mark applied that identifies the equipment as reconditioned

Statement of Problem and Substantiation for Public Comment

The presence of the original certification mark on the equipment suggest to the installer and AHJ that the equipment is compliant with the current requirements for listing. Where the NEC mandates the use of listed equipment for new installations, the revision and informational note provides the AHJ with the information necessary to make an informed decision on the acceptance of the reconditioned equipment.

Related Item

- PI No. 2935-NFPA 70-2017

Submitter Information Verification

Submitter Full Name: Donald Talka

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 28 17:01:07 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Donald Talka, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Donald Talka, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 2159-NFPA 70-2018 [Section No. 110.21(A)(2)]****(2) Reconditioned Equipment.**

Reconditioned equipment shall be marked with the name, trademark, or other descriptive marking by which the organization responsible for reconditioning the electrical equipment can be identified, along with the date of the reconditioning.

Reconditioned equipment shall be identified as “reconditioned” and approval of the reconditioned equipment shall not be based solely on the equipment’s original listing.

Exception: In industrial occupancies, where conditions of maintenance and supervision ensure that only qualified persons service the equipment, the markings indicated in 110.21(A)(2) shall not be required for equipment that is reconditioned by the owner or operator as part of a regular equipment maintenance program.

Informational Note No. 1: Industry standards are available for application of reconditioned and refurbished equipment. One example is the PEARL (Professional Electrical Apparatus Reconditioning League) EERS (Electrical Equipment Reconditioning Standard) for Electrical Apparatus and Equipment used in Commercial and Industrial Applications. Normal servicing of equipment that remains within a facility should not be considered reconditioning or refurbishing.

Informational Note No. 2: The term “reconditioned” may be interchangeable with the terms “rebuilt,” “refurbished,” or “remanufactured.”

Statement of Problem and Substantiation for Public Comment

Referencing the newly published consensus standard for evaluating Electrical Apparatus and Equipment used in Commercial and Industrial Applications (PEARL EERS) would provide helpful information to code users encountering reconditioned equipment in the field.

Related Item

- PI 4356

Submitter Information Verification

Submitter Full Name: Howard Herndon

Organization: National Field Services

Street Address:

City:

State:

Zip:

Submittal Date: Thu Aug 30 21:16:35 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Howard Herndon, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Howard Herndon, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 336-NFPA 70-2018 [Section No. 110.21(A)(2)]****(2) Reconditioned Equipment.**

Reconditioned equipment shall be marked with the name, trademark, or other descriptive marking by which the organization responsible for reconditioning the electrical equipment can be identified, along with the date of the reconditioning.

Reconditioned equipment shall be identified as “reconditioned” and ~~approval~~ the original listing mark removed or obliterated. Approval of the reconditioned equipment shall not be based solely on the equipment’s original listing.

Exception: In industrial occupancies, where conditions of maintenance and supervision ensure that only qualified persons service the equipment, the markings indicated in 110.21(A)(2) shall not be required for equipment that is reconditioned by the owner or operator as part of a regular equipment maintenance program.

Informational Note No. 1: Industry standards are available for application of reconditioned and refurbished equipment. Normal servicing of equipment that remains within a facility should not be considered reconditioning or refurbishing.

Informational Note No. 2: The term “reconditioned” may be interchangeable with the terms “rebuilt,” “refurbished,” or “remanufactured.”

Statement of Problem and Substantiation for Public Comment

The application of a certification mark (listing mark) is the Original Equipment Manufacturer’s attestation that the product complied with certification requirements in effect at the time of manufacture. The ability of the reconditioned equipment to comply with current certification requirements is unknown and therefore any certification marks (listing marks) on the product must be removed regardless of whom is performing the reconditioning process.

Related Item

- PI No.2935-NFPA 70-2017

Submitter Information Verification

Submitter Full Name: Donald Talka

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submission Date: Wed Aug 01 13:32:53 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Donald Talka, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Donald Talka, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 1349-NFPA 70-2018 [Section No. 110.22(A)]****(A) General.**

Each disconnecting means shall be legibly marked to indicate its purpose unless located and arranged so the purpose is evident. In other than one- or two-family dwellings, the marking shall include the identification of the circuit source that supplies the disconnecting means. The marking shall be of sufficient durability to withstand the environment involved.

Exception: In industrial occupancies, where conditions of maintenance and supervision ensure that only qualified persons service the equipment, the markings indicated in 110.22(A) shall not be required if the source is within the same substation, or within site of the disconnecting means.

Statement of Problem and Substantiation for Public Comment

The new marking requirement proposed in FR-8600 is overly restrictive and does not consider situations where the intended purpose or source is evident. For example, under the proposed change, motor disconnecting means as part of combination motor starters in a motor control center (MCC) would need to have both the "purpose" and "circuit source" marked even though they may be supplied by the MCC bus and MCC main breaker. An industrial exemption is proposed to recognize not all disconnecting means must be identified with the circuit source, where the source is within the same substation or within site of the disconnecting means.

Related Item

- FR-8600

Submitter Information Verification

Submitter Full Name: Louis Barrios

Organization: Shell Global Solutions

Affiliation: American Chemistry Council (ACC)

Street Address:

City:

State:

Zip:

Submission Date: Mon Aug 27 12:15:20 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Louis Barrios, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Louis Barrios, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 1875-NFPA 70-2018 [Section No. 110.22(B)]****~~(B) Engineered Series Combination Systems.~~**

~~Equipment enclosures for circuit breakers or fuses applied in compliance with series combination ratings selected under engineering supervision in accordance with 240.86(A) shall be legibly marked in the field as directed by the engineer to indicate the equipment has been applied with a series combination rating. The marking shall meet the requirements in 110.21(B) and shall be readily visible and state the following:~~

~~CAUTION — ENGINEERED SERIES COMBINATION SYSTEM RATED _____ AMPERES.
IDENTIFIED REPLACEMENT COMPONENTS REQUIRED.~~

Statement of Problem and Substantiation for Public Comment

The rejection stated that the labeling requirement shall remain in 110.22. this labeling requirement is not referred from any other parts of the NEC and therefor not a general statement. This labeling is specific to 240.86 and would be better served in NEC 240.86. There are many examples in the NEC that would support this input. NEC 408.3 has multiple labeling requirements such as (F)(2) labeling for a High leg "Caution _____ Phase Has _____ Volts to Ground. NEC 408.4(B) has labeling requirements as to where panels were fed from. A companion proposal comment was submitted to 240.86(B) using the exact language that is presently located in NEC 110.22(B)

Related Item

- PI # 3346

Submitter Information Verification

Submitter Full Name: James Dorsey

Organization: Douglas County Electrical Insp

Street Address:

City:

State:

Zip:

Submission Date: Thu Aug 30 10:54:04 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, James Dorsey, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am James Dorsey, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 1883-NFPA 70-2018 [Section No. 110.22(C)]****~~(C) Tested Series Combination Systems.~~**

~~Equipment enclosures for circuit breakers or fuses applied in compliance with the series combination ratings marked on the equipment by the manufacturer in accordance with 240.86(B) shall be legibly marked in the field to indicate the equipment has been applied with a series combination rating. The marking shall meet the requirements in 110.21(B) and shall be readily visible and state the following:~~

~~CAUTION — SERIES COMBINATION SYSTEM RATED ____ AMPERES. IDENTIFIED REPLACEMENT COMPONENTS REQUIRED.~~

~~Informational Note: See IEEE 3004.5-2014 *Recommended Practice for the Application of Low-Voltage Circuit Breakers in Industrial and Commercial Power Systems* for further information on series tested systems.~~

Statement of Problem and Substantiation for Public Comment

This Input was rejected stating it shall remain in NEC 110. However, this labeling is not referred from any other parts of the NEC and therefore not a general statement. This labeling is specific to 240.86 and would be better served here. Labeling is standardized throughout the NEC such as 700.7(B), 701.7(B), 408.3 has multiple labeling requirements such as (F)(2) labeling for a High leg "Caution ____ Phase Has ____ Volts to Ground. NEC 408.4(B) has labeling requirements as to where panels were fed from. Previous Substantiation below: The proposed additional language is currently found in 110.22(B) under Part I of Article 110 which provides general requirements. The marking required in this section is not general at all but is rather specific to one unique type of installation only mentioned in Section 240.86 of the NEC. It would make sense to have all requirements related to series rated electrical systems located in 240.86 including the marking requirements currently found in 110.22(B). A companion proposal comment has been added to NEC 240.86(C) replacing the exact language that is presently located in NEC 110.22(C)

Related Item

- PI# 3347

Submitter Information Verification

Submitter Full Name: James Dorsey

Organization: Douglas County Electrical Insp

Street Address:

City:

State:

Zip:

Submission Date: Thu Aug 30 10:58:27 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, James Dorsey, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am James Dorsey, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 420-NFPA 70-2018 [Section No. 110.24(A)]****(A) Field Marking.**

Service equipment at other than dwelling units shall be legibly marked in the field with the 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. The calculation shall be documented and made available to those authorized to design, install, inspect, maintain, or operate the system.

Informational Note No. 1: The available fault-current marking(s) addressed in 110.24 is related to required short-circuit current ratings of equipment and interrupting ratings of overcurrent protective devices. *NFPA 70E-2018, Standard for Electrical Safety in the Workplace*, provides assistance in determining the severity of potential exposure, planning safe work practices, and selecting personal protective equipment.

Informational Note No. 2: Values of available fault current for use in determining appropriate minimum short-circuit current ratings and interrupting ratings of service equipment are available from electric utilities in published or other forms.

Statement of Problem and Substantiation for Public Comment

The additional informational Note 2 accurately calls out that the values of fault current are used to determine adequate short-circuit current ratings of service equipment but also must identify that adequate interrupting ratings is another area where these values are used. Modification was also made in Informational Note No. 1 to ensure consistency between these two informational notes.

Related Item

- FR 8617

Submitter Information Verification

Submitter Full Name: Thomas Domitrovich

Organization: Eaton Corporation

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 06 11:22:52 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Thomas Domitrovich, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Thomas Domitrovich, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 1304-NFPA 70-2018 [Section No. 110.26(A)]****(A) Working Space.**

Working space for equipment operating at 1000 volts, nominal, or less to ground and likely to require examination, adjustment, servicing, or maintenance while energized shall comply with the dimensions of 110.26(A)(1), (A)(2), (A)(3), and (A)(4) or as required or permitted elsewhere in this *Code*. 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.

Informational Note: *NFPA 70E-2018, Standard for Electrical Safety in the Workplace*, provides guidance, such as determining severity of potential exposure, planning safe work practices including establishing an electrically safe work condition, arc flash labeling, and selecting personal protective equipment. Requirements in this *Code* do not endorse unjustified work on energized electrical equipment.

(1) Depth of Working Space.

The depth of the working space in the direction of live parts shall not be less than that specified in Table 110.26(A)(1) unless the requirements of 110.26(A)(1)(a), ~~(A)(1)(b)~~, or (A)(1)(c) are met. Distances shall be measured from the exposed live parts or from the enclosure or opening if the live parts are enclosed.

Table 110.26(A)(1) Working Spaces

<u>Nominal Voltage to Ground</u>	<u>Minimum Clear Distance</u>		
	<u>Condition 1</u>	<u>Condition 2</u>	<u>Condition 3</u>
0–150	900 mm (3 ft)	900 mm (3 ft)	900 mm (3 ft)
151–600	900 mm (3 ft)	1.0 m (3 ft 6 in.)	1.2 m (4 ft)
601–1000	900 mm (3 ft)	1.2 m (4 ft)	1.5 m (5 ft)

Note: Where the conditions are as follows:

Condition 1 — Exposed live parts on one side of the working space and no live or grounded parts on the other side of the working space, or exposed live parts on both sides of the working space that are effectively guarded by insulating materials.

Condition 2 — Exposed live parts on one side of the working space and grounded parts on the other side of the working space. Concrete, brick, or tile walls shall be considered as grounded.

Condition 3 — Exposed live parts on both sides of the 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 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.

(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.~~

(c)

(d) *Existing Buildings.* In existing buildings where electrical equipment is being replaced, Condition 2 working clearance shall be permitted between dead-front switchboards, switchgear, panelboards, or motor control centers located across the aisle from each other where conditions of maintenance and supervision ensure that written procedures have been adopted to prohibit equipment on both sides of the aisle from being open at the same time and qualified persons who are authorized will service the installation.

(2) Width of Working Space.

The width of the working space in front of the electrical equipment shall be the width of the equipment or 762 mm (30 in.), whichever is greater. In all cases, the work space shall permit at least a 90 degree opening of equipment doors or hinged panels.

(3) Height of Working Space.

The work space shall be clear and extend from the grade, floor, or platform to a height of 2.0 m (6½ ft) or the height of the equipment, whichever is greater. Within the height requirements of this section, other equipment that is associated with the electrical installation and is located above or below the electrical equipment shall be permitted to extend not more than 150 mm (6 in.) beyond the front of the electrical equipment.

Exception No. 1: In existing dwelling units, service equipment or panelboards that do not exceed 200 amperes shall be permitted in spaces where the height of the working space is less than 2.0 m (6½ ft).

Exception No. 2: Meters that are installed in meter sockets shall be permitted to extend beyond the other equipment. The meter socket shall be required to follow the rules of this section.

Exception No. 3: On battery systems mounted on open racks, the top clearance shall comply with 480.10(D).

(4) Limited Access.

Where equipment operating at 1000 volts, nominal, or less to ground and likely to require examination, adjustment, servicing, or maintenance while energized is required by installation instructions or function to be located in a space with limited access, all of the following shall apply:

- (1) Where equipment is installed above a lay-in ceiling, there shall be an opening not smaller than 559 mm × 559 mm (22 in. × 22 in.), or in a crawl space, there shall be an accessible opening not smaller than 559 mm × 762 mm (22 in. × 30 in.).
- (2) The width of the working space shall be the width of the equipment enclosure or a minimum of 762 mm (30 in.), whichever is greater.
- (3) All enclosure doors or hinged panels shall be capable of opening a minimum of 90 degrees.
- (4) The space in front of the enclosure shall comply with the depth requirements of Table 110.26(A)(1). The maximum height of the working space shall be the height necessary to install the equipment in the limited space. A horizontal ceiling structural member or access panel shall be permitted in this space.

(5) Separation from High-Voltage Equipment.

Where switches, cutouts, or other equipment operating at 1000 volts, nominal, or less are installed in a vault, room, or enclosure where there are exposed live parts or exposed wiring operating over 1000 volts, nominal, the high-voltage equipment shall be effectively separated from the space occupied by the low-voltage equipment by a suitable partition, fence, or screen.

Statement of Problem and Substantiation for Public Comment

PI 2519 proposed changing the first line of the working space table to 50-150 volts. The panel rejected this proposal and wrote that the provision for low voltage is well known in the industry. If this provision is 110.26(A)(1)(b), then there is a problem. 110.26(A)(1)(b) is in the section for "Depth of working Space." This means that the low voltage provision only applies to the depth and not to the Width or Height.

Related Public Comments for This Document

<u>Related Comment</u>	<u>Relationship</u>
Public Comment No. 1426-NFPA 70-2018 [New Section after 725.121(C)]	
<u>Related Item</u>	
• 2519-NFPA 70-2017 • 2520-NFPA 70-2017	

Submitter Information Verification

Submitter Full Name: Eric Stromberg
Organization: Los Alamos National Laboratory
Affiliation: Self
Street Address:
City:
State:
Zip:

Submittal Date: Sun Aug 26 13:26:41 EDT 2018
Committee: NEC-P01

Copyright Assignment

I, Eric Stromberg, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Eric Stromberg, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 2092-NFPA 70-2018 [Section No. 110.26(A)(3)]****(3) Height of Working Space.**

The work space shall be clear and extend from the grade, floor, or platform to a height of 2.0 m (6½ ft) or the height of the equipment, whichever is greater. Within the height requirements of this section, other equipment or structural support items that ~~is- are~~ associated with the electrical installation and ~~is- are~~ located above or below the electrical equipment shall be permitted to extend not more than 150 mm (6 in.) beyond the front of the electrical equipment.

Exception No. 1: In existing dwelling units, service equipment or panelboards that do not exceed 200 amperes shall be permitted in spaces where the height of the working space is less than 2.0 m (6½ ft).

Exception No. 2: Meters that are installed in meter sockets shall be permitted to extend beyond the other equipment. The meter socket shall be required to follow the rules of this section.

Exception No. 3: On battery systems mounted on open racks, the top clearance shall comply with 480.10(D).

Statement of Problem and Substantiation for Public Comment

Accept the Public Input in concept but relocate it as a new revision to 110.26(A)(3).

The words missing in the Panel Resolve Statement are "other equipment. Considering a concrete pad or other structural assembly to be equipment (which is the present term used) does not match how the terms "Equipment" and "Structure" are defined in Article 100. This is an issue that has varying interpretations and adding language such as what is proposed will help NEC users.

Related Item

- Public Input No. 2450

Submitter Information Verification

Submitter Full Name: Paul Dobrowsky

Organization: Innovative Technology Services

Street Address:

City:

State:

Zip:

Submittal Date: Thu Aug 30 17:14:31 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Paul Dobrowsky, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Paul Dobrowsky, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 449-NFPA 70-2018 [Section No. 110.26(A)(3)]****(3) Height of Working Space.**

The work space shall be clear and extend from the grade, floor, or platform to a height of 2.0 m (6½ ft) or the height of the equipment, whichever is greater. Within the height requirements of this section, other equipment that is associated with the electrical installation and is located above or below the electrical equipment shall be permitted to extend not more than 150 mm (6 in.) beyond the front of the electrical equipment.

Exception No. 1: In existing dwelling units, service equipment or panelboards that do not exceed 200 amperes shall be permitted in spaces where the height of the working space is less than 2.0 m (6½ ft).

Exception No. 2: Meters that are installed in meter sockets shall be permitted to extend beyond the other equipment. The meter socket shall be required to follow the rules of this section.

Exception No. 3: On battery systems mounted on open racks, the top clearance shall comply with 480.10(D).

Exception No. 4 Housekeeping pads extending not more than 150 mm (6 in.) beyond the front of the electrical equipment shall be permitted.

Statement of Problem and Substantiation for Public Comment

There is nothing in the code to support the panel statement that a concrete house keeping pad is equipment. This PI should be accepted to make it clear that house keeping pads are permitted to extend out from the face of the equipment that they support.

Related Item

• Public Input No. 1383-NFPA 70-2017 • Public Input No. 2202-NFPA 70-2017

Submitter Information Verification

Submitter Full Name: Don Ganiere

Organization: [Not Specified]

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 07 18:08:44 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Don Ganiere, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Don Ganiere, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 1355-NFPA 70-2018 [Section No. 110.26(A) [Excluding any Sub-Sections]]

Working space for equipment operating at 1000 volts, nominal, or less to ground and likely to require examination, adjustment, servicing, or maintenance while energized shall comply with the dimensions of 110.26(A)(1), (A)(2), (A)(3), and (A)(4) or as required or permitted elsewhere in this *Code*.

Informational Note: *NFPA 70E-2018, Standard for Electrical Safety in the Workplace*, provides guidance, such as determining severity of potential exposure, planning safe work practices including establishing an electrically safe work condition, arc flash labeling, and selecting personal protective equipment. ~~Requirements in this Code do not endorse unjustified work on energized electrical equipment.~~

Statement of Problem and Substantiation for Public Comment

The proposed phrase "Requirements in this Code do not endorse unjustified work on energized electrical equipment." should not have been accepted for the Informational Note in FR-8621. Neither the Code, nor requirements of the Code "endorse" anything. The NEC is an installation standard, not a work practice standard, and should not be taking positions on work practices whether justified or "unjustified". The proposed wording is also unclear as to the meaning of "unjustified work". For example, does "unjustified work" mean "energized work"? By definition in NFPA 70E, voltage verification can be considered "working on", or "energized work". Is this new clause suggesting that voltage verification for the purposes of safe equipment isolation is not "endorsed"? This statement in the Informational Note is not appropriate for the NEC.

