Public Input No. 2423-NFPA 70-2023 [Global Input]

See Attached File - Which Includes multiple related changes, all under the purview of CMP 2.

Additional Proposed Changes

File Name	Description	Approved
PI_For_CMP_2_Voltage_Demarcation_.docx	Global PI for CMP 2 (Consistent Voltage Demarcation)	

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, Larry Wildermuth, and Kyle Krueger.

Changes related to the voltage demarcation have been grouped to assist the CMP with review and resolution, with each change, and it's