Related Item

- FR-8621

Submitter Information Verification

Submitter Full Name: Louis Barrios

Organization: Shell Global Solutions

Affiliation: American Chemistry Council (ACC)

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 27 13:10:48 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Louis Barrios, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Louis Barrios, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 523-NFPA 70-2018 [Section No. 110.26(A) [Excluding any Sub-Sections]]

Working space for equipment operating at 1000 volts, nominal, or less to ground and likely to require examination, adjustment, servicing, or maintenance while energized shall comply with the dimensions of 110.26(A)(1), (A)(2), (A)(3), and (A)(4) or as required or permitted elsewhere in this *Code*.

Informational Note: *NFPA 70E-2018, Standard for Electrical Safety in the Workplace*, provides guidance, such as determining severity of potential exposure, planning safe work practices including establishing an electrically safe work condition, arc flash labeling, and selecting personal protective equipment. ~~Requirements in this Code do not endorse unjustified work on energized electrical equipment.~~

Statement of Problem and Substantiation for Public Comment

The NEC is not a document that contains best practices and should not under any case allude to an endorsement or the lack thereof. The last sentence as seen in FR seems to step up and endorse "justified energized work". However, the NEC does not provide thresholds for "justification" of energized work as seen on NFPA 70E 130.2. Nor does the NEC contain the general requirements of NFPA 70E to eliminate the hazard through the implementation of an electrically safe work condition. The purpose of NFPA 70E is to eliminate the hazard. If this sentence remains, it will infer that the NEC endorses "justified" energized work leaving the thresholds to justification up to the NEC reader.

Related Item

- FR 8621

Submitter Information Verification

Submitter Full Name: James Dollard

Organization: IBEW Local Union 98

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 10 10:17:48 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, James Dollard, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am James Dollard, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 253-NFPA 70-2018 [Section No. 110.26(B)]****(B) Clear Spaces.**

Working space required by this section shall not be used for storage and shall remain cleared away . When normally enclosed live parts are exposed for inspection or servicing, the working space, if in a passageway or general open space, shall be suitably guarded.

Statement of Problem and Substantiation for Public Comment

storage is a defined term, you do not store snow or ice or fallen debris. let be clear for the safety of the electricians, first responder and occupants access must be maintained, snow and debris must be removed . PLEASE see photos provided with Public Input No. 1807-NFPA 70-2017

Related Item

- Public Input No. 1807-NFPA 70-2017

Submitter Information Verification

Submitter Full Name: Alfio Torrisi

Organization: master

Street Address:

City:

State:

Zip:

Submittal Date: Sun Jul 22 08:07:58 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Alfio Torrisi, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Alfio Torrisi, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 151-NFPA 70-2018 [Section No. 110.26(C)(2)]****(2) Large Equipment.**

For equipment rated ~~1200 amperes~~ 1000 kW or more and over 1.8 m (6 ft) wide that contains overcurrent devices, switching devices, or control devices, or where the combined ampere rating of service disconnecting means installed in accordance with 230.71 is ~~1200 amperes~~ 1000 kW or more, 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.

A single entrance to and egress from the required working space shall be permitted where either of the conditions in 110.26(C)(2)(a) or (C)(2)(b) is met.

(a) *Unobstructed Egress.* Where the location permits a continuous and unobstructed way of egress travel, a single entrance to the working space shall be permitted.

(b) *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.

Statement of Problem and Substantiation for Public Comment

I believe that the NEC needs to recognize as very different, the arc-explosion/burning hazards presented by different system voltages. It seems totally incorrect to rule as equivalent the 1,000,000 Joules-per-second ($1200 / 1.2 * 1,000$) of a typical 480 volt three-phase system, the 433,213 Joules-per-second ($1200 / 2.77 * 1,000$) of a typical 208 volt three-phase system, or worse, the 288,000 Joules-per-second ($1200 * 240$) of a typical 240 volt single-phase system. The arc-flash "ball of fire" energy available at these differing system voltages is very different, as are the arc-sustaining capabilities. There simply is no equivalent comparison of arc-flash burning which can be calculated utilizing amperages.

Even if we choose to ignore the very different arc-sustaining capabilities over time which different voltages alone possess, we should not ignore the absolute calculable reality of the physics-related "ball of fire" I believe we are worried about personnel being able to escape from.

Certainly utilizing the wattage capacity of a system is a far more accurate way to draw the necessary hazard line.

I believe that the use of "kW" in place of "amperes" transitions this section to being based in reasonable scientific fact. The "1200 amperes" should be replaced with "1000 kW" giving proper relationship between the rule and the hazard we are trying to protect against.

If there are elements of the physics involved I am missing or have misapplied, please point them out for me.

Related Item

• 8653

Submitter Information Verification

Submitter Full Name: Scott Cline

Organization: McMurtrey Electric, Inc.

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jul 02 19:55:53 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Scott Cline, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Scott Cline, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 814-NFPA 70-2018 [Section No. 110.26(C)(2)]

(2) Large Equipment.

For

equipment rated 1200 amperes or more and over 1.8 m (6 ft) wide

large equipment that contains overcurrent devices, switching devices, or control devices,

or where the combined ampere rating of service disconnecting means installed in accordance with 230.71 is 1200 amperes or more, there

t here shall be one entrance to and egress from the required working space not less than

610 mm

610mm (

24 in

24 in .) wide and 2.

0 m

0 m (6 - 1

/

/ 2 ft)

high

high at each end of the working space . . This requirement shall apply to either of the following conditions :

(1) For equipment rated 1200 amperes or more and over 1.8 m (6 ft) wide

(2) For equipment where the combined ampere rating is 1200 amps or more and over 1.8 m (6 ft) wide

A single entrance to and egress from the required working space shall be permitted where either of the conditions in 110.26(C)(2)(a) or (C)(2)(b) is met.

(a) *Unobstructed Egress.* Where the location permits a continuous and unobstructed way of egress travel, a single entrance to the working space shall be permitted.

(b) *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.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
110.26_C_2_Revised.docx	Revision to 110.26(C)(2)	

Statement of Problem and Substantiation for Public Comment

This revision clarifies that there shall be one entrance to and egress from the required working space for all large equipment not just service equipment. The rule applies to either condition in list item #1 or 2.

Terra incorrectly reformatted the revision and numbering so please see the attached Word file for the correct wording and formatting.

Related Item

- FR - 8653

Submitter Information Verification

Submitter Full Name: David Hittinger

Organization: IEC

Affiliation: Independent Electrical Contractors Inc.

Copyright Assignment:

Street Address:

City: I, David Hittinger, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

State: By checking this box I affirm that I am David Hittinger and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

Zip:

Supplemental Date:

Committee:

SUN AUG 19 16:35:03 EDT 2018
NEC-POF

Revise 110.26(C)(2)

(2) Large Equipment.

For large equipment 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 610mm (24 in.) wide and 2.0 m (6-1/2 ft) high at each end of the working space. This requirement shall apply to either of the following conditions:

- (1) For equipment rated 1200 amperes or more and over 1.8 m (6 ft) wide
- (2) For equipment where the combined ampere rating is 1200 amps or more and over 1.8 m (6 ft) wide.

**Public Comment No. 881-NFPA 70-2018 [Section No. 110.26(C)(2)]****(2) Large Equipment.**

For equipment rated 1200 amperes or more and over 1.8 m (6 ft) wide that contains overcurrent devices, switching devices, or control devices, or where the combined ampere rating of service disconnecting means installed in accordance with 230.71 is 1200 amperes or more, 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.

A single entrance to and egress from the required working space shall be permitted where either of the conditions in 110.26(C)(2)(a) or (C)(2)(b) is met.

(a) *Unobstructed Egress.* Where the location permits a continuous and unobstructed way of egress travel, a single entrance to the working space shall be permitted.

(b) *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.

For equipment with doors that will not open at least 120 degrees, in addition to the minimum working spaces required in 110.26(A), there shall be a minimum clearance in the egress path of 610 mm (24 in.) wide and 2.0 m (6½ ft) high beyond the edge of the equipment door(s) when the door(s) are in the maximum open position. For equipment with doors that will open to at least 120 degrees this requirement shall not apply.

Additional Proposed Changes**File Name****Description Approved**

110.26_C_4_Art_File.pdf

Statement of Problem and Substantiation for Public Comment

Substantiation: This comment attempts to further clarify the text suggested in Public Input 1624 in the interest of addressing concerns of trapping a worker between open equipment doors and an obstruction such as a wall facing the equipment. See the sketch provided that illustrates the problem. For equipment with doors that can be opened more than 90 degrees but not less than 120 degrees from the closed position, this requirement would not apply. Some jurisdictions have a local amendment that address this issue. As requested by CMP-1 the text has been clarified and relocated into 110.26(C)(2).

Related Item

- FR 8484

Submitter Information Verification

Submitter Full Name: Agnieszka Golriz

Organization: NECA

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 20 14:43:39 EDT 2018

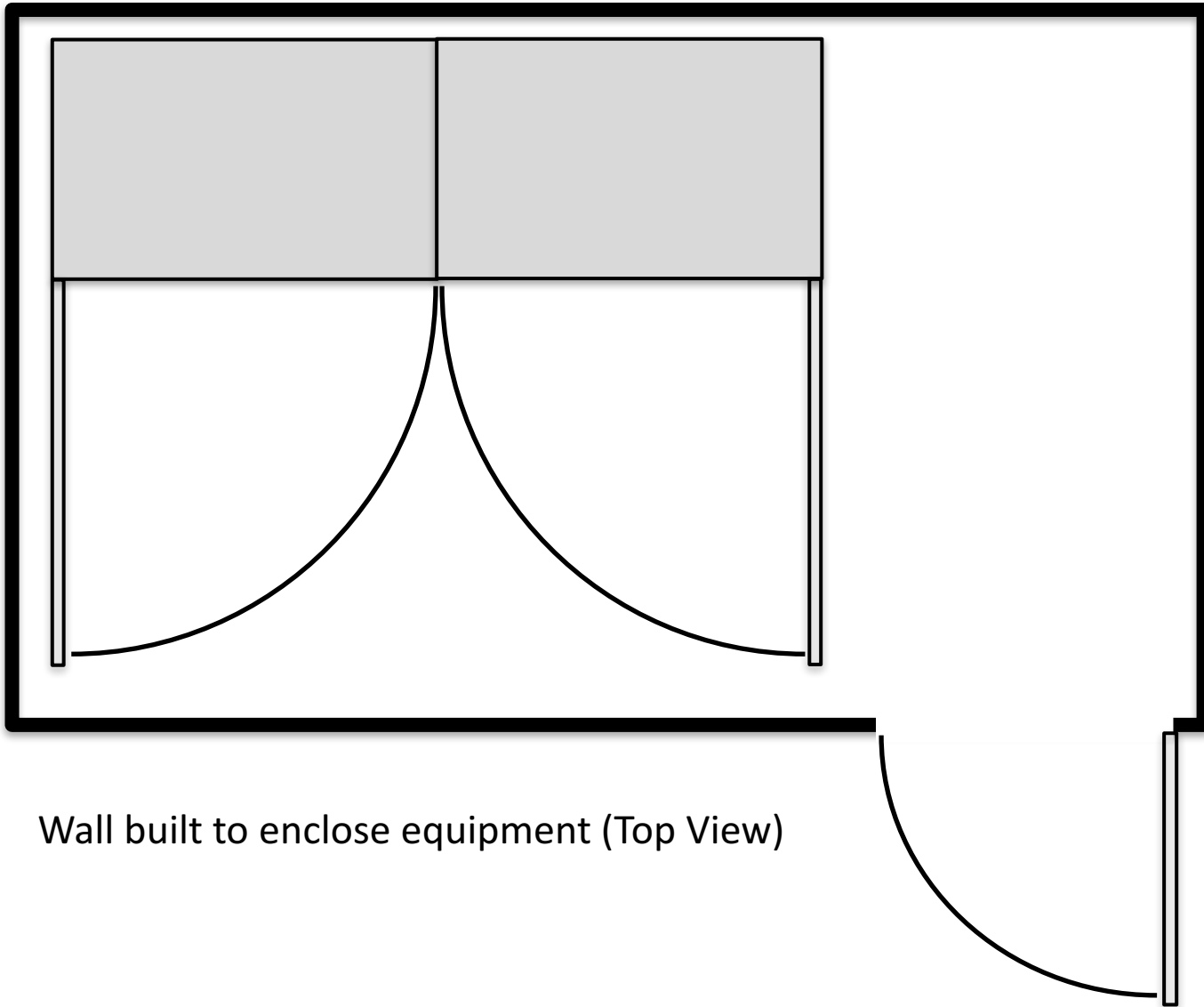
Committee: NEC-P01

Copyright Assignment

I, Agnieszka Golriz, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Agnieszka Golriz, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

Typical Switchboard 3R Enclosure with doors



Wall built to enclose equipment (Top View)

**Public Comment No. 450-NFPA 70-2018 [Section No. 110.26(D)]****(D) Illumination.**

Illumination shall be provided for all working spaces about service equipment, switchboards, switchgear, panelboards, or motor control centers installed indoors. Control by automatic ~~means only~~ means shall not be permitted. Additional lighting outlets shall not be required where the work space is illuminated by an adjacent light source or as permitted by 210.70(A)(1), Exception No. 1, for switched receptacles.

Statement of Problem and Substantiation for Public Comment

The PI to delete the word only should be accepted. There is no good reason to permit automatic control of these lights with a manual over ride. This is a safety issue. the worker may not activate the manual over ride creating a serious hazard if the lights go out while working on the equipment.

Related Item

- Public Input No. 1094-NFPA 70-2017

Submitter Information Verification

Submitter Full Name: Don Ganiere

Organization: [Not Specified]

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 07 18:12:43 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Don Ganiere, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Don Ganiere, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 451-NFPA 70-2018 [Section No. 110.26(E)(2)]****(2) Outdoor.**

Outdoor installations shall comply with 110.26(E)(2)(a) through (E)(2)(c).

(a) *Installation Requirements.* Outdoor electrical equipment shall be the following:

- (2) Installed in identified enclosures
- (3) Protected from accidental contact by unauthorized personnel or by vehicular traffic
- (4) Protected from accidental spillage or leakage from piping systems

(e) *Work Space.* ~~The working clearance space shall include the zone described in 110.26(A). No architectural appurtenance or other equipment shall be located in this zone.~~

(f)

(g) *Dedicated Equipment Space.* The space equal to the width and depth of the equipment, and extending from grade to a height of 1.8 m (6 ft) above the equipment, shall be dedicated to the electrical installation. No piping or other equipment foreign to the electrical installation shall be located in this zone.

Exception: Structural overhangs or roof extensions shall be permitted in this zone.

Statement of Problem and Substantiation for Public Comment

The original submitter is correct. The required work space in 110.26(A) applies everywhere and there is no need to add a that in the the outdoor section.

Related Item

- Public Input No. 446-NFPA 70-2017

Submitter Information Verification

Submitter Full Name: Don Ganiere

Organization: [Not Specified]

Street Address:

City:

State:

Zip:

Submission Date: Tue Aug 07 18:19:23 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Don Ganiere, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Don Ganiere, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 452-NFPA 70-2018 [Section No. 110.26(F)]**

~~(F) Locked Electrical Equipment Rooms or Enclosures.~~

~~Electrical equipment rooms or enclosures housing electrical apparatus that are controlled by a lock(s) shall be considered accessible to qualified persons.~~

Statement of Problem and Substantiation for Public Comment

My PI to remove this section should be accepted.

While I fully understand that a definition is not a requirement, it is a definition and it very clearly tells us that a locked electrical room is readily accessible. There is absolutely no need for 110.26(F) to tell us that a locked room is only "accessible". This adds unnecessary confusion to the application of the code.

With all due respect, I don't agree with the panel that my PI did not comply with Section 4.3.4.1(d) of the Regulations Governing the Development of NFPA Standards.

Related Item

• Public Input No. 2659-NFPA 70-2017

• Public Input No. 2672-NFPA 70-2017

• Public Input No. 41-NFPA 70-2017 [Section No. 110.26(F)]

Submitter Information Verification

Submitter Full Name: Don Ganiere

Organization: [Not Specified]

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 07 18:28:47 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Don Ganiere, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Don Ganiere, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 1358-NFPA 70-2018 [Section No. 110.28]

110.28 Enclosure Types.

Enclosures (other than surrounding fences or walls covered in 110.31) of switchboards, switchgear, 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, fire pump motors, and motor controllers, rated not over 1000 volts nominal and intended for such locations, shall be marked with an enclosure-type number as shown in Table 110.28.

Table 110.28 shall be used for selecting these enclosures for use in specific locations other than hazardous (classified) locations. The enclosures are not intended to protect against conditions such as condensation, icing, corrosion, or contamination that may occur within the enclosure or enter via the conduit or unsealed openings.

Table 110.28 Enclosure Selection

<u>Provides a Degree of Protection Against the Following Environmental Conditions</u>	<u>For Outdoor Use</u>									
	<u>Enclosure Type Number</u>									
	<u>3</u>	<u>3R</u>	<u>3S</u>	<u>3X</u>	<u>3RX</u>	<u>3SX</u>	<u>4</u>	<u>4X</u>	<u>6</u>	<u>6P</u>
Incidental contact with the enclosed equipment	X	X	X	X	X	X	X	X	X	X
Rain, snow, and sleet	X	X	X	X	X	X	X	X	X	X
Sleet*	—	—	X	—	—	X	—	—	—	—
Windblown dust	X	—	X	X	—	X	X	X	X	X
Hosedown	—	—	—	—	—	—	X	X	X	X
Corrosive agents	—	—	—	X	X	X	—	X	—	X
Temporary submersion	—	—	—	—	—	—	—	—	X	X
Prolonged submersion	—	—	—	—	—	—	—	—	—	X

<u>Provides a Degree of Protection Against the Following Environmental Conditions</u>	<u>For Indoor Use</u>									
	<u>Enclosure Type Number</u>									
	<u>1</u>	<u>2</u>	<u>4</u>	<u>4X</u>	<u>5</u>	<u>6</u>	<u>6P</u>	<u>12</u>	<u>12K</u>	<u>13</u>
Incidental contact with the enclosed equipment	X	X	X	X	X	X	X	X	X	X
Falling dirt	X	X	X	X	X	X	X	X	X	X
Falling liquids and light splashing	—	X	X	X	X	X	X	X	X	X
Circulating dust, lint, fibers, and flyings	—	—	X	X	—	X	X	X	X	X
Settling airborne dust, lint, fibers, and flyings	—	—	X	X	X	X	X	X	X	X
Hosedown and splashing water	—	—	X	X	—	X	X	—	—	—
Oil and coolant seepage	—	—	—	—	—	—	—	X	X	X
Oil or coolant spraying and splashing	—	—	—	—	—	—	—	—	—	X
Corrosive agents	—	—	—	X	—	—	X	—	—	—
Temporary submersion	—	—	—	—	—	X	X	—	—	—
Prolonged submersion	—	—	—	—	—	—	X	—	—	—

*Mechanism shall be operable when ice covered.

Informational Note No. 1: The term *raintight* is typically used in conjunction with Enclosure Types 3, 3S, 3SX, 3X, 4, 4X, 6, and 6P. The term *rainproof* is typically used in conjunction with Enclosure Types 3R and 3RX. The term *watertight* is typically used in conjunction with Enclosure Types 4, 4X, 6, and 6P. The term *driptight* is typically used in conjunction with Enclosure Types 2, 5, 12, 12K, and 13. The term *dusttight* is typically used in conjunction with Enclosure Types 3, 3S, 3SX, 3X, 4, 4X, 5, 6, 6P, 12, 12K, and 13.

Informational Note No. 2: Ingress protection (IP) ratings may be found in ANSI/IEC 60529, *Degrees of Protection Provided by Enclosures*. IP ratings are not a substitute for Enclosure Type ratings.

Informational Note No. 3: Dusttight-rated enclosures are permitted in hazardous locations in accordance with 502.10(B)(4), 503.10(A)(2), and 506.15(C)(8).

Informational Note No. 4: Dusttight enclosures are suitable for use in unclassified locations and in Class II, Division 2; Class III; and Zone 22 hazardous (classified) locations.

Statement of Problem and Substantiation for Public Comment

As stated in 110.28, "Table 110.28 shall be used for selecting these enclosures for use in specific locations other than hazardous (classified) locations." As such, the addition of the two Informational Notes 3 and 4 indicating equipment suitability in classified areas related to dusttight enclosures is not appropriate and is outside the purview of Code Making Panel 1.

Related Item

- FR-8672

Submitter Information Verification

Submitter Full Name: Louis Barrios

Organization: Shell Global Solutions

Affiliation: American Chemistry Council (ACC)

Street Address:

City:

State:

Zip:

Submission Date: Mon Aug 27 13:21:22 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Louis Barrios, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Louis Barrios, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 453-NFPA 70-2018 [Section No. 110.28]

110.28 Enclosure Types.

Enclosures (other than surrounding fences or walls covered in 110.31) of switchboards, switchgear, 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, fire pump motors, and motor controllers, rated not over 1000 volts nominal and intended for such locations, shall be marked with an enclosure-type number as shown in Table 110.28.

Table 110.28 shall be used for selecting these enclosures for use in specific locations other than hazardous (classified) locations. The enclosures are not intended to protect against conditions such as condensation, icing, corrosion, or contamination that may occur within the enclosure or enter via the ~~conduit~~ raceway or unsealed openings.

Table 110.28 Enclosure Selection

<u>Provides a Degree of Protection Against the Following Environmental Conditions</u>	<u>For Outdoor Use</u>									
	<u>Enclosure Type Number</u>									
	<u>3</u>	<u>3R</u>	<u>3S</u>	<u>3X</u>	<u>3RX</u>	<u>3SX</u>	<u>4</u>	<u>4X</u>	<u>6</u>	<u>6P</u>
Incidental contact with the enclosed equipment	X	X	X	X	X	X	X	X	X	X
Rain, snow, and sleet	X	X	X	X	X	X	X	X	X	X
Sleet*	—	—	X	—	—	X	—	—	—	—
Windblown dust	X	—	X	X	—	X	X	X	X	X
Hosedown	—	—	—	—	—	—	X	X	X	X
Corrosive agents	—	—	—	X	X	X	—	X	—	X
Temporary submersion	—	—	—	—	—	—	—	—	X	X
Prolonged submersion	—	—	—	—	—	—	—	—	—	X

<u>Provides a Degree of Protection Against the Following Environmental Conditions</u>	<u>For Indoor Use</u>									
	<u>Enclosure Type Number</u>									
	<u>1</u>	<u>2</u>	<u>4</u>	<u>4X</u>	<u>5</u>	<u>6</u>	<u>6P</u>	<u>12</u>	<u>12K</u>	<u>13</u>
Incidental contact with the enclosed equipment	X	X	X	X	X	X	X	X	X	X
Falling dirt	X	X	X	X	X	X	X	X	X	X
Falling liquids and light splashing	—	X	X	X	X	X	X	X	X	X
Circulating dust, lint, fibers, and flyings	—	—	X	X	—	X	X	X	X	X
Settling airborne dust, lint, fibers, and flyings	—	—	X	X	X	X	X	X	X	X
Hosedown and splashing water	—	—	X	X	—	X	X	—	—	—
Oil and coolant seepage	—	—	—	—	—	—	—	X	X	X
Oil or coolant spraying and splashing	—	—	—	—	—	—	—	—	—	X
Corrosive agents	—	—	—	X	—	—	X	—	—	—
Temporary submersion	—	—	—	—	—	X	X	—	—	—
Prolonged submersion	—	—	—	—	—	—	X	—	—	—

*Mechanism shall be operable when ice covered.

Informational Note No. 1: The term *raintight* is typically used in conjunction with Enclosure Types 3, 3S, 3SX, 3X, 4, 4X, 6, and 6P. The term *rainproof* is typically used in conjunction with Enclosure Types 3R and 3RX. The term *watertight* is typically used in conjunction with Enclosure Types 4, 4X, 6, and 6P. The term *driptight* is typically used in conjunction with Enclosure Types 2, 5, 12, 12K, and 13. The term *dusttight* is typically used in conjunction with Enclosure Types 3, 3S, 3SX, 3X, 4, 4X, 5, 6, 6P, 12, 12K, and 13.

Informational Note No. 2: Ingress protection (IP) ratings may be found in ANSI/IEC 60529, *Degrees of Protection Provided by Enclosures*. IP ratings are not a substitute for Enclosure Type ratings.

Informational Note No. 3: Dusttight-rated enclosures are permitted in hazardous locations in accordance with 502.10(B)(4), 503.10(A)(2), and 506.15(C)(8).

Informational Note No. 4: Dusttight enclosures are suitable for use in unclassified locations and in Class II, Division 2; Class III; and Zone 22 hazardous (classified) locations.

Statement of Problem and Substantiation for Public Comment

The submitter of PI 453 is correct. Conduit is not the correct term for this rule. Raceways other than conduits, for example wireways and EMT connect to enclosures.

Related Item

- Public Input No. 453-NFPA 70-2017

Submitter Information Verification

Submitter Full Name: Don Ganiere

Organization: [Not Specified]

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 07 18:46:05 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Don Ganiere, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Don Ganiere, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 51-NFPA 70-2018 [Section No. 110.28]

110.28 Enclosure Types.

Enclosures (other than surrounding fences or walls covered in 110.31) of switchboards, switchgear, 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, fire pump motors, and motor controllers, rated not over 1000 volts nominal and intended for such locations, shall be marked with an enclosure-type number as shown in Table 110.28.

Table 110.28 shall be used for selecting these enclosures for use in specific locations other than hazardous (classified) locations. The enclosures are not intended to protect against conditions such as condensation, icing, corrosion, or contamination that may occur within the enclosure or enter via the conduit or unsealed openings.

Table 110.28 Enclosure Selection

Provides a Degree of Protection Against the Following Environmental Conditions	For Outdoor Use									
	Enclosure Type Number									
	3	3R	3S	3X	3RX	3SX	4	4X	6	6P
Incidental contact with the enclosed equipment	X	X	X	X	X	X	X	X	X	X
Rain, snow, and sleet	X	X	X	X	X	X	X	X	X	X
Sleet*	—	—	X	—	—	X	—	—	—	—
Windblown dust	X	—	X	X	—	X	X	X	X	X
Hosedown	—	—	—	—	—	—	X	X	X	X
Corrosive agents	—	—	—	X	X	X	—	X	—	X
Temporary submersion	—	—	—	—	—	—	—	—	X	X
Prolonged submersion	—	—	—	—	—	—	—	—	—	X

Provides a Degree of Protection Against the Following Environmental Conditions	For Indoor Use									
	Enclosure Type Number									
	1	2	4	4X	5	6	6P	12	12K	13
Incidental contact with the enclosed equipment	X	X	X	X	X	X	X	X	X	X
Falling dirt	X	X	X	X	X	X	X	X	X	X
Falling liquids and light splashing	—	X	X	X	X	X	X	X	X	X
Circulating dust, lint, fibers, and flyings	—	—	X	X	—	X	X	X	X	X
Settling airborne dust, lint, fibers, and flyings	—	—	X	X	X	X	X	X	X	X
Hosedown and splashing water	—	—	X	X	—	X	X	—	—	—
Oil and coolant seepage	—	—	—	—	—	—	—	X	X	X
Oil or coolant spraying and splashing	—	—	—	—	—	—	—	—	—	X
Corrosive agents	—	—	—	X	—	—	X	—	—	—
Temporary submersion	—	—	—	—	—	X	X	—	—	—
Prolonged submersion	—	—	—	—	—	—	X	—	—	—

*Mechanism shall be operable when ice covered.

Informational Note No. 1: The term *raintight* is typically used in conjunction with Enclosure Types 3, 3S, 3SX, 3X, 4, 4X, 6, and 6P. The term *rainproof* is typically used in conjunction with Enclosure Types 3R and 3RX. The term *watertight* is typically used in conjunction with Enclosure Types 4, 4X, 6, and 6P. The term *driptight* is typically used in conjunction with Enclosure Types 2, 5, 12, 12K, and 13. The term *dusttight* is typically used in conjunction with Enclosure Types 3, 3S, 3SX, 3X, 4, 4X, 5, 6, 6P, 12, 12K, and 13.

Informational Note No. 2: Ingress protection (IP) ratings may be found in ANSI/IEC 60529, *Degrees of Protection Provided by Enclosures*. IP ratings are not a substitute for Enclosure Type ratings.

Informational Note No. 3: Dusttight ~~rated~~ enclosures are permitted suitable for use in hazardous locations in accordance with 502.10(B)(4), 503.10(A)(2), and 506.15(C)(8).

Informational Note No. 4: Dusttight enclosures are suitable for use in unclassified locations and in Class II, Division 2; Class III; and Zone 22 hazardous (classified) locations.

Statement of Problem and Substantiation for Public Comment

The Informational Note No. 3 is being correlated for consistency with Informational Note No. 4. NEMA supports the relocation of Informational Notes 3 and 4 under the Table 110.28 and the location of Informational Note No. 1 under Table 110.28.

Related Item

- FR 8672

Submitter Information Verification

Submitter Full Name: Vince Baclawski

Organization: Nema

Street Address:

City:

State:

Zip:

Submittal Date: Wed Jun 27 14:26:41 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Vince Baclawski, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Vince Baclawski, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 181-NFPA 70-2018 [Section No. 110.31(A)(4)]****(4)** Locks.

Doors shall be equipped with locks, and doors shall be kept locked, with access allowed only to qualified persons. Personnel doors shall open in the direction of egress and be equipped with listed panic hardware or listed fire exit hardware.

Statement of Problem and Substantiation for Public Comment

This public comment is submitted on behalf of a task group appointed by the NEC Correlating Committee. The members of the Task Group are David Hittinger, John Kovacik, and Robert Osborne. The task group was appointed to identify areas in the Code® where “listed panic hardware” is required to expand the requirement to address both “listed panic hardware” and “listed fire exit hardware” as both types of hardware are evaluated to the Standard for Panic Hardware, UL 305, with “listed fire exit hardware” evaluated to both UL 305 AND the Standard for Positive Pressure Fire Tests of Door Assemblies, UL 10C. This action is taken to ensure consistency throughout the Code® where “panic hardware” is specified. Other changes to the verbiage may be included with the specific Public Comment, with the goal of establishing consistency with how these requirements are stated. Changes to Section 110.26(C)(3), as detailed in FR 8658, serve as the template for these revisions.

Related Item

- FR 8658

Submitter Information Verification

Submitter Full Name: Robert Osborne

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jul 09 09:06:54 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Robert Osborne, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Robert Osborne, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 520-NFPA 70-2018 [Section No. 110.31(A)(5)]

(5) Transformers.

Where a transformer is installed in a vault as required by Article 450, the vault shall be constructed in accordance with the requirements of Part III of Article 450.

Informational Note No. 1: For additional information, see ANSI/ASTM E119-2015 2018a , *Method for Fire Tests of Building Construction and Materials*, and NFPA 80-2016, *Standard for Fire Doors and Other Opening Protectives*.

Informational Note No. 2: A typical 3-hour construction is 150 mm (6 in.) thick reinforced concrete.

Statement of Problem and Substantiation for Public Comment

date update

Related Item

- FR8682

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler

Organization: GBH International

Street Address:

City:

State:

Zip:

Submission Date: Thu Aug 09 18:49:27 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Marcelo Hirschler, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Marcelo Hirschler, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 182-NFPA 70-2018 [Section No. 110.33(A)(3)]****(3)** Personnel Doors.

Where there are personnel doors 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 doors shall open in the direction of egress and be equipped with listed panic hardware or listed fire exit hardware.

Statement of Problem and Substantiation for Public Comment

This public comment is submitted on behalf of a task group appointed by the NEC Correlating Committee. The members of the Task Group are David Hittinger, John Kovacik, and Robert Osborne. The task group was appointed to identify areas in the Code® where “listed panic hardware” is required to expand the requirement to address both “listed panic hardware” and “listed fire exit hardware” as both types of hardware are evaluated to the Standard for Panic Hardware, UL 305, with “listed fire exit hardware” evaluated to both UL 305 AND the Standard for Positive Pressure Fire Tests of Door Assemblies, UL 10C. This action is taken to ensure consistency throughout the Code® where “panic hardware” is specified. Other changes to the verbiage may be included with the specific Public Comment, with the goal of establishing consistency with how these requirements are stated. Changes to Section 110.26(C)(3), as detailed in FR 8658, serve as the template for these revisions.

Related Item

- FR 8658

Submitter Information Verification

Submitter Full Name: Robert Osborne

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submittal Date: Mon Jul 09 09:10:59 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Robert Osborne, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Robert Osborne, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 1175-NFPA 70-2018 [Annex A]

Informative Annex A Product Safety Standards

Informative Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only.

This informative annex provides a list of product safety standards used for product listing where that listing is required by this *Code*. It is recognized that this list is current at the time of publication but that new standards or modifications to existing standards can occur at any time while this edition of the *Code* is in effect.

This informative annex does not form a mandatory part of the requirements of this *Code* but is intended to identify for the *Code* users the standards upon which *Code* requirements have been based.

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
110	UL 310	Electrical Quick-Connect Terminals
	UL 305	Panic Hardware
	UL 486A-486B	Wire Connectors
	UL 486C	Splicing Wire Connectors
	UL 486D	Sealed Wire Connector Systems
	UL 486E	Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
	UL 486F	Bare and Covered Ferrules
	UL 486G	Sealed Twist-On Connecting Devices
	UL 510	Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
	UL Subject 546	Conductor Termination Compounds
	UL 2459	Insulated Multi-Pole Splicing Wire Connectors
210	UL 943	Ground-Fault Circuit-Interrupters
	UL 1699	Arc-Fault Circuit-Interrupters
230	UL 1053	Ground-Fault Sensing and Relaying Equipment
	UL 2735	Electric Utility Meters
240	UL 198M	Mine-Duty Fuses
	UL 248-1	Low-Voltage Fuses — Part 1: General Requirements
	UL 248-2	Low-Voltage Fuses — Part 2: Class C Fuses
	UL 248-3	Low-Voltage Fuses — Part 3: Class CA and CB Fuses
	UL 248-4	Low-Voltage Fuses — Part 4: Class CC Fuses
	UL 248-5	Low-Voltage Fuses — Part 5: Class G Fuses
	UL 248-6	Low-Voltage Fuses — Part 6: Class H Renewable Fuses
	UL 248-7	Low-Voltage Fuses — Part 7: Class H Renewable Fuses
	UL 248-8	Low-Voltage Fuses — Part 8: Class J Fuses
	UL 248-9	Low-Voltage Fuses — Part 9: Class K Fuses
	UL 248-10	Low-Voltage Fuses — Part 10: Class L Fuses
	UL 248-11	Low-Voltage Fuses — Part 11: Plug Fuses
	UL 248-12	Low-Voltage Fuses — Part 12: Class R Fuses
	UL 248-13	Low-Voltage Fuses — Part 13: Semiconductor Fuses
	UL 248-14	Low-Voltage Fuses — Part 14: Supplemental Fuses
	UL 248-15	Low-Voltage Fuses — Part 15: Class T Fuses
	UL 248-16	Low-Voltage Fuses — Part 16: Test Limiters
	UL Subject 248-17	Low-Voltage Fuses — Part 17: Class CF Fuses
	UL 489	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
250	UL 467	Grounding and Bonding Equipment
280	IEEE C62.1	Surge Arresters — Gapped Silicon-Carbide Surge Arresters for AC Power Circuits

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
	IEEE C62.11	Surge Arresters — Metal-Oxide Surge Arresters for AC Power Circuits
285	UL 1449	Surge Protective Devices
300	UL 263	Fire Tests of Building Construction and Materials
	UL Subject 267	Wire Pulling Compounds
	UL 514B	Conduit, Tubing, and Cable Fittings
	UL 635	Insulated Bushings
	UL 1479	Fire Tests of Through-Penetration Firestops
	UL 1565	Positioning Devices
	UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
	UL 2043	Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
	UL Subject 2419	Electrically Conductive Corrosion Resistant Compounds
	UL 60730-1	Automatic Electrical Controls — Part 1: General Requirements
310	UL 44	Thermoset-Insulated Wires and Cables
	UL 66	Fixture Wire
	UL 83	Thermoplastic-Insulated Wires and Cables
	UL 1063	Machine-Tool Wires and Cables
312	UL 414	Meter Sockets
314	UL 50	Enclosures for Electrical Equipment
	UL 50E	Enclosures for Electrical Equipment, Environmental Considerations
	UL 514A	Metallic Outlet Boxes
	UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
	UL 514D	Cover Plates for Flush-Mounted Wiring Devices
320	UL 4	Armored Cable
328	UL 1072	Medium-Voltage Power Cables
330	UL 1569	Metal-Clad Cables
334	UL 719	Nonmetallic-Sheathed Cables
	UL Subject 2256	Nonmetallic Sheathed Cable Interconnects
336	UL 1277	Electrical Power and Control Tray Cables with Optional Optical-Fiber Members
338	UL 854	Service-Entrance Cables
340	UL 493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables
342	UL 1242	Electrical Intermediate Metal Conduit — Steel
344	UL 6	Electrical Rigid Metal Conduit — Steel
	UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel
348	UL 1	Flexible Metal Conduit
350	UL 360	Liquid-Tight Flexible Steel Conduit
352	UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
353	UL 651A	Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit
354	UL 1990	Nonmetallic Underground Conduit with Conductors
355	UL 2420	Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
	UL 2515A	Supplemental Requirements for Extra-Heavy Wall Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
356	UL 1660	Liquid-Tight Flexible Nonmetallic Conduit
358	UL 797A	Electrical Metallic Tubing — Aluminum

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
	UL 797	Electrical Metallic Tubing — Steel
360	UL Subject 1652	Flexible Metallic Tubing
362	UL 1653	Electrical Nonmetallic Tubing
368	UL 1953	Power Distribution Blocks
	UL Subject 509	Bus Drop Cable
	UL 857	Busways
374	UL 209	Cellular Metal Floor Raceways and Fittings
376	UL 870	Wireways, Auxiliary Gutters, and Associated Fittings
380	UL Subject 111	Multioutlet Assemblies
384	UL 5B	Strut-Type Channel Raceways and Fittings
386	UL 5	Surface Metal Raceways and Fittings
388	UL 5A	Nonmetallic Surface Raceways and Fittings
390	UL 884	Underfloor Raceways and Fittings
392	UL 568	Nonmetallic Cable Tray Systems
400	UL 62	Flexible Cords and Cables
	UL 817	Cord Sets and Power-Supply Cords
	UL Subject 1650	Portable Power Cable
404	UL 20	General-Use Snap Switches
	UL 98	Enclosed and Dead-Front Switches
	UL Subject 98A	Open-Type Switches
	UL 363	Knife Switches
	UL 773	Plug-In Locking Type Photocontrols for Use with Area Lighting
	UL 773A	Nonindustrial Photoelectric Switches for Lighting Control
	UL 917	Clock-Operated Switches
	UL 1429	Pullout Switches
406	UL 498	Attachment Plugs and Receptacles
	UL 1682	Plugs, Receptacles, and Cable Connectors, of the Pin and Sleeve Type
408	UL 67	Panelboards
	UL 891	Switchboards
	UL 1558	Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear
	UL 60947-1	Low-Voltage Switchgear and Controlgear — Part 1: General Rules
	UL 60947-4-1	Low-Voltage Switchgear and Controlgear — Part 4-1: Contactors and Motor-Starters — Electromechanical Contactors and Motor-Starters
	UL 60947-4-2	Voltage Switchgear and Controlgear - Part 4-2: Contactors and Motor-Starters — AC Semiconductor Motor Controllers and Starters
	UL 60947-5-1	Low-Voltage Switchgear and Controlgear — Part 5-1: Control Circuit Devices and Switching Elements — Electromechanical Control Circuit Devices
	UL 60947-5-2	Low-Voltage Switchgear and Controlgear — Part 5-2: Control Circuit Devices and Switching Elements — Proximity Switches
	UL 60947-7-1	Low-Voltage Switchgear And Controlgear — Part 7-1: Ancillary Equipment — Terminal Blocks for Copper Conductors
	UL 60947-7-2	Low-Voltage Switchgear and Controlgear — Part 7-2: Ancillary Equipment — Protective Conductor Terminal Blocks for Copper Conductors
	UL 60947-7-3	Low-Voltage Switchgear and Controlgear — Part 7-3: Ancillary Equipment — Safety Requirements for Fuse Terminal Blocks
409	UL 508	Industrial Control Equipment

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
410	UL 508A	Industrial Control Panels
	UL 65	Wired Cabinets
	UL 153	Portable Electric Luminaires
	UL 496	Lampholders
	UL 542	Fluorescent Lamp Starters
	UL 588	Seasonal and Holiday Decorative Products
	UL 935	Fluorescent-Lamp Ballasts
	UL 1029	High-Intensity-Discharge Lamp Ballasts
	UL Subject 1029A	Ignitors and Related Auxiliaries for HID Lamp Ballasts
	UL 1574	Track Lighting Systems
	UL 1598	Luminaires
	UL 1598B	Luminaire Reflector Kits for Installation on Previously Installed Fluorescent Luminaires, Supplemental Requirements
	UL 1598C	Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits
	UL 1993	Self-Ballasted Lamps and Lamp Adapters
	UL 2388	Flexible Lighting Products
	UL 8750	Light Emitting Diode (LED) Equipment for Use in Lighting Products
	UL 8752	Organic Light Emitting Diode (OLED) Panels
	UL 8753	Field-Replaceable Light Emitting Diode (LED) Light Engines
	UL 8754	Holders, Bases and Connectors for Solid-State (LED) Light Engines and Arrays
	UL Subject 8800	Horticultural Lighting Equipment
411	UL 234	Low-Voltage Lighting Fixtures for Use in Recreational Vehicles
	UL 1838	Low-Voltage Landscape Lighting Systems
	UL 2108	Low-Voltage Lighting Systems
422	UL 22	Amusement and Gaming Machines
	UL 73	Motor-Operated Appliances
	UL 122	Photographic Equipment
	UL 141	Garment Finishing Appliances
	UL 174	Household Electric Storage Tank Water Heaters
	UL 197	Commercial Electric Cooking Appliances
	UL 283	Air Fresheners and Deodorizers
	UL 399	Drinking Water Coolers
	UL 430	Waste Disposers
	UL 474	Dehumidifiers
	UL 507	Electric Fans
	UL 574	Electric Oil Heaters
	UL 621	Ice Cream Makers
	UL 705	Power Ventilators
	UL 710B	Recirculating Systems
	UL 749	Household Dishwashers
	UL 751	Vending Machines
	UL 763	Motor-Operated Commercial Food Preparing Machines
	UL 858	Household Electric Ranges
	UL 875	Electric Dry-Bath Heaters
	UL 921	Commercial Dishwashers
	UL 923	Microwave Cooking Appliances

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
	UL 962	Household and Commercial Furnishings
	UL 962A	Furniture Power Distribution Units
	UL 1017	Vacuum Cleaners, Blower Cleaners, and Household Floor Finishing Machines
	UL 1026	Household Electric Cooking and Food Serving Appliances
	UL 1278	Movable and Wall- or Ceiling-Hung Electric Room Heaters
	UL 1453	Electric Booster and Commercial Storage Tank Water Heaters
	UL 1727	Commercial Electric Personal Grooming Appliances
	UL 1776	High-Pressure Cleaning Machines
	UL 60335-2-40	Household and Similar Electrical Appliances, Part 2: Particular Requirements for Heating and Cooling
	UL 60335-2-24	Household and Similar Electrical Appliances, Part 2: Particular Requirements for Refrigerating Appliances, Ice-Cream Appliances, and Ice-Makers
424	UL 499	Electric Heating Appliances
	UL 834	Heating, Water Supply, and Power Boilers — Electric
	UL 873	Temperature-Indicating and -Regulating Equipment
	UL 1042	Electric Baseboard Heating Equipment
	UL 1673	Electric Space Heating Cables
	UL 1693	Electric Radiant Heating Panels and Heating Panel Sets
	UL 1995	Heating and Cooling Equipment
	UL 1996	Electric Duct Heaters
	UL 2021	Fixed and Location-Dedicated Electric Room Heaters
426	UL Subject 1588	Roof and Gutter De-Icing Cable Units
427	IEEE 515	Electrical Resistance Heat Tracing for Industrial Applications
	UL 515	Electrical Resistance Heat Tracing for Commercial and Industrial Applications
	UL Subject 2049	Residential Pipe Heating Cable
430	UL 508C	Power Conversion Equipment
	UL 845	Motor Control Centers
	UL 1004-1	Rotating Electrical Machines — General Requirements
	UL 1004-2	Impedance Protected Motors
	UL 1004-3	Thermally Protected Motors
	UL 2111	Overheating Protection for Motors
	UL 1004-6	Servo and Stepper Motors
	UL 1004-7	Electronically Protected Motors
	UL 1004-8	Inverter Duty Motors
	UL 1004-9	Medium Voltage and Form Wound Motors
	UL 60034-1	Rotating Electrical Machines
440	UL 250	Household Refrigerators and Freezers
	UL 412	Refrigeration Unit Coolers
	UL 416	Refrigerated Medical Equipment
	UL 427	Refrigerating Units
	UL 471	Commercial Refrigerators and Freezers
	UL 484	Room Air Conditioners
	UL 541	Refrigerated Vending Machines
	UL 563	Ice Makers
445	UL 1004-4	Electric Generators
450	UL 506	Specialty Transformers

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
	UL 5085-1	Low Voltage Transformers — Part 1: General Requirements
	UL 5085-2	Low Voltage Transformers — Part 2: General Purpose Transformers
	UL 1062	Unit Substations
	UL 1561	Dry-Type General Purpose and Power Transformers
	UL 1562	Transformers, Distribution, Dry-Type — Over 600 Volts
460	UL 810	Capacitors
	UL 810A	Electrochemical Capacitors
480	UL 1642	Lithium Batteries
	UL 1973	Batteries for Use in Light Electric Rail (LER) Applications and Stationary Applications
	UL 1989	Standby Batteries
	UL 2054	Household and Commercial Batteries
490	UL 347	Medium-Voltage AC Contactors, Controllers, and Control Centers
	UL Subject 347A	Medium Voltage Power Conversion Controllers
	UL Subject 347B	Medium Voltage Motor Controllers, Up to 15kV
	UL Subject 347C	Medium Voltage Solid State Resistive Load Controllers, Up to 15kV
500	ANSI/ISA 12.12.01	Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations
	ANSI/ISA-12.27.01	Requirements for Process Sealing Between Electrical Systems and Potentially Flammable or Combustible Process Fluids
	UL 698A	Industrial Control Panels Relating to Hazardous (Classified) Locations
	UL 844	Luminaires for Use in Hazardous (Classified) Locations
	UL 1203	Explosionproof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations
	UL 2075	Gas and Vapor Detectors and Sensors
	UL 2225	Cable and Cable Fittings for Use in Hazardous (Classified) Locations
	UL 60079-29-1	Explosive Atmospheres — Part 29-1: Gas Detectors — Performance Requirements of Detectors for Flammable Gases
501	UL 60079-15	Electrical Apparatus for Explosive Gas Atmospheres — Part 15: Type of Protection “n”
	UL 60079-0	Explosive Gas Atmospheres — Part 0: Equipment — General Requirements
	UL 60079-7	Explosive Gas Atmospheres — Part 7: Increased Safety “e”
	UL 60079-1	Explosive Gas Atmospheres — Part 1: Type of Protection – Flameproof “d”
	UL 60079-5	Explosive Gas Atmospheres — Part 5: Type of Protection – Powder Filling “q”
	UL 60079-6	Explosive Gas Atmospheres — Part 6: Type of Protection – Oil Immersion “o”
504	UL 913	Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations
505	UL 60079-11	Explosive Atmospheres — Part 11: Equipment Protection by Intrinsic Safety “i”
	UL 60079-18	Electrical Apparatus for Use in Class I, Zone 1 Hazardous (Classified) Locations Type of Protection — Encapsulation “m”
506	UL 61241-18	Electrical Apparatus for Use in Zone 20, Zone 21, and Zone 22 Hazardous (Classified) Locations — Protection by Encapsulation “mD”
	UL 61241-1	Electrical Apparatus for Use in Zone 21 and Zone 22 Hazardous (Classified) Locations — Protection by Enclosure “tD”
	UL 61241-0	Electrical Apparatus for Use in Zone 20, Zone 21, and Zone 22 Hazardous (Classified) Locations — General Requirements
	UL 61241-11	Electrical Apparatus for Use in Zone 20, Zone 21, and Zone 22 Hazardous (Classified) Locations — Protection by Intrinsic Safety “iD”

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
	UL 61241-2	Electrical Apparatus for Use in Zone 21 and Zone 22 Hazardous (Classified) Locations — Protection by Pressurization “pD”
511	UL 201	Garage Equipment
	UL 1564	Industrial Battery Chargers
517	UL 1022	Line Isolation Monitors
	UL 1047	Isolated Power Systems Equipment
	UL 60601-1	Medical Electrical Equipment — Part 1: General Requirements for Safety
520	UL Subject 334	Theater Lighting Distribution and Control Equipment
	UL 1573	Stage and Studio Luminaires and Connector Strips
	UL 1640	Portable Power-Distribution Equipment
550	UL Subject 1462	Mobile Home Pipe Heating Cable
551	UL 231	Power Outlets
600	UL 48	Electric Signs
	UL 814	Gas-Tube-Sign Cable
	UL 879	Electric Sign Components
	UL 879A	LED Sign and Sign Retrofit Kits
	UL Subject 879B	Polymeric Enclosure Systems for the Splice Between Neon Tubing Electrode Leads and GTO Cable, and the GTO Cable Leading to the Splice
	UL 2161	Neon Transformers and Power Supplies
604	UL 183	Manufactured Wiring Systems
605	UL 1286	Office Furnishings
	UL 962	Household and Commercial Furnishings
610	UL Subject 2273	Festoon Cable
625	UL 2202	Electric Vehicle (EV) Charging System Equipment
	UL 2231-1	Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits; Part 1: General Requirements
	UL 2231-2	Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits; Part 2: Particular Requirements for Protection Devices for Use in Charging Systems
	UL 2251	Plugs, Receptacles and Couplers for Electrical Vehicles
	UL 2580	Batteries for Use in Electric Vehicles
	UL 2594	Electric Vehicle Supply Equipment
	UL Subject 9741	Bidirectional Electric Vehicle (EV) Charging System Equipment
626	UL 1686	Pin and Sleeve Configurations
630	UL 551	Transformer-Type Arc-Welding Machines
640	UL 813	Commercial Audio Equipment
	UL 1419	Professional Video and Audio Equipment
	UL 1492	Audio-Video Products and Accessories
	UL 1711	Amplifiers for Fire Protective Signaling Systems
	UL 6500	Audio/Video and Musical Instrument Apparatus for Household, Commercial, and Similar General Use
	UL 60065	Audio, Video and Similar Electronic Apparatus — Safety Requirements
	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
645	UL 1690	Data-Processing Cable
	UL 1778	Uninterruptible Power Systems
	UL 60950-1	Information Technology Equipment Safety — Part 1: General Requirements

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
	UL 60950-21	Information Technology Equipment Safety — Part 21: Remote Power Feeding
	UL 60950-22	Information Technology Equipment Safety — Part 22: Equipment to be Installed Outdoors
	UL 60950-23	Information Technology Equipment Safety — Part 23: Large Data Storage Equipment
646	UL Subject 2755	Modular Data Centers
670	UL 61800-5-1	Adjustable Speed Electrical Power Drive Systems — Part 5-1: Safety Requirements — Electrical, Thermal and Energy
680	UL 379	Power Units for Fountain, Swimming Pool, and Spa Luminaires
	UL 676	Underwater Luminaires and Submersible Junction Boxes
	UL 676A	Potting Compounds for Swimming Pool, Fountain, and Spa Equipment
	UL 1081	Swimming Pool Pumps, Filters, and Chlorinators
	UL 1241	Isolated Power Systems Equipment
	UL 1261	Electric Water Heaters for Pools and Tubs
	UL 1563	Electric Spas, Equipment Assemblies, and Associated Equipment
	UL 1795	Hydromassage Bathtubs
690	UL 98B	Enclosed and Dead-Front Switches for Use in Photovoltaic Systems
	UL 489B	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures for Use with Photovoltaic (PV) Systems
	UL Subject 508I	Manual Disconnect Switches Intended for Use in Photovoltaic Systems
	UL Subject 1699B	Photovoltaic DC Arc-Fault Circuit Protection
	UL 1703	Flat-Plate Photovoltaic Modules and Panels
	UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources
	UL Subject 2579	Low-Voltage Fuses — Fuses for Photovoltaic Systems
	UL Subject 3703	Solar Trackers
	UL Subject 3730	Photovoltaic Junction Boxes
	UL 4703	Photovoltaic Wire
	UL 6703	Connectors for Use in Photovoltaic Systems
	UL Subject 6703A	Multi-Pole Connectors for Use in Photovoltaic Systems
	UL Subject 8703	Concentrator Photovoltaic Modules and Assemblies
	UL Subject 9703	Distributed Wiring Harnesses
	UL 62109-1	Power Converters for use in Photovoltaic Power Systems — Part 1: General Requirements
	UL 3003	Distributed Generation Cables
	UL 61730-1	Photovoltaic (PV) Module Safety Qualification — Part 1: Requirements for Construction
	UL 61730-2	Photovoltaic (PV) Module Safety Qualification — Part 2: Requirements for Testing
	UL 3741	Photovoltaic Hazard Control
694	UL Subject 489C	Molded-Case Circuit Breakers and Molded-Case Switches for Use with Wind Turbines
	UL Subject 6140	Wind Turbine Generating Systems

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
	UL 6141	Wind Turbines Permitting Entry of Personnel
	UL 6142	Wind Turbine Generating Systems — Small
695	UL 218	Fire Pump Controllers
	UL 448	Centrifugal Stationary Pumps for Fire-Protection Service
	UL 448B	Residential Fire Pumps Intended for One- and Two-Family Dwellings and Manufactured Homes
	UL 448C	Stationary, Rotary-Type, Positive-Displacement Pumps for Fire Protection Service
	UL 1004-5	Fire Pump Motors
700	UL 924	Emergency Lighting and Power Equipment
	UL 1008	Transfer Switch Equipment
	UL 1008A	Medium-Voltage Transfer Switches
	UL 2200	Stationary Engine Generator Assemblies
706	UL 9540	Energy Storage Systems and Equipment
725	UL 5C	Surface Raceways and Fittings for Use with Data, Signal and Control Circuits
	UL 13	Power-Limited Circuit Cables
	UL 1012	Power Units Other Than Class 2
	UL 1310	Class 2 Power Units
	UL 1666	Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
	UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables
	UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers
	UL Subject 9990	Information and Communication Technology (ICT) Power Cables
727	UL 2250	Instrumentation Tray Cable
728	UL Subject 1724	Fire Tests for Electrical Circuit Protective Systems
	UL 2196	Tests for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables UL 2196
		Fire Resistive Cables, Tests for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables UL 2196
750	UL 916	Energy Management Equipment
760	UL 268	Smoke Detectors for Fire Alarm Signaling Systems
	UL 268A	Smoke Detectors for Duct Application
	UL 497B	Protectors for Data Communication and Fire Alarm Circuits
	UL 1424	Cables for Power-Limited Fire-Alarm Circuits
	UL 1425	Cables for Non-Power-Limited Fire-Alarm Circuits
	UL 1480	Speakers for Fire Alarm and Signaling Systems, Including Accessories
770	UL 1651	Optical Fiber Cable
	UL 2024	Optical Fiber and Communication Cable Raceway
800	UL 444	Communications Cables
	UL 489A	Circuit Breakers for Use in Communication Equipment
	UL 497	Protectors for Paired-Conductor Communications Circuits
	UL 497A	Secondary Protectors for Communications Circuits
	UL 497C	Protectors for Coaxial Communications Circuits
	UL Subject 497E	Protectors for Antenna Lead-In Conductors
	UL Subject 523	Telephone Service Drop Wire
	UL 1863	Communication Circuit Accessories

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
810	UL 150	Antenna Rotators
	UL 452	Antenna-Discharge Units
820	UL 1655	Community-Antenna Television Cables

Additional Proposed Changes

<u>File Name</u>	<u>Description Approved</u>
CN_137.pdf	70_CN 137

Statement of Problem and Substantiation for Public Comment

NOTE: This Public Comment appeared as CC Note No. 137 in the First Draft Report on First Revision No. 8759.

It was the action of the Correlating Committee to direct that Code-Making Panel 1 clarify why UL 2196 has two titles, neither title shown is correct.

This action will be considered as a public comment.

The Correlating Committee notes that the correct title is;

Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables

Related Item

- FR 8759

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC

Organization: NEC Correlating Committee

Street Address:

City:

State:

Zip:

Submission Date: Fri Aug 24 10:05:21 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, CC on NEC-AAC, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am CC on NEC-AAC, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Correlating Committee Note No. 137-NFPA 70-2018 [Annex A]

Submitter Information Verification

Submitter Full Name: Erik Hohengasser

Committee:

Submittal Date: Thu May 10 15:27:33 EDT 2018

Committee Statement and Meeting Notes

Committee Statement: It was the action of the Correlating Committee to direct that Code-Making Panel 1 clarify why UL 2196 has two titles, neither title shown is correct.

This action will be considered as a public comment.

The Correlating Committee notes that the correct title is;

Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables

First Revision No. 8759-NFPA 70-2018 [Annex A]

Ballot Results

✓ **This item has passed ballot**

12 Eligible Voters

0 Not Returned

12 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Affirmative All

Brunssen, James E.

Dressman, Kevin L.

Hickman, Palmer L.

Hittinger, David L.

Holub, Richard A.

Johnston, Michael J.

Kovacik, John R.

Manche, Alan

McDaniel, Roger D.

Pierce, James F.

Saporita, Vincent J.

Williams, David A.



Public Comment No. 675-NFPA 70-2018 [Annex A]

Informative Annex A Product Safety Standards

Informative Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only.

This informative annex provides a list of product safety standards used for product listing where that listing is required by this Code. It is recognized that this list is current at the time of publication but that new standards or modifications to existing standards can occur at any time while this edition of the Code is in effect.

This informative annex does not form a mandatory part of the requirements of this Code but is intended to identify for the Code users the standards upon which Code requirements have been based.

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
110	UL 310	Electrical Quick-Connect Terminals
-	UL 305	Panic Hardware
-	UL 486A-486B	Wire Connectors
-	UL 486C	Splicing Wire Connectors
-	UL 486D	Sealed Wire Connector Systems
-	UL 486E	Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
-	UL 486F	Bare and Covered Ferrules
-	UL 486G	Sealed Twist-On Connecting Devices
-	UL 510	Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
-	UL Subject 546	Conductor Termination Compounds
-	UL 2459	Insulated Multi-Pole Splicing Wire Connectors
210	UL 943	Ground-Fault Circuit-Interruption
-	UL 1699	Arc-Fault Circuit-Interruption
230	UL 1053	Ground-Fault Sensing and Relaying Equipment
-	UL 2735	Electric Utility Meters
240	UL 198M	Mine-Duty Fuses
-	UL 248-1	Low-Voltage Fuses — Part 1: General Requirements
-	UL 248-2	Low-Voltage Fuses — Part 2: Class C Fuses
-	UL 248-3	Low-Voltage Fuses — Part 3: Class CA and CB Fuses
-	UL 248-4	Low-Voltage Fuses — Part 4: Class CC Fuses
-	UL 248-5	Low-Voltage Fuses — Part 5: Class G Fuses

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
-	UL 248-6	Low-Voltage Fuses — Part 6: Class H Renewable Fuses
-	UL 248-7	Low-Voltage Fuses — Part 7: Class H Renewable Fuses
-	UL 248-8	Low-Voltage Fuses — Part 8: Class J Fuses
-	UL 248-9	Low-Voltage Fuses — Part 9: Class K Fuses
-	UL 248-10	Low-Voltage Fuses — Part 10: Class L Fuses
-	UL 248-11	Low-Voltage Fuses — Part 11: Plug Fuses
-	UL 248-12	Low-Voltage Fuses — Part 12: Class R Fuses
-	UL 248-13	Low-Voltage Fuses — Part 13: Semiconductor Fuses
-	UL 248-14	Low-Voltage Fuses — Part 14: Supplemental Fuses
-	UL 248-15	Low-Voltage Fuses — Part 15: Class T Fuses
-	UL 248-16	Low-Voltage Fuses — Part 16: Test Limiters
-	UL Subject 248-17	Low-Voltage Fuses — Part 17: Class CF Fuses
-	UL 489	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit- Breaker Enclosures
250	UL 467	Grounding and Bonding Equipment
280	IEEE C62.1	Surge Arresters — Gapped Silicon- Carbide Surge Arresters for AC Power Circuits
-	IEEE C62.11	Surge Arresters — Metal- Oxide Surge Arresters for AC Power Circuits
285	UL 1449	Surge Protective Devices
300	UL 263	Fire Tests of Building Construction and Materials
-	UL Subject 267	Wire Pulling Compounds
-	UL 514B	Conduit, Tubing, and Cable Fittings
-	UL 635	Insulated Bushings
-	UL 1479	Fire Tests of Through- Penetration Firestops
-	UL 1565	Positioning Devices

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
-	UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
-	UL 2043	Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
-	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
-	UL Subject 2419	Electrically Conductive Corrosion Resistant Compounds
-	UL 60730-1	Automatic Electrical Controls — Part 1: General Requirements
310	UL 44	Thermoset-Insulated Wires and Cables
-	UL 66	Fixture Wire
-	UL 83	Thermoplastic-Insulated Wires and Cables
-	UL 1063	Machine-Tool Wires and Cables
312	UL 414	Meter Sockets
314	UL 50	Enclosures for Electrical Equipment
-	UL 50E	Enclosures for Electrical Equipment, Environmental Considerations
-	UL 514A	Metallic Outlet Boxes
-	UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
-	UL 514D	Cover Plates for Flush-Mounted Wiring Devices
320	UL 4	Armored Cable
328	UL 1072	Medium-Voltage Power Cables
330	UL 1569	Metal-Clad Cables
334	UL 719	Nonmetallic-Sheathed Cables
-	UL Subject 2256	Nonmetallic Sheathed Cable Interconnects
336	UL 1277	Electrical Power and Control Tray Cables with Optional Optical-Fiber Members
338	UL 854	Service-Entrance Cables
340	UL 493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
342	UL 1242	Electrical Intermediate Metal Conduit — Steel
344	UL 6	Electrical Rigid Metal Conduit — Steel
-	UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel
348	UL 1	Flexible Metal Conduit
350	UL 360	Liquid-Tight Flexible Steel Conduit
352	UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
353	UL 651A	Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit
354	UL 1990	Nonmetallic Underground Conduit with Conductors
355	UL 2420	Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
-	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
-	UL 2515A	Supplemental Requirements for Extra-Heavy Wall Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
356	UL 1660	Liquid-Tight Flexible Nonmetallic Conduit
358	UL 797A	Electrical Metallic Tubing — Aluminum
-	UL 797	Electrical Metallic Tubing — Steel
360	UL Subject 1652	Flexible Metallic Tubing
362	UL 1653	Electrical Nonmetallic Tubing
368	UL 1953	Power Distribution Blocks
-	UL Subject 509	Bus Drop Cable
-	UL 857	Busways
374	UL 209	Cellular Metal Floor Raceways and Fittings
376	UL 870	Wireways, Auxiliary Gutters, and Associated Fittings
380	UL Subject 111	Multioutlet Assemblies

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
384	UL 5B	Strut-Type Channel Raceways and Fittings
386	UL 5	Surface Metal Raceways and Fittings
388	UL 5A	Nonmetallic Surface Raceways and Fittings
390	UL 884	Underfloor Raceways and Fittings
392	UL 568	Nonmetallic Cable Tray Systems
400	UL 62	Flexible Cords and Cables
-	UL 817	Cord Sets and Power-Supply Cords
-	UL Subject 1650	Portable Power Cable
404	UL 20	General-Use Snap Switches
-	UL 98	Enclosed and Dead-Front Switches
-	UL Subject 98A	Open-Type Switches
-	UL 363	Knife Switches
-	UL 773	Plug-In Locking Type Photocontrols for Use with Area Lighting
-	UL 773A	Nonindustrial Photoelectric Switches for Lighting Control
-	UL 917	Clock-Operated Switches
-	UL 1429	Pullout Switches
406	UL 498	Attachment Plugs and Receptacles
-	UL 1682	Plugs, Receptacles, and Cable Connectors, of the Pin and Sleeve Type
408	UL 67	Panelboards
-	UL 891	Switchboards
-	UL 1558	Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear
-	UL 60947-1	Low-Voltage Switchgear and Controlgear — Part 1: General Rules
-	UL 60947-4-1	Low-Voltage Switchgear and Controlgear — Part 4-1: Contactors and Motor-Starters — Electromechanical Contactors and Motor-Starters
-	UL 60947-4-2	Voltage Switchgear and Controlgear - Part 4-2: Contactors and Motor-Starters — AC Semiconductor Motor Controllers and Starters

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
-	UL 60947-5-1	Low-Voltage Switchgear and Controlgear — Part 5-1: Control Circuit Devices and Switching Elements — Electromechanical Control Circuit Devices
-	UL 60947-5-2	Low-Voltage Switchgear and Controlgear — Part 5-2: Control Circuit Devices and Switching Elements — Proximity Switches
-	UL 60947-7-1	Low-Voltage Switchgear And Controlgear — Part 7-1: Ancillary Equipment — Terminal Blocks for Copper Conductors
-	UL 60947-7-2	Low-Voltage Switchgear and Controlgear — Part 7-2: Ancillary Equipment — Protective Conductor Terminal Blocks for Copper Conductors
-	UL 60947-7-3	Low-Voltage Switchgear and Controlgear — Part 7-3: Ancillary Equipment — Safety Requirements for Fuse Terminal Blocks
409	UL 508	Industrial Control Equipment
-	UL 508A	Industrial Control Panels
410	UL 65	Wired Cabinets
-	UL 153	Portable Electric Luminaires
-	UL 496	Lampholders
-	UL 542	Fluorescent Lamp Starters
-	UL 588	Seasonal and Holiday Decorative Products
-	UL 935	Fluorescent-Lamp Ballasts
-	UL 1029	High-Intensity-Discharge Lamp Ballasts
-	UL Subject 1029A	Ignitors and Related Auxiliaries for HID Lamp Ballasts
-	UL 1574	Track Lighting Systems
-	UL 1598	Luminaires
-	UL 1598B	Luminaire Reflector Kits for Installation on Previously Installed Fluorescent Luminaires, Supplemental Requirements

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
-	UL 1598C	Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits
-	UL 1993	Self-Ballasted Lamps and Lamp Adapters
-	UL 2388	Flexible Lighting Products
-	UL 8750	Light Emitting Diode (LED) Equipment for Use in Lighting Products
-	UL 8752	Organic Light Emitting Diode (OLED) Panels
-	UL 8753	Field-Replaceable Light Emitting Diode (LED) Light Engines
-	UL 8754	Holders, Bases and Connectors for Solid-State (LED) Light Engines and Arrays
-	UL Subject 8800	Horticultural Lighting Equipment
411	UL 234	Low-Voltage Lighting Fixtures for Use in Recreational Vehicles
-	UL 1838	Low-Voltage Landscape Lighting Systems
-	UL 2108	Low-Voltage Lighting Systems
422	UL 22	Amusement and Gaming Machines
-	UL 73	Motor-Operated Appliances
-	UL 122	Photographic Equipment
-	UL 141	Garment Finishing Appliances
-	UL 174	Household Electric Storage Tank Water Heaters
-	UL 197	Commercial Electric Cooking Appliances
-	UL 283	Air Fresheners and Deodorizers
-	UL 399	Drinking Water Coolers
-	UL 430	Waste Disposers
-	UL 474	Dehumidifiers
-	UL 507	Electric Fans
-	UL 574	Electric Oil Heaters
-	UL 621	Ice Cream Makers
-	UL 705	Power Ventilators
-	UL 710B	Recirculating Systems
-	UL 749	Household Dishwashers
-	UL 751	Vending Machines
-	UL 763	Motor-Operated Commercial Food Preparing Machines

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
-	UL 858	Household Electric Ranges
-	UL 875	Electric Dry-Bath Heaters
-	UL 921	Commercial Dishwashers
-	UL 923	Microwave Cooking Appliances
-	UL 962	Household and Commercial Furnishings
-	UL 962A	Furniture Power Distribution Units
-	UL 1017	Vacuum Cleaners, Blower Cleaners, and Household Floor Finishing Machines
-	UL 1026	Household Electric Cooking and Food Serving Appliances
-	UL 1278	Movable and Wall- or Ceiling-Hung Electric Room Heaters
-	UL 1453	Electric Booster and Commercial Storage Tank Water Heaters
-	UL 1727	Commercial Electric Personal Grooming Appliances
-	UL 1776	High-Pressure Cleaning Machines
-	UL 60335-2-40	Household and Similar Electrical Appliances, Part 2: Particular Requirements for Heating and Cooling
-	UL 60335-2-24	Household and Similar Electrical Appliances, Part 2: Particular Requirements for Refrigerating Appliances, Ice-Cream Appliances, and Ice-Makers
424	UL 499	Electric Heating Appliances
-	UL 834	Heating, Water Supply, and Power Boilers — Electric
-	UL 873	Temperature-Indicating and -Regulating Equipment
-	UL 1042	Electric Baseboard Heating Equipment
-	UL 1673	Electric Space Heating Cables
-	UL 1693	Electric Radiant Heating Panels and Heating Panel Sets
-	UL 1995	Heating and Cooling Equipment

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
-	UL 1996	Electric Duct Heaters
-	UL 2021	Fixed and Location-Dedicated Electric Room Heaters
426	UL Subject 1588	Roof and Gutter De-Icing Cable Units
427	IEEE 515	Electrical Resistance Heat Tracing for Industrial Applications
-	UL 515	Electrical Resistance Heat Tracing for Commercial and Industrial Applications
-	UL Subject 2049	Residential Pipe Heating Cable
430	UL 508C	Power Conversion Equipment
-	UL 845	Motor Control Centers
-	UL 1004-1	Rotating Electrical Machines — General Requirements
-	UL 1004-2	Impedance Protected Motors
-	UL 1004-3	Thermally Protected Motors
-	UL 2111	Overheating Protection for Motors
-	UL 1004-6	Servo and Stepper Motors
-	UL 1004-7	Electronically Protected Motors
-	UL 1004-8	Inverter Duty Motors
-	UL 1004-9	Medium Voltage and Form Wound Motors
-	UL 60034-1	Rotating Electrical Machines
440	UL 250	Household Refrigerators and Freezers
-	UL 412	Refrigeration Unit Coolers
-	UL 416	Refrigerated Medical Equipment
-	UL 427	Refrigerating Units
-	UL 471	Commercial Refrigerators and Freezers
-	UL 484	Room Air Conditioners
-	UL 541	Refrigerated Vending Machines
-	UL 563	Ice Makers
445	UL 1004-4	Electric Generators
450	UL 506	Specialty Transformers
-	UL 5085-1	Low Voltage Transformers — Part 1: General Requirements

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>	
	-	UL 5085-2	Low Voltage Transformers — Part 2: General Purpose Transformers
	-	UL 1062	Unit Substations
	-	UL 1561	Dry-Type General Purpose and Power Transformers
	-	UL 1562	Transformers, Distribution, Dry-Type — Over 600 Volts
460	UL 810	Capacitors	
	-	UL 810A	Electrochemical Capacitors
480	UL 1642	Lithium Batteries	
	-	UL 1973	Batteries for Use in Stationary, Vehicle Auxiliary Power, and Light Electric Rail (LER) Applications and Stationary Applications
	UL 1989	Standby Batteries	
	-	UL 2054	Household and Commercial Batteries
490	UL 347	Medium-Voltage AC Contactors, Controllers, and Control Centers	
	-	UL Subject 347A	Medium Voltage Power Conversion Controllers
	-	UL Subject 347B	Medium Voltage Motor Controllers, Up to 15kV
	-	UL Subject 347C	Medium Voltage Solid State Resistive Load Controllers, Up to 15kV
500	ANSI/ISA 12.12.01	Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations	
	-	ANSI/ISA-12.27.01	Requirements for Process Sealing Between Electrical Systems and Potentially Flammable or Combustible Process Fluids
	-	UL 698A	Industrial Control Panels Relating to Hazardous (Classified) Locations
	-	UL 844	Luminaires for Use in Hazardous (Classified) Locations
	-	UL 1203	Explosionproof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified)

Applications

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
		Locations
	-	UL 2075 Gas and Vapor Detectors and Sensors
	-	UL 2225 Cable and Cable Fittings for Use in Hazardous (Classified) Locations
	-	UL 60079-29-1 Explosive Atmospheres — Part 29-1: Gas Detectors — Performance Requirements of Detectors for Flammable Gases
501	UL 60079-15	Electrical Apparatus for Explosive Gas Atmospheres — Part 15: Type of Protection “n”
	-	UL 60079-0 Explosive Gas Atmospheres — Part 0: Equipment — General Requirements
	-	UL 60079-7 Explosive Gas Atmospheres — Part 7: Increased Safety “e”
	-	UL 60079-1 Explosive Gas Atmospheres — Part 1: Type of Protection – Flameproof “d”
	-	UL 60079-5 Explosive Gas Atmospheres — Part 5: Type of Protection – Powder Filling “q”
	-	UL 60079-6 Explosive Gas Atmospheres — Part 6: Type of Protection – Oil Immersion “o”
504	UL 913	Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations
505	UL 60079-11	Explosive Atmospheres — Part 11: Equipment Protection by Intrinsic Safety “i”
	-	UL 60079-18 Electrical Apparatus for Use in Class I, Zone 1 Hazardous (Classified) Locations Type of Protection — Encapsulation “m”
506	UL 61241-18	Electrical Apparatus for Use in Zone 20, Zone 21, and Zone 22 Hazardous (Classified) Locations — Protection by Encapsulation “mD”

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
-	UL 61241-1	Electrical Apparatus for Use in Zone 21 and Zone 22 Hazardous (Classified) Locations — Protection by Enclosure “tD”
-	UL 61241-0	Electrical Apparatus for Use in Zone 20, Zone 21, and Zone 22 Hazardous (Classified) Locations — General Requirements
-	UL 61241-11	Electrical Apparatus for Use in Zone 20, Zone 21, and Zone 22 Hazardous (Classified) Locations — Protection by Intrinsic Safety “iD”
-	UL 61241-2	Electrical Apparatus for Use in Zone 21 and Zone 22 Hazardous (Classified) Locations — Protection by Pressurization “pD”
511	UL 201	Garage Equipment
-	UL 1564	Industrial Battery Chargers
517	UL 1022	Line Isolation Monitors
-	UL 1047	Isolated Power Systems Equipment
-	UL 60601-1	Medical Electrical Equipment — Part 1: General Requirements for Safety
520	UL Subject 334	Theater Lighting Distribution and Control Equipment
-	UL 1573	Stage and Studio Luminaires and Connector Strips
-	UL 1640	Portable Power-Distribution Equipment
550	UL Subject 1462	Mobile Home Pipe Heating Cable
551	UL 231	Power Outlets
600	UL 48	Electric Signs
-	UL 814	Gas-Tube-Sign Cable
-	UL 879	Electric Sign Components
-	UL 879A	LED Sign and Sign Retrofit Kits
-	UL Subject 879B	Polymeric Enclosure Systems for the Splice Between Neon Tubing Electrode Leads and GTO Cable, and the GTO Cable Leading to the Splice
-	UL 2161	Neon Transformers and Power Supplies

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
604	UL 183	Manufactured Wiring Systems
605	UL 1286	Office Furnishings
	-	UL 962 Household and Commercial Furnishings
610	UL Subject 2273	Festoon Cable
625	UL 2202	Electric Vehicle (EV) Charging System Equipment
	-	UL 2231-1 Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits; Part 1: General Requirements
	-	UL 2231-2 Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits; Part 2: Particular Requirements for Protection Devices for Use in Charging Systems
	-	UL 2251 Plugs, Receptacles and Couplers for Electrical Vehicles
	-	UL 2580 Batteries for Use in Electric Vehicles
	-	UL 2594 Electric Vehicle Supply Equipment
	-	UL Subject 9741 Bidirectional Electric Vehicle (EV) Charging System Equipment
626	UL 1686	Pin and Sleeve Configurations
630	UL 551	Transformer-Type Arc-Welding Machines
640	UL 813	Commercial Audio Equipment
	-	UL 1419 Professional Video and Audio Equipment
	-	UL 1492 Audio-Video Products and Accessories
	-	UL 1711 Amplifiers for Fire Protective Signaling Systems
	-	UL 6500 Audio/Video and Musical Instrument Apparatus for Household, Commercial, and Similar General Use
	-	UL 60065 Audio, Video and Similar Electronic Apparatus — Safety Requirements
	-	UL 62368-1 Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
645	UL 1690	Data-Processing Cable
-	UL 1778	Uninterruptible Power Systems
-	UL 60950-1	Information Technology Equipment Safety — Part 1: General Requirements
-	UL 60950-21	Information Technology Equipment Safety — Part 21: Remote Power Feeding
-	UL 60950-22	Information Technology Equipment Safety — Part 22: Equipment to be Installed Outdoors
-	UL 60950-23	Information Technology Equipment Safety — Part 23: Large Data Storage Equipment
646	UL Subject 2755	Modular Data Centers
670	UL 61800-5-1	Adjustable Speed Electrical Power Drive Systems — Part 5-1: Safety Requirements — Electrical, Thermal and Energy
680	UL 379	Power Units for Fountain, Swimming Pool, and Spa Luminaires
-	UL 676	Underwater Luminaires and Submersible Junction Boxes
-	UL 676A	Potting Compounds for Swimming Pool, Fountain, and Spa Equipment
-	UL 1081	Swimming Pool Pumps, Filters, and Chlorinators
-	UL 1241	Isolated Power Systems Equipment
-	UL 1261	Electric Water Heaters for Pools and Tubs
-	UL 1563	Electric Spas, Equipment Assemblies, and Associated Equipment
-	UL 1795	Hydromassage Bathtubs
690	UL 98B	Enclosed and Dead-Front Switches for Use in Photovoltaic Systems
-	UL 489B	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures for Use with Photovoltaic (PV) Systems

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
-	UL Subject 508I	Manual Disconnect Switches Intended for Use in Photovoltaic Systems
-	UL Subject 1699B	Photovoltaic DC Arc-Fault Circuit Protection
-	UL 1703	Flat-Plate Photovoltaic Modules and Panels
-	UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources
-	UL Subject 2579	Low-Voltage Fuses — Fuses for Photovoltaic Systems
-	UL Subject 3703	Solar Trackers
-	UL Subject 3730	Photovoltaic Junction Boxes
-	UL 4703	Photovoltaic Wire
-	UL 6703	Connectors for Use in Photovoltaic Systems
-	UL Subject 6703A	Multi-Pole Connectors for Use in Photovoltaic Systems
-	UL Subject 8703	Concentrator Photovoltaic Modules and Assemblies
-	UL Subject 9703	Distributed Wiring Harnesses
-	UL 62109-1	Power Converters for use in Photovoltaic Power Systems — Part 1: General Requirements
-	UL 3003	Distributed Generation Cables
-	UL 61730-1	Photovoltaic (PV) Module Safety Qualification — Part 1: Requirements for Construction
-	UL 61730-2	Photovoltaic (PV) Module Safety Qualification — Part 2: Requirements for Testing
-	UL 3741	Photovoltaic Hazard Control
694	UL Subject 489C	Molded-Case Circuit Breakers and Molded- Case Switches for Use with Wind Turbines
-	UL Subject 6140	Wind Turbine Generating Systems
-	UL 6141	Wind Turbines Permitting Entry of Personnel
-	UL 6142	Wind Turbine Generating Systems — Small

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
695	UL 218	Fire Pump Controllers
-	UL 448	Centrifugal Stationary Pumps for Fire-Protection Service
-	UL 448B	Residential Fire Pumps Intended for One- and Two-Family Dwellings and Manufactured Homes
-	UL 448C	Stationary, Rotary-Type, Positive-Displacement Pumps for Fire Protection Service
-	UL 1004-5	Fire Pump Motors
700	UL 924	Emergency Lighting and Power Equipment
-	UL 1008	Transfer Switch Equipment
-	UL 1008A	Medium-Voltage Transfer Switches
-	UL 2200	Stationary Engine Generator Assemblies
706	UL 9540	Energy Storage Systems and Equipment
725	UL 5C	Surface Raceways and Fittings for Use with Data, Signal and Control Circuits
-	UL 13	Power-Limited Circuit Cables
-	UL 1012	Power Units Other Than Class 2
-	UL 1310	Class 2 Power Units
-	UL 1666	Test for Flame Propagation Height of Electrical and Optical- Fiber Cables Installed Vertically in Shafts
-	UL 1685	Vertical-Tray Fire- Propagation and Smoke- Release Test for Electrical and Optical-Fiber Cables
-	UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers
-	UL Subject 9990	Information and Communication Technology (ICT) Power Cables
727	UL 2250	Instrumentation Tray Cable
728	UL Subject 1724	Fire Tests for Electrical Circuit Protective Systems
-	UL 2196	Tests for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>	
			and Data Cables UL 2196
			Fire Resistive Cables, Tests for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables UL 2196
750	UL 916	Energy Management Equipment	
760	UL 268	Smoke Detectors for Fire Alarm Signaling Systems	
	-	UL 268A	Smoke Detectors for Duct Application
	-	UL 497B	Protectors for Data Communication and Fire Alarm Circuits
	-	UL 1424	Cables for Power-Limited Fire-Alarm Circuits
	-	UL 1425	Cables for Non-Power-Limited Fire-Alarm Circuits
	-	UL 1480	Speakers for Fire Alarm and Signaling Systems, Including Accessories
770	UL 1651	Optical Fiber Cable	
	-	UL 2024	Optical Fiber and Communication Cable Raceway
800	UL 444	Communications Cables	
	-	UL 489A	Circuit Breakers for Use in Communication Equipment
	-	UL 497	Protectors for Paired-Conductor Communications Circuits
	-	UL 497A	Secondary Protectors for Communications Circuits
	-	UL 497C	Protectors for Coaxial Communications Circuits
	-	UL Subject 497E	Protectors for Antenna Lead-In Conductors
	-	UL Subject 523	Telephone Service Drop Wire
	-	UL 1863	Communication Circuit Accessories
810	UL 150	Antenna Rotators	
	-	UL 452	Antenna-Discharge Units
820	UL 1655	Community-Antenna Television Cables	

Statement of Problem and Substantiation for Public Comment

The title of UL 1973 was revised upon publication of the 2nd edition in 2018.

Related Public Comments for This Document

<u>Related Comment</u>	<u>Relationship</u>
Public Comment No. 670-NFPA 70-2018 [Section No. 480.1]	
<u>Related Item</u>	
• 8759	

Submitter Information Verification

Submitter Full Name: Laurie Florence
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 14 22:18:09 EDT 2018
Committee: NEC-P01

Copyright Assignment

I, Laurie Florence, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Laurie Florence, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 732-NFPA 70-2018 [Annex A]

Informative Annex A Product Safety Standards

Informative Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only.

This informative annex provides a list of product safety standards used for product listing where that listing is required by this Code. It is recognized that this list is current at the time of publication but that new standards or modifications to existing standards can occur at any time while this edition of the Code is in effect.

This informative annex does not form a mandatory part of the requirements of this Code but is intended to identify for the Code users the standards upon which Code requirements have been based.

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
110	UL 310	Electrical Quick-Connect Terminals
-	UL 305	Panic Hardware
-	UL 486A-486B	Wire Connectors
-	UL 486C	Splicing Wire Connectors
-	UL 486D	Sealed Wire Connector Systems
-	UL 486E	Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
-	UL 486F	Bare and Covered Ferrules
-	UL 486G	Sealed Twist-On Connecting Devices
-	UL 510	Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
-	UL Subject 546	Conductor Termination Compounds
-	UL 2459	Insulated Multi-Pole Splicing Wire Connectors
210	UL 943	Ground-Fault Circuit-Interrupters
-	UL 1699	Arc-Fault Circuit-Interrupters
230	UL 1053	Ground-Fault Sensing and Relaying Equipment
-	UL 2735	Electric Utility Meters
240	UL 198M	Mine-Duty Fuses
-	UL 248-1	Low-Voltage Fuses — Part 1: General Requirements
-	UL 248-2	Low-Voltage Fuses — Part 2: Class C Fuses
-	UL 248-3	Low-Voltage Fuses — Part 3: Class CA and CB Fuses
-	UL 248-4	Low-Voltage Fuses — Part 4: Class CC Fuses
-	UL 248-5	Low-Voltage Fuses — Part 5: Class G Fuses
-	UL 248-6	Low-Voltage Fuses — Part 6: Class H Renewable Fuses
-	UL 248-7	Low-Voltage Fuses — Part 7: Class H Renewable Fuses
-	UL 248-8	Low-Voltage Fuses — Part 8: Class J Fuses

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
-	UL 248-9	Low-Voltage Fuses — Part 9: Class K Fuses
-	UL 248-10	Low-Voltage Fuses — Part 10: Class L Fuses
-	UL 248-11	Low-Voltage Fuses — Part 11: Plug Fuses
-	UL 248-12	Low-Voltage Fuses — Part 12: Class R Fuses
-	UL 248-13	Low-Voltage Fuses — Part 13: Semiconductor Fuses
-	UL 248-14	Low-Voltage Fuses — Part 14: Supplemental Fuses
-	UL 248-15	Low-Voltage Fuses — Part 15: Class T Fuses
-	UL 248-16	Low-Voltage Fuses — Part 16: Test Limiters
-	UL Subject 248-17	Low-Voltage Fuses — Part 17: Class CF Fuses
-	UL 489	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
250	UL 467	Grounding and Bonding Equipment
280	IEEE C62.1	Surge Arresters — Gapped Silicon-Carbide Surge Arresters for AC Power Circuits
-	IEEE C62.11	Surge Arresters — Metal- Oxide Surge Arresters for AC Power Circuits
285	UL 1449	Surge Protective Devices
300	UL 263	Fire Tests of Building Construction and Materials
-	UL Subject 267	Wire Pulling Compounds
-	UL 514B	Conduit, Tubing, and Cable Fittings
-	UL 635	Insulated Bushings
-	UL 1479	Fire Tests of Through- Penetration Firestops
-	UL 1565	Positioning Devices
-	UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
-	UL 2043	Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air- Handling Spaces
-	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
-	UL Subject 2419	Electrically Conductive Corrosion Resistant Compounds

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>	
	-	UL 60730-1	Automatic Electrical Controls — Part 1: General Requirements
310	UL 44	Thermoset-Insulated Wires and Cables	
	-	UL 66	Fixture Wire
	-	UL 83	Thermoplastic-Insulated Wires and Cables
	-	UL 1063	Machine-Tool Wires and Cables
312	UL 414	Meter Sockets	
314	UL 50	Enclosures for Electrical Equipment	
	-	UL 50E	Enclosures for Electrical Equipment, Environmental Considerations
	-	UL 514A	Metallic Outlet Boxes
	-	UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
	-	UL 514D	Cover Plates for Flush- Mounted Wiring Devices
320	UL 4	Armored Cable	
328	UL 1072	Medium-Voltage Power Cables	
330	UL 1569	Metal-Clad Cables	
334	UL 719	Nonmetallic-Sheathed Cables	
	-	UL Subject 2256	Nonmetallic Sheathed Cable Interconnects
336	UL 1277	Electrical Power and Control Tray Cables with Optional Optical-Fiber Members	
338	UL 854	Service-Entrance Cables	
340	UL 493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables	
342	UL 1242	Electrical Intermediate Metal Conduit — Steel	
344	UL 6	Electrical Rigid Metal Conduit — Steel	
	-	UL 6A	Electrical Rigid Metal Conduit – Aluminum, Red Brass and Stainless Steel
348	UL 1	Flexible Metal Conduit	
350	UL 360	Liquid-Tight Flexible Steel Conduit	
352	UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings	
353	UL 651A	Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit	

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
354	UL 1990	Nonmetallic Underground Conduit with Conductors
355	UL 2420	Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
-	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
-	UL 2515A	Supplemental Requirements for Extra-Heavy Wall Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
356	UL 1660	Liquid-Tight Flexible Nonmetallic Conduit
358	UL 797A	Electrical Metallic Tubing — Aluminum
-	UL 797	Electrical Metallic Tubing — Steel
360	UL Subject 1652	Flexible Metallic Tubing
362	UL 1653	Electrical Nonmetallic Tubing
368	UL 1953	Power Distribution Blocks
-	UL Subject 509	Bus Drop Cable
-	<u>UL 857</u>	<u>Busways</u>
<u>3XX</u>	<u>UL 1366</u>	<u>Insulated Bus Pipe (IBP)</u>
374	UL 209	Cellular Metal Floor Raceways and Fittings
376	UL 870	Wireways, Auxiliary Gutters, and Associated Fittings
380	UL Subject 111	Multioutlet Assemblies
384	UL 5B	Strut-Type Channel Raceways and Fittings
386	UL 5	Surface Metal Raceways and Fittings
388	UL 5A	Nonmetallic Surface Raceways and Fittings
390	UL 884	Underfloor Raceways and Fittings
392	UL 568	Nonmetallic Cable Tray Systems
400	UL 62	Flexible Cords and Cables
-	UL 817	Cord Sets and Power-Supply Cords
-	UL Subject 1650	Portable Power Cable
404	UL 20	General-Use Snap Switches
-	UL 98	Enclosed and Dead-Front Switches
-	UL Subject 98A	Open-Type Switches

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
-	UL 363	Knife Switches
-	UL 773	Plug-In Locking Type Photocontrols for Use with Area Lighting
-	UL 773A	Nonindustrial Photoelectric Switches for Lighting Control
-	UL 917	Clock-Operated Switches
-	UL 1429	Pullout Switches
406	UL 498	Attachment Plugs and Receptacles
-	UL 1682	Plugs, Receptacles, and Cable Connectors, of the Pin and Sleeve Type
408	UL 67	Panelboards
-	UL 891	Switchboards
-	UL 1558	Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear
-	UL 60947-1	Low-Voltage Switchgear and Controlgear — Part 1: General Rules
-	UL 60947-4-1	Low-Voltage Switchgear and Controlgear — Part 4-1: Contactors and Motor-Starters — Electromechanical Contactors and Motor-Starters
-	UL 60947-4-2	Voltage Switchgear and Controlgear - Part 4-2: Contactors and Motor-Starters — AC Semiconductor Motor Controllers and Starters
-	UL 60947-5-1	Low-Voltage Switchgear and Controlgear — Part 5-1: Control Circuit Devices and Switching Elements — Electromechanical Control Circuit Devices
-	UL 60947-5-2	Low-Voltage Switchgear and Controlgear — Part 5-2: Control Circuit Devices and Switching Elements — Proximity Switches
-	UL 60947-7-1	Low-Voltage Switchgear And Controlgear — Part 7-1: Ancillary Equipment — Terminal Blocks for Copper Conductors
-	UL 60947-7-2	Low-Voltage Switchgear and Controlgear — Part 7-2: Ancillary Equipment — Protective Conductor Terminal Blocks for Copper Conductors
-	UL 60947-7-3	Low-Voltage Switchgear and Controlgear — Part 7-3: Ancillary Equipment — Safety Requirements for Fuse Terminal Blocks

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
409	UL 508	Industrial Control Equipment
-	-	UL 508A Industrial Control Panels
410	UL 65	Wired Cabinets
-	-	UL 153 Portable Electric Luminaires
-	-	UL 496 Lampholders
-	-	UL 542 Fluorescent Lamp Starters
-	-	UL 588 Seasonal and Holiday Decorative Products
-	-	UL 935 Fluorescent-Lamp Ballasts
-	-	UL 1029 High-Intensity-Discharge Lamp Ballasts
-	-	UL Subject 1029A Ignitors and Related Auxiliaries for HID Lamp Ballasts
-	-	UL 1574 Track Lighting Systems
-	-	UL 1598 Luminaires
-	-	UL 1598B Luminaire Reflector Kits for Installation on Previously Installed Fluorescent Luminaires, Supplemental Requirements
-	-	UL 1598C Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits
-	-	UL 1993 Self-Ballasted Lamps and Lamp Adapters
-	-	UL 2388 Flexible Lighting Products
-	-	UL 8750 Light Emitting Diode (LED) Equipment for Use in Lighting Products
-	-	UL 8752 Organic Light Emitting Diode (OLED) Panels
-	-	UL 8753 Field-Replaceable Light Emitting Diode (LED) Light Engines
-	-	UL 8754 Holders, Bases and Connectors for Solid-State (LED) Light Engines and Arrays
-	-	UL Subject 8800 Horticultural Lighting Equipment
411	UL 234	Low-Voltage Lighting Fixtures for Use in Recreational Vehicles
-	-	UL 1838 Low-Voltage Landscape Lighting Systems
-	-	UL 2108 Low-Voltage Lighting Systems
422	UL 22	Amusement and Gaming Machines
-	-	UL 73 Motor-Operated Appliances
-	-	UL 122 Photographic Equipment
-	-	UL 141 Garment Finishing Appliances
-	-	UL 174 Household Electric Storage Tank Water Heaters

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
-	UL 197	Commercial Electric Cooking Appliances
-	UL 283	Air Fresheners and Deodorizers
-	UL 399	Drinking Water Coolers
-	UL 430	Waste Disposers
-	UL 474	Dehumidifiers
-	UL 507	Electric Fans
-	UL 574	Electric Oil Heaters
-	UL 621	Ice Cream Makers
-	UL 705	Power Ventilators
-	UL 710B	Recirculating Systems
-	UL 749	Household Dishwashers
-	UL 751	Vending Machines
-	UL 763	Motor-Operated Commercial Food Preparing Machines
-	UL 858	Household Electric Ranges
-	UL 875	Electric Dry-Bath Heaters
-	UL 921	Commercial Dishwashers
-	UL 923	Microwave Cooking Appliances
-	UL 962	Household and Commercial Furnishings
-	UL 962A	Furniture Power Distribution Units
-	UL 1017	Vacuum Cleaners, Blower Cleaners, and Household Floor Finishing Machines
-	UL 1026	Household Electric Cooking and Food Serving Appliances
-	UL 1278	Movable and Wall- or Ceiling-Hung Electric Room Heaters
-	UL 1453	Electric Booster and Commercial Storage Tank Water Heaters
-	UL 1727	Commercial Electric Personal Grooming Appliances
-	UL 1776	High-Pressure Cleaning Machines
-	UL 60335-2-40	Household and Similar Electrical Appliances, Part 2: Particular Requirements for Heating and Cooling
-	UL 60335-2-24	Household and Similar Electrical Appliances, Part 2: Particular Requirements for Refrigerating Appliances, Ice-Cream Appliances, and Ice-Makers
424	UL 499	Electric Heating Appliances
-	UL 834	Heating, Water Supply, and Power Boilers — Electric
-	UL 873	Temperature-Indicating and -Regulating Equipment

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
	-	UL 1042 Electric Baseboard Heating Equipment
	-	UL 1673 Electric Space Heating Cables
	-	UL 1693 Electric Radiant Heating Panels and Heating Panel Sets
	-	UL 1995 Heating and Cooling Equipment
	-	UL 1996 Electric Duct Heaters
	-	UL 2021 Fixed and Location-Dedicated Electric Room Heaters
426	UL Subject 1588	Roof and Gutter De-Icing Cable Units
427	IEEE 515	Electrical Resistance Heat Tracing for Industrial Applications
	-	UL 515 Electrical Resistance Heat Tracing for Commercial and Industrial Applications
	-	UL Subject 2049 Residential Pipe Heating Cable
430	UL 508C	Power Conversion Equipment
	-	UL 845 Motor Control Centers
	-	UL 1004-1 Rotating Electrical Machines — General Requirements
	-	UL 1004-2 Impedance Protected Motors
	-	UL 1004-3 Thermally Protected Motors
	-	UL 2111 Overheating Protection for Motors
	-	UL 1004-6 Servo and Stepper Motors
	-	UL 1004-7 Electronically Protected Motors
	-	UL 1004-8 Inverter Duty Motors
	-	UL 1004-9 Medium Voltage and Form Wound Motors
	-	UL 60034-1 Rotating Electrical Machines
440	UL 250	Household Refrigerators and Freezers
	-	UL 412 Refrigeration Unit Coolers
	-	UL 416 Refrigerated Medical Equipment
	-	UL 427 Refrigerating Units
	-	UL 471 Commercial Refrigerators and Freezers
	-	UL 484 Room Air Conditioners
	-	UL 541 Refrigerated Vending Machines
	-	UL 563 Ice Makers
445	UL 1004-4	Electric Generators
450	UL 506	Specialty Transformers
	-	UL 5085-1 Low Voltage Transformers — Part 1: General Requirements
	-	UL 5085-2 Low Voltage Transformers — Part 2: General Purpose Transformers

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
	-	UL 1062 Unit Substations
	-	UL 1561 Dry-Type General Purpose and Power Transformers
	-	UL 1562 Transformers, Distribution, Dry- Type — Over 600 Volts
460	UL 810	Capacitors
	-	UL 810A Electrochemical Capacitors
480	UL 1642	Lithium Batteries
	-	UL 1973 Batteries for Use in Light Electric Rail (LER) Applications and Stationary Applications
	-	UL 1989 Standby Batteries
	-	UL 2054 Household and Commercial Batteries
490	UL 347	Medium-Voltage AC Contactors, Controllers, and Control Centers
	-	UL Subject 347A Medium Voltage Power Conversion Controllers
	-	UL Subject 347B Medium Voltage Motor Controllers, Up to 15kV
	-	UL Subject 347C Medium Voltage Solid State Resistive Load Controllers, Up to 15kV
500	ANSI/ISA 12.12.01	Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations
	-	ANSI/ISA-12.27.01 Requirements for Process Sealing Between Electrical Systems and Potentially Flammable or Combustible Process Fluids
	-	UL 698A Industrial Control Panels Relating to Hazardous (Classified) Locations
	-	UL 844 Luminaires for Use in Hazardous (Classified) Locations
	-	UL 1203 Explosionproof and Dust- Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations
	-	UL 2075 Gas and Vapor Detectors and Sensors
	-	UL 2225 Cable and Cable Fittings for Use in Hazardous (Classified) Locations
	-	UL 60079-29-1 Explosive Atmospheres — Part 29-1: Gas Detectors — Performance Requirements of Detectors for Flammable Gases

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
501	UL 60079-15	Electrical Apparatus for Explosive Gas Atmospheres — Part 15: Type of Protection “n”
-	UL 60079-0	Explosive Gas Atmospheres — Part 0: Equipment — General Requirements
-	UL 60079-7	Explosive Gas Atmospheres — Part 7: Increased Safety “e”
-	UL 60079-1	Explosive Gas Atmospheres — Part 1: Type of Protection – Flameproof “d”
-	UL 60079-5	Explosive Gas Atmospheres — Part 5: Type of Protection – Powder Filling “q”
-	UL 60079-6	Explosive Gas Atmospheres — Part 6: Type of Protection – Oil Immersion “o”
504	UL 913	Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations
505	UL 60079-11	Explosive Atmospheres — Part 11: Equipment Protection by Intrinsic Safety “i”
-	UL 60079-18	Electrical Apparatus for Use in Class I, Zone 1 Hazardous (Classified) Locations Type of Protection — Encapsulation “m”
506	UL 61241-18	Electrical Apparatus for Use in Zone 20, Zone 21, and Zone 22 Hazardous (Classified) Locations — Protection by Encapsulation “mD”
-	UL 61241-1	Electrical Apparatus for Use in Zone 21 and Zone 22 Hazardous (Classified) Locations — Protection by Enclosure “tD”
-	UL 61241-0	Electrical Apparatus for Use in Zone 20, Zone 21, and Zone 22 Hazardous (Classified) Locations — General Requirements
-	UL 61241-11	Electrical Apparatus for Use in Zone 20, Zone 21, and Zone 22 Hazardous (Classified) Locations — Protection by Intrinsic Safety “iD”
-	UL 61241-2	Electrical Apparatus for Use in Zone 21 and Zone 22 Hazardous (Classified) Locations — Protection by Pressurization “pD”
511	UL 201	Garage Equipment

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>	
	-	UL 1564	Industrial Battery Chargers
517	UL 1022	Line Isolation Monitors	
	-	UL 1047	Isolated Power Systems Equipment
	-	UL 60601-1	Medical Electrical Equipment — Part 1: General Requirements for Safety
520	UL Subject 334	Theater Lighting Distribution and Control Equipment	
	-	UL 1573	Stage and Studio Luminaires and Connector Strips
	-	UL 1640	Portable Power-Distribution Equipment
550	UL Subject 1462	Mobile Home Pipe Heating Cable	
551	UL 231	Power Outlets	
600	UL 48	Electric Signs	
	-	UL 814	Gas-Tube-Sign Cable
	-	UL 879	Electric Sign Components
	-	UL 879A	LED Sign and Sign Retrofit Kits
	-	UL Subject 879B	Polymeric Enclosure Systems for the Splice Between Neon Tubing Electrode Leads and GTO Cable, and the GTO Cable Leading to the Splice
	-	UL 2161	Neon Transformers and Power Supplies
604	UL 183	Manufactured Wiring Systems	
605	UL 1286	Office Furnishings	
	-	UL 962	Household and Commercial Furnishings
610	UL Subject 2273	Festoon Cable	
625	UL 2202	Electric Vehicle (EV) Charging System Equipment	
	-	UL 2231-1	Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits; Part 1: General Requirements
	-	UL 2231-2	Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits; Part 2: Particular Requirements for Protection Devices for Use in Charging Systems
	-	UL 2251	Plugs, Receptacles and Couplers for Electrical Vehicles
	-	UL 2580	Batteries for Use in Electric Vehicles
	-	UL 2594	Electric Vehicle Supply Equipment

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>	
	-	UL Subject 9741	Bidirectional Electric Vehicle (EV) Charging System Equipment
626	UL 1686	Pin and Sleeve Configurations	
630	UL 551	Transformer-Type Arc-Welding Machines	
640	UL 813	Commercial Audio Equipment	
	-	UL 1419	Professional Video and Audio Equipment
	-	UL 1492	Audio-Video Products and Accessories
	-	UL 1711	Amplifiers for Fire Protective Signaling Systems
	-	UL 6500	Audio/Video and Musical Instrument Apparatus for Household, Commercial, and Similar General Use
	-	UL 60065	Audio, Video and Similar Electronic Apparatus — Safety Requirements
	-	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
645	UL 1690	Data-Processing Cable	
	-	UL 1778	Uninterruptible Power Systems
	-	UL 60950-1	Information Technology Equipment Safety — Part 1: General Requirements
	-	UL 60950-21	Information Technology Equipment Safety — Part 21: Remote Power Feeding
	-	UL 60950-22	Information Technology Equipment Safety — Part 22: Equipment to be Installed Outdoors
	-	UL 60950-23	Information Technology Equipment Safety — Part 23: Large Data Storage Equipment
646	UL Subject 2755	Modular Data Centers	
670	UL 61800-5-1	Adjustable Speed Electrical Power Drive Systems — Part 5-1: Safety Requirements — Electrical, Thermal and Energy	
680	UL 379	Power Units for Fountain, Swimming Pool, and Spa Luminaires	
	-	UL 676	Underwater Luminaires and Submersible Junction Boxes
	-	UL 676A	Potting Compounds for Swimming Pool, Fountain, and Spa Equipment

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
690	-	UL 1081 Swimming Pool Pumps, Filters, and Chlorinators
	-	UL 1241 Isolated Power Systems Equipment
	-	UL 1261 Electric Water Heaters for Pools and Tubs
	-	UL 1563 Electric Spas, Equipment Assemblies, and Associated Equipment
	-	UL 1795 Hydromassage Bathtubs
	UL 98B	Enclosed and Dead-Front Switches for Use in Photovoltaic Systems
	-	UL 489B Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures for Use with Photovoltaic (PV) Systems
	-	UL Subject 508I Manual Disconnect Switches Intended for Use in Photovoltaic Systems
	-	UL Subject 1699B Photovoltaic DC Arc-Fault Circuit Protection
	-	UL 1703 Flat-Plate Photovoltaic Modules and Panels
	-	UL 1741 Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources
	-	UL Subject 2579 Low-Voltage Fuses — Fuses for Photovoltaic Systems
	-	UL Subject 3703 Solar Trackers
	-	UL Subject 3730 Photovoltaic Junction Boxes
	-	UL 4703 Photovoltaic Wire
	-	UL 6703 Connectors for Use in Photovoltaic Systems
	-	UL Subject 6703A Multi-Pole Connectors for Use in Photovoltaic Systems
	-	UL Subject 8703 Concentrator Photovoltaic Modules and Assemblies
	-	UL Subject 9703 Distributed Wiring Harnesses
	-	UL 62109-1 Power Converters for use in Photovoltaic Power Systems — Part 1: General Requirements
	-	UL 3003 Distributed Generation Cables
	-	UL 61730-1 Photovoltaic (PV) Module Safety Qualification — Part 1: Requirements for Construction
	-	UL 61730-2 Photovoltaic (PV) Module Safety Qualification — Part 2: Requirements for Testing
	-	UL 3741 Photovoltaic Hazard Control

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
694	UL Subject 489C	Molded-Case Circuit Breakers and Molded-Case Switches for Use with Wind Turbines
-	UL Subject 6140	Wind Turbine Generating Systems
-	UL 6141	Wind Turbines Permitting Entry of Personnel
-	UL 6142	Wind Turbine Generating Systems — Small
695	UL 218	Fire Pump Controllers
-	UL 448	Centrifugal Stationary Pumps for Fire-Protection Service
-	UL 448B	Residential Fire Pumps Intended for One- and Two-Family Dwellings and Manufactured Homes
-	UL 448C	Stationary, Rotary-Type, Positive-Displacement Pumps for Fire Protection Service
-	UL 1004-5	Fire Pump Motors
700	UL 924	Emergency Lighting and Power Equipment
-	UL 1008	Transfer Switch Equipment
-	UL 1008A	Medium-Voltage Transfer Switches
-	UL 2200	Stationary Engine Generator Assemblies
706	UL 9540	Energy Storage Systems and Equipment
725	UL 5C	Surface Raceways and Fittings for Use with Data, Signal and Control Circuits
-	UL 13	Power-Limited Circuit Cables
-	UL 1012	Power Units Other Than Class 2
-	UL 1310	Class 2 Power Units
-	UL 1666	Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
-	UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables
-	UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers
-	UL Subject 9990	Information and Communication Technology (ICT) Power Cables
727	UL 2250	Instrumentation Tray Cable
728	UL Subject 1724	Fire Tests for Electrical Circuit Protective Systems

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>	
	-	UL 2196	Tests for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables UL 2196
	-	-	Fire Resistive Cables, Tests for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables UL 2196
750	UL 916	Energy Management Equipment	
760	UL 268	Smoke Detectors for Fire Alarm Signaling Systems	
	-	UL 268A	Smoke Detectors for Duct Application
	-	UL 497B	Protectors for Data Communication and Fire Alarm Circuits
	-	UL 1424	Cables for Power-Limited Fire-Alarm Circuits
	-	UL 1425	Cables for Non-Power-Limited Fire-Alarm Circuits
	-	UL 1480	Speakers for Fire Alarm and Signaling Systems, Including Accessories
770	UL 1651	Optical Fiber Cable	
	-	UL 2024	Optical Fiber and Communication Cable Raceway
800	UL 444	Communications Cables	
	-	UL 489A	Circuit Breakers for Use in Communication Equipment
	-	UL 497	Protectors for Paired-Conductor Communications Circuits
	-	UL 497A	Secondary Protectors for Communications Circuits
	-	UL 497C	Protectors for Coaxial Communications Circuits
	-	UL Subject 497E	Protectors for Antenna Lead-In Conductors
	-	UL Subject 523	Telephone Service Drop Wire
	-	UL 1863	Communication Circuit Accessories
810	UL 150	Antenna Rotators	
	-	UL 452	Antenna-Discharge Units
820	UL 1655	Community-Antenna Television Cables	

Statement of Problem and Substantiation for Public Comment

Include UL Standard for "Insulated Bus Pipe (IBP)" - UL 1366, which is the basis for a new Article in Chapter 3 (proposed as Article 369).

Related Public Comments for This Document

Related Comment

[Public Comment No. 719-NFPA 70-2018 \[Section No. 300.37\]](#)

[Public Comment No. 729-NFPA 70-2018 \[Global Input\]](#)

Related Item

• [PI 1882](#) • [PI 1883](#)

Relationship**Submitter Information Verification**

Submitter Full Name: Robert Osborne

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submittal Date: Thu Aug 16 15:34:19 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Robert Osborne, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Robert Osborne, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Public Comment No. 83-NFPA 70-2018 [Annex A]

Informative Annex A Product Safety Standards

Informative Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only.

This informative annex provides a list of product safety standards used for product listing where that listing is required by this Code. It is recognized that this list is current at the time of publication but that new standards or modifications to existing standards can occur at any time while this edition of the Code is in effect.

This informative annex does not form a mandatory part of the requirements of this Code but is intended to identify for the Code users the standards upon which Code requirements have been based.

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
110	UL 310	Electrical Quick-Connect Terminals
-	UL 305	Panic Hardware
-	UL 486A-486B	Wire Connectors
-	UL 486C	Splicing Wire Connectors
-	UL 486D	Sealed Wire Connector Systems
-	UL 486E	Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
-	UL 486F	Bare and Covered Ferrules
-	UL 486G	Sealed Twist-On Connecting Devices
-	UL 510	Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
-	UL Subject 546	Conductor Termination Compounds
-	UL 2459	Insulated Multi-Pole Splicing Wire Connectors
210	UL 943	Ground-Fault Circuit-Interruptioners
-	UL 1699	Arc-Fault Circuit-Interruptioners
230	UL 1053	Ground-Fault Sensing and Relaying Equipment
-	UL 2735	Electric Utility Meters
240	UL 198M	Mine-Duty Fuses
-	UL 248-1	Low-Voltage Fuses — Part 1: General Requirements
-	UL 248-2	Low-Voltage Fuses — Part 2: Class C Fuses
-	UL 248-3	Low-Voltage Fuses — Part 3: Class CA and CB Fuses
-	UL 248-4	Low-Voltage Fuses — Part 4: Class CC Fuses
-	UL 248-5	Low-Voltage Fuses — Part 5: Class G Fuses
-	UL 248-6	Low-Voltage Fuses — Part 6: Class H Renewable Fuses
-	UL 248-7	Low-Voltage Fuses — Part 7: Class H Renewable Fuses
-	UL 248-8	Low-Voltage Fuses — Part 8: Class J Fuses

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
-	UL 248-9	Low-Voltage Fuses — Part 9: Class K Fuses
-	UL 248-10	Low-Voltage Fuses — Part 10: Class L Fuses
-	UL 248-11	Low-Voltage Fuses — Part 11: Plug Fuses
-	UL 248-12	Low-Voltage Fuses — Part 12: Class R Fuses
-	UL 248-13	Low-Voltage Fuses — Part 13: Semiconductor Fuses
-	UL 248-14	Low-Voltage Fuses — Part 14: Supplemental Fuses
-	UL 248-15	Low-Voltage Fuses — Part 15: Class T Fuses
-	UL 248-16	Low-Voltage Fuses — Part 16: Test Limiters
-	UL Subject 248-17	Low-Voltage Fuses — Part 17: Class CF Fuses
-	UL 489	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
250	UL 467	Grounding and Bonding Equipment
280	IEEE C62.1	Surge Arresters — Gapped Silicon-Carbide Surge Arresters for AC Power Circuits
-	IEEE C62.11	Surge Arresters — Metal- Oxide Surge Arresters for AC Power Circuits
285	UL 1449	Surge Protective Devices
300	UL 263	Fire Tests of Building Construction and Materials
-	UL Subject 267	Wire Pulling Compounds
-	UL 514B	Conduit, Tubing, and Cable Fittings
-	UL 635	Insulated Bushings
-	UL 1479	Fire Tests of Through- Penetration Firestops
-	UL 1565	Positioning Devices
-	UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
-	UL 2043	Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air- Handling Spaces
-	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
-	UL Subject 2419	Electrically Conductive Corrosion Resistant Compounds

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>	
	-	UL 60730-1	Automatic Electrical Controls — Part 1: General Requirements
310	UL 44	Thermoset-Insulated Wires and Cables	
	-	UL 66	Fixture Wire
	-	UL 83	Thermoplastic-Insulated Wires and Cables
	-	UL 1063	Machine-Tool Wires and Cables
312	UL 414	Meter Sockets	
314	UL 50	Enclosures for Electrical Equipment	
	-	UL 50E	Enclosures for Electrical Equipment, Environmental Considerations
	-	UL 514A	Metallic Outlet Boxes
	-	UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
	-	UL 514D	Cover Plates for Flush- Mounted Wiring Devices
320	UL 4	Armored Cable	
328	UL 1072	Medium-Voltage Power Cables	
330	UL 1569	Metal-Clad Cables	
334	UL 719	Nonmetallic-Sheathed Cables	
	-	UL Subject 2256	Nonmetallic Sheathed Cable Interconnects
336	UL 1277	Electrical Power and Control Tray Cables with Optional Optical-Fiber Members	
338	UL 854	Service-Entrance Cables	
340	UL 493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables	
342	UL 1242	Electrical Intermediate Metal Conduit — Steel	
344	UL 6	Electrical Rigid Metal Conduit — Steel	
	-	UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel
348	UL 1	Flexible Metal Conduit	
350	UL 360	Liquid-Tight Flexible Steel Conduit	
352	UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings	
353	UL 651A	Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit	

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>	
354	UL 1990	Nonmetallic Underground Conduit with Conductors	
355	UL 2420	Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings	
-	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings	
-	UL 2515A	Supplemental Requirements for Extra-Heavy Wall Reinforced Thermosetting Resin Conduit (RTRC) and Fittings	
356	UL 1660	Liquid-Tight Flexible Nonmetallic Conduit	
358	UL 797A	Electrical Metallic Tubing — Aluminum	
-	UL 797	Electrical Metallic Tubing — Steel	
360	UL Subject 1652	Flexible Metallic Tubing	
362	UL 1653	Electrical Nonmetallic Tubing	
368	UL 1953	Power Distribution Blocks	
-	UL Subject 509	Bus Drop Cable	
-	UL 857	Busways	
374	UL 209	Cellular Metal Floor Raceways and Fittings	
376	UL 870	Wireways, Auxiliary Gutters, and Associated Fittings	
380	UL Subject 111	Multioutlet Assemblies	
384	UL 5B	Strut-Type Channel Raceways and Fittings	
386	UL 5	Surface Metal Raceways and Fittings	
388	UL 5A	Nonmetallic Surface Raceways and Fittings	
390	UL 884	Underfloor Raceways and Fittings	
392	UL 568	Nonmetallic Cable Tray Systems	
400	UL 62	Flexible Cords and Cables	
-	UL 817	Cord Sets and Power-Supply Cords	
-	UL Subject 1650	Portable Power Cable	
404	UL 20	General-Use Snap Switches	
-	UL 98	Enclosed and Dead-Front Switches	
-	UL Subject 98A	Open-Type Switches	
-	UL 363	Knife Switches	

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
-	UL 773	Plug-In Locking Type Photocontrols for Use with Area Lighting
-	UL 773A	Nonindustrial Photoelectric Switches for Lighting Control
-	UL 917	Clock-Operated Switches
-	UL 1429	Pullout Switches
406	UL 498	Attachment Plugs and Receptacles
-	UL 1682	Plugs, Receptacles, and Cable Connectors, of the Pin and Sleeve Type
408	UL 67	Panelboards
-	UL 891	Switchboards
-	UL 1558	Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear
-	UL 60947-1	Low-Voltage Switchgear and Controlgear — Part 1: General Rules
-	UL 60947-4-1	Low-Voltage Switchgear and Controlgear — Part 4-1: Contactors and Motor-Starters — Electromechanical Contactors and Motor-Starters
-	UL 60947-4-2	Voltage Switchgear and Controlgear - Part 4-2: Contactors and Motor-Starters — AC Semiconductor Motor Controllers and Starters
-	UL 60947-5-1	Low-Voltage Switchgear and Controlgear — Part 5-1: Control Circuit Devices and Switching Elements — Electromechanical Control Circuit Devices
-	UL 60947-5-2	Low-Voltage Switchgear and Controlgear — Part 5-2: Control Circuit Devices and Switching Elements — Proximity Switches
-	UL 60947-7-1	Low-Voltage Switchgear And Controlgear — Part 7-1: Ancillary Equipment — Terminal Blocks for Copper Conductors
-	UL 60947-7-2	Low-Voltage Switchgear and Controlgear — Part 7-2: Ancillary Equipment — Protective Conductor Terminal Blocks for Copper Conductors
-	UL 60947-7-3	Low-Voltage Switchgear and Controlgear — Part 7-3: Ancillary Equipment — Safety Requirements for Fuse Terminal Blocks
409	UL 508	Industrial Control Equipment

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>	
410	-	UL 508A	Industrial Control Panels
	UL 65	Wired Cabinets	
	-	UL 153	Portable Electric Luminaires
	-	UL 496	Lampholders
	-	UL 542	Fluorescent Lamp Starters
	-	UL 588	Seasonal and Holiday Decorative Products
	-	UL 935	Fluorescent-Lamp Ballasts
	-	UL 1029	High-Intensity-Discharge Lamp Ballasts
	-	UL Subject 1029A	Ignitors and Related Auxiliaries for HID Lamp Ballasts
	-	UL 1574	Track Lighting Systems
	-	UL 1598	Luminaires
	-	UL 1598B	Luminaire Reflector Kits for Installation on Previously Installed Fluorescent Luminaires, Supplemental Requirements
	-	UL 1598C	Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits
	-	UL 1993	Self-Ballasted Lamps and Lamp Adapters
	-	UL 2388	Flexible Lighting Products
	-	UL 8750	Light Emitting Diode (LED) Equipment for Use in Lighting Products
	-	UL 8752	Organic Light Emitting Diode (OLED) Panels
	-	UL 8753	Field-Replaceable Light Emitting Diode (LED) Light Engines
	-	UL 8754	Holders, Bases and Connectors for Solid-State (LED) Light Engines and Arrays
	-	UL Subject 8800	Horticultural Lighting Equipment
411	UL 234	Low-Voltage Lighting Fixtures for Use in Recreational Vehicles	
	-	UL 1838	Low-Voltage Landscape Lighting Systems
	-	UL 2108	Low-Voltage Lighting Systems
422	UL 22	Amusement and Gaming Machines	
	-	UL 73	Motor-Operated Appliances
	-	UL 122	Photographic Equipment
	-	UL 141	Garment Finishing Appliances
	-	UL 174	Household Electric Storage Tank Water Heaters

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
-	UL 197	Commercial Electric Cooking Appliances
-	UL 283	Air Fresheners and Deodorizers
-	UL 399	Drinking Water Coolers
-	UL 430	Waste Disposers
-	UL 474	Dehumidifiers
-	UL 507	Electric Fans
-	UL 574	Electric Oil Heaters
-	UL 621	Ice Cream Makers
-	UL 705	Power Ventilators
-	UL 710B	Recirculating Systems
-	UL 749	Household Dishwashers
-	UL 751	Vending Machines
-	UL 763	Motor-Operated Commercial Food Preparing Machines
-	UL 858	Household Electric Ranges
-	UL 875	Electric Dry-Bath Heaters
-	UL 921	Commercial Dishwashers
-	UL 923	Microwave Cooking Appliances
-	UL 962	Household and Commercial Furnishings
-	UL 962A	Furniture Power Distribution Units
-	UL 1017	Vacuum Cleaners, Blower Cleaners, and Household Floor Finishing Machines
-	UL 1026	Household Electric Cooking and Food Serving Appliances
-	UL 1278	Movable and Wall- or Ceiling-Hung Electric Room Heaters
-	UL 1453	Electric Booster and Commercial Storage Tank Water Heaters
-	UL 1727	Commercial Electric Personal Grooming Appliances
-	UL 1776	High-Pressure Cleaning Machines
-	UL 60335-2-40	Household and Similar Electrical Appliances, Part 2: Particular Requirements for Heating and Cooling
-	UL 60335-2-24	Household and Similar Electrical Appliances, Part 2: Particular Requirements for Refrigerating Appliances, Ice-Cream Appliances, and Ice-Makers
424	UL 499	Electric Heating Appliances
-	UL 834	Heating, Water Supply, and Power Boilers — Electric

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
-	UL 873	Temperature-Indicating and -Regulating Equipment
-	UL 1042	Electric Baseboard Heating Equipment
-	UL 1673	Electric Space Heating Cables
-	UL 1693	Electric Radiant Heating Panels and Heating Panel Sets
-	UL 1995	Heating and Cooling Equipment
-	UL 1996	Electric Duct Heaters
-	UL 2021	Fixed and Location-Dedicated Electric Room Heaters
426	UL Subject 1588	Roof and Gutter De-Icing Cable Units
427	IEEE 515	Electrical Resistance Heat Tracing for Industrial Applications
-	UL 515	Electrical Resistance Heat Tracing for Commercial and Industrial Applications
-	UL Subject 2049	Residential Pipe Heating Cable
430	UL 508C	Power Conversion Equipment
-	UL 845	Motor Control Centers
-	UL 1004-1	Rotating Electrical Machines — General Requirements
-	UL 1004-2	Impedance Protected Motors
-	UL 1004-3	Thermally Protected Motors
-	UL 2111	Overheating Protection for Motors
-	UL 1004-6	Servo and Stepper Motors
-	UL 1004-7	Electronically Protected Motors
-	UL 1004-8	Inverter Duty Motors
-	UL 1004-9	Medium Voltage and Form Wound Motors
-	UL 60034-1	Rotating Electrical Machines
440	UL 250	Household Refrigerators and Freezers
-	UL 412	Refrigeration Unit Coolers
-	UL 416	Refrigerated Medical Equipment
-	UL 427	Refrigerating Units
-	UL 471	Commercial Refrigerators and Freezers
-	UL 484	Room Air Conditioners
-	UL 541	Refrigerated Vending Machines
-	UL 563	Ice Makers

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
445	<u>UL 1004-4</u>	<u>Electric Generators</u>
	<u>UL 2200</u>	<u>Stationary Engine Generator Assemblies</u>
	<u>ANSI/PGMA G300-2015</u>	<u>Safety and Performance of Portable Generators</u>
450	UL 506	Specialty Transformers
-	UL 5085-1	Low Voltage Transformers — Part 1: General Requirements
-	UL 5085-2	Low Voltage Transformers — Part 2: General Purpose Transformers
-	UL 1062	Unit Substations
-	UL 1561	Dry-Type General Purpose and Power Transformers
-	UL 1562	Transformers, Distribution, Dry-Type — Over 600 Volts
460	UL 810	Capacitors
-	UL 810A	Electrochemical Capacitors
480	UL 1642	Lithium Batteries
-	UL 1973	Batteries for Use in Light Electric Rail (LER) Applications and Stationary Applications
-	UL 1989	Standby Batteries
-	UL 2054	Household and Commercial Batteries
490	UL 347	Medium-Voltage AC Contactors, Controllers, and Control Centers
-	UL Subject 347A	Medium Voltage Power Conversion Controllers
-	UL Subject 347B	Medium Voltage Motor Controllers, Up to 15kV
-	UL Subject 347C	Medium Voltage Solid State Resistive Load Controllers, Up to 15kV
500	ANSI/ISA 12.12.01	Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations
-	ANSI/ISA-12.27.01	Requirements for Process Sealing Between Electrical Systems and Potentially Flammable or Combustible Process Fluids
-	UL 698A	Industrial Control Panels Relating to Hazardous (Classified) Locations
-	UL 844	Luminaires for Use in Hazardous (Classified) Locations

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
-	UL 1203	Explosionproof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations
-	UL 2075	Gas and Vapor Detectors and Sensors
-	UL 2225	Cable and Cable Fittings for Use in Hazardous (Classified) Locations
-	UL 60079-29-1	Explosive Atmospheres — Part 29-1: Gas Detectors — Performance Requirements of Detectors for Flammable Gases
501	UL 60079-15	Electrical Apparatus for Explosive Gas Atmospheres — Part 15: Type of Protection “n”
-	UL 60079-0	Explosive Gas Atmospheres — Part 0: Equipment — General Requirements
-	UL 60079-7	Explosive Gas Atmospheres — Part 7: Increased Safety “e”
-	UL 60079-1	Explosive Gas Atmospheres — Part 1: Type of Protection — Flameproof “d”
-	UL 60079-5	Explosive Gas Atmospheres — Part 5: Type of Protection — Powder Filling “q”
-	UL 60079-6	Explosive Gas Atmospheres — Part 6: Type of Protection — Oil Immersion “o”
504	UL 913	Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations
505	UL 60079-11	Explosive Atmospheres — Part 11: Equipment Protection by Intrinsic Safety “i”
-	UL 60079-18	Electrical Apparatus for Use in Class I, Zone 1 Hazardous (Classified) Locations Type of Protection — Encapsulation “m”
506	UL 61241-18	Electrical Apparatus for Use in Zone 20, Zone 21, and Zone 22 Hazardous (Classified) Locations — Protection by Encapsulation “mD”
-	UL 61241-1	Electrical Apparatus for Use in Zone 21 and Zone 22 Hazardous (Classified) Locations — Protection by Enclosure “tD”

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
-	UL 61241-0	Electrical Apparatus for Use in Zone 20, Zone 21, and Zone 22 Hazardous (Classified) Locations — General Requirements
-	UL 61241-11	Electrical Apparatus for Use in Zone 20, Zone 21, and Zone 22 Hazardous (Classified) Locations — Protection by Intrinsic Safety “iD”
-	UL 61241-2	Electrical Apparatus for Use in Zone 21 and Zone 22 Hazardous (Classified) Locations — Protection by Pressurization “pD”
511	UL 201	Garage Equipment
-	UL 1564	Industrial Battery Chargers
517	UL 1022	Line Isolation Monitors
-	UL 1047	Isolated Power Systems Equipment
-	UL 60601-1	Medical Electrical Equipment — Part 1: General Requirements for Safety
520	UL Subject 334	Theater Lighting Distribution and Control Equipment
-	UL 1573	Stage and Studio Luminaires and Connector Strips
-	UL 1640	Portable Power-Distribution Equipment
550	UL Subject 1462	Mobile Home Pipe Heating Cable
551	UL 231	Power Outlets
600	UL 48	Electric Signs
-	UL 814	Gas-Tube-Sign Cable
-	UL 879	Electric Sign Components
-	UL 879A	LED Sign and Sign Retrofit Kits
-	UL Subject 879B	Polymeric Enclosure Systems for the Splice Between Neon Tubing Electrode Leads and GTO Cable, and the GTO Cable Leading to the Splice
-	UL 2161	Neon Transformers and Power Supplies
604	UL 183	Manufactured Wiring Systems
605	UL 1286	Office Furnishings
-	UL 962	Household and Commercial Furnishings
610	UL Subject 2273	Festoon Cable
625	UL 2202	Electric Vehicle (EV) Charging System Equipment

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
-	UL 2231-1	Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits; Part 1: General Requirements
-	UL 2231-2	Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits; Part 2: Particular Requirements for Protection Devices for Use in Charging Systems
-	UL 2251	Plugs, Receptacles and Couplers for Electrical Vehicles
-	UL 2580	Batteries for Use in Electric Vehicles
-	UL 2594	Electric Vehicle Supply Equipment
-	UL Subject 9741	Bidirectional Electric Vehicle (EV) Charging System Equipment
626	UL 1686	Pin and Sleeve Configurations
630	UL 551	Transformer-Type Arc- Welding Machines
640	UL 813	Commercial Audio Equipment
-	UL 1419	Professional Video and Audio Equipment
-	UL 1492	Audio-Video Products and Accessories
-	UL 1711	Amplifiers for Fire Protective Signaling Systems
-	UL 6500	Audio/Video and Musical Instrument Apparatus for Household, Commercial, and Similar General Use
-	UL 60065	Audio, Video and Similar Electronic Apparatus — Safety Requirements
-	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
645	UL 1690	Data-Processing Cable
-	UL 1778	Uninterruptible Power Systems
-	UL 60950-1	Information Technology Equipment Safety — Part 1: General Requirements
-	UL 60950-21	Information Technology Equipment Safety — Part 21: Remote Power Feeding
-	UL 60950-22	Information Technology Equipment Safety — Part 22: Equipment to be Installed Outdoors

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
	-	UL 60950-23 Information Technology Equipment Safety — Part 23: Large Data Storage Equipment
646	UL Subject 2755	Modular Data Centers
670	UL 61800-5-1	Adjustable Speed Electrical Power Drive Systems — Part 5-1: Safety Requirements — Electrical, Thermal and Energy
680	UL 379	Power Units for Fountain, Swimming Pool, and Spa Luminaires
-	UL 676	Underwater Luminaires and Submersible Junction Boxes
-	UL 676A	Potting Compounds for Swimming Pool, Fountain, and Spa Equipment
-	UL 1081	Swimming Pool Pumps, Filters, and Chlorinators
-	UL 1241	Isolated Power Systems Equipment
-	UL 1261	Electric Water Heaters for Pools and Tubs
-	UL 1563	Electric Spas, Equipment Assemblies, and Associated Equipment
-	UL 1795	Hydromassage Bathtubs
690	UL 98B	Enclosed and Dead-Front Switches for Use in Photovoltaic Systems
-	UL 489B	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures for Use with Photovoltaic (PV) Systems
-	UL Subject 508I	Manual Disconnect Switches Intended for Use in Photovoltaic Systems
-	UL Subject 1699B	Photovoltaic DC Arc-Fault Circuit Protection
-	UL 1703	Flat-Plate Photovoltaic Modules and Panels
-	UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources
-	UL Subject 2579	Low-Voltage Fuses — Fuses for Photovoltaic Systems
-	UL Subject 3703	Solar Trackers
-	UL Subject 3730	Photovoltaic Junction Boxes
-	UL 4703	Photovoltaic Wire

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>
	-	UL 6703 Connectors for Use in Photovoltaic Systems
	-	UL Subject 6703A Multi-Pole Connectors for Use in Photovoltaic Systems
	-	UL Subject 8703 Concentrator Photovoltaic Modules and Assemblies
	-	UL Subject 9703 Distributed Wiring Harnesses
	-	UL 62109-1 Power Converters for use in Photovoltaic Power Systems — Part 1: General Requirements
	-	UL 3003 Distributed Generation Cables
	-	UL 61730-1 Photovoltaic (PV) Module Safety Qualification — Part 1: Requirements for Construction
	-	UL 61730-2 Photovoltaic (PV) Module Safety Qualification — Part 2: Requirements for Testing
	-	UL 3741 Photovoltaic Hazard Control
694	UL Subject 489C	Molded-Case Circuit Breakers and Molded- Case Switches for Use with Wind Turbines
	-	UL Subject 6140 Wind Turbine Generating Systems
	-	UL 6141 Wind Turbines Permitting Entry of Personnel
	-	UL 6142 Wind Turbine Generating Systems — Small
695	UL 218	Fire Pump Controllers
	-	UL 448 Centrifugal Stationary Pumps for Fire-Protection Service
	-	UL 448B Residential Fire Pumps Intended for One- and Two- Family Dwellings and Manufactured Homes
	-	UL 448C Stationary, Rotary-Type, Positive-Displacement Pumps for Fire Protection Service
	-	UL 1004-5 Fire Pump Motors
700	UL 924	Emergency Lighting and Power Equipment
	-	UL 1008 Transfer Switch Equipment
	-	UL 1008A Medium-Voltage Transfer Switches
	-	UL 2200 Stationary Engine Generator Assemblies
706	UL 9540	Energy Storage Systems and Equipment
725	UL 5C	Surface Raceways and Fittings for Use with Data, Signal and Control Circuits
	-	UL 13 Power-Limited Circuit Cables

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>	
-	UL 1012	Power Units Other Than Class 2	
-	UL 1310	Class 2 Power Units	
-	UL 1666	Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts	
-	UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables	
-	UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers	
-	UL Subject 9990	Information and Communication Technology (ICT) Power Cables	
727	UL 2250	Instrumentation Tray Cable	
728	UL Subject 1724	Fire Tests for Electrical Circuit Protective Systems	
-	UL 2196	Tests for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables UL 2196	
	-	-	Fire Resistive Cables, Tests for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables UL 2196
750	UL 916	Energy Management Equipment	
760	UL 268	Smoke Detectors for Fire Alarm Signaling Systems	
-	UL 268A	Smoke Detectors for Duct Application	
-	UL 497B	Protectors for Data Communication and Fire Alarm Circuits	
-	UL 1424	Cables for Power-Limited Fire-Alarm Circuits	
-	UL 1425	Cables for Non-Power-Limited Fire-Alarm Circuits	
-	UL 1480	Speakers for Fire Alarm and Signaling Systems, Including Accessories	
770	UL 1651	Optical Fiber Cable	
-	UL 2024	Optical Fiber and Communication Cable Raceway	
800	UL 444	Communications Cables	
-	UL 489A	Circuit Breakers for Use in Communication Equipment	
-	UL 497	Protectors for Paired-Conductor Communications Circuits	

<u>Article</u>	<u>Standard Number</u>	<u>Standard Title</u>	
-	UL 497A	Secondary Protectors for Communications Circuits	
-	UL 497C	Protectors for Coaxial Communications Circuits	
-	UL Subject 497E	Protectors for Antenna Lead-In Conductors	
-	UL Subject 523	Telephone Service Drop Wire	
-	UL 1863	Communication Circuit Accessories	
810	UL 150	Antenna Rotators	
-	UL 452	Antenna-Discharge Units	
820	UL 1655	Community-Antenna Television Cables	

Statement of Problem and Substantiation for Public Comment

This Public Comment is tied to PC-5 to add a new 445.6 Listing Requirements for generators. The Public Comment is for informational purposes to add the UL 2200 Standard of Stationary Generator Assemblies and the ANSI/PGMA G300-2015 Safety and Performance of Portable Generators to Annex A.

Related Public Comments for This Document

<u>Related Comment</u>	<u>Relationship</u>
Public Comment No. 5-NFPA 70-2018 [New Section after 445.1]	Listing of generators

Related Item

- PI-12 NFPA 70-2017

Submitter Information Verification

Submitter Full Name: Brian Baughman
Organization: Generac Power Systems Inc
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 28 09:52:35 EDT 2018
Committee: NEC-P01

Copyright Assignment

I, Brian Baughman, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Brian Baughman, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 1981-NFPA 70-2018 [Section No. 80.21(C)]****(C) Responsibility of the Authority Having Jurisdiction.**

It shall be the responsibility of the authority having jurisdiction to promulgate rules that cover the following:

- (1) Review of construction documents and drawings shall be completed within established time frames for the purpose of acceptance or to provide reasons for nonacceptance.
- (2) Review and approval by the authority having jurisdiction shall not relieve the applicant of the responsibility of compliance with this *Code*.
- (3) Where field conditions necessitate any substantial change from the approved plan, the authority having jurisdiction shall be permitted to require that the corrected plans be submitted for fr approval.
- (4) **The authority having jurisdiction shall be permitted to determine the scope of electrical power system rehabilitation independent of the requirements of the building code.**

Statement of Problem and Substantiation for Public Comment

The use of the term "it shall be permitted" already appears under the rubric "responsibility" of the AHJ in the line above.. This item should be added to this so that when a building undergoes a renovation -- particularly a significant one, perhaps on the borderline of the 50 percent criteria, the inspector shall be permitted the authority to require more extensive electrical renovations than, say, the lead architect and/or owner. Addition of this item, which reflects an understanding of the reality of renovation project budgets. will contribute to safer building power systems in renovation projects. If state agencies do not want to use it; they have the option to strike it if they do not want to convey that authority upon the electrical inspector who is usually most sensitive to the electrical hazards. State and local agencies will benefit from this.

Related Item

- Public Input No. 3884-NFPA 70-2017 [Section No. 80.21(C)]

Submitter Information Verification

Submitter Full Name: Michael Anthony

Organization: Standards Michigan

Street Address:

City:

State:

Zip:

Submission Date: Thu Aug 30 13:32:59 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Michael Anthony, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Michael Anthony, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

**Public Comment No. 2084-NFPA 70-2018 [Section No. 80.33]****~~80.33~~ Repeal of Conflicting Acts.**

~~All acts or parts of acts in conflict with the provisions of Article 80 are hereby repealed.~~

Statement of Problem and Substantiation for Public Comment

It is appropriate that the NEC have model administrative text but that text should serve as "model" text in which it may be adopted whole cloth or in part. The ICC, for example, places model administrative text for local jurisdictions to adopt their consensus products (the IBC, IPC, IMC, etc). When you have a statement near the end of Article 80 that effectively says: "This section supersedes everything" then some jurisdictions may avoid using it.

Article 80 is an important template for administering the NEC but it should not repeal everything in conflict with it. Let the local jurisdictions decide.

I was a member of CMP-1 during the 2002 NEC revision cycle when Article 80 was placed at the front of the NEC, and also a member of a breakout Task Group that prepared position statements so that the entire CMP-1 had the benefit of code professionals looking more deeply into meaning and prospective effect of Article 80. As I recall this particular passage drew no special consideration, however. In retrospect it does not make sense (even if it were legally possible) to assert that all conflicting acts are repealed with the adoption of Article 80. Let the adopting jurisdictions determine that. I recommend removal of this section.

Related Item

- Public Input No. 3178-NFPA 70-2017 [Section No. 80.33]

Submitter Information Verification

Submitter Full Name: Michael Anthony

Organization: Standards Michigan

Street Address:

City:

State:

Zip:

Submittal Date: Thu Aug 30 16:40:05 EDT 2018

Committee: NEC-P01

Copyright Assignment

I, Michael Anthony, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☒ By checking this box I affirm that I am Michael Anthony, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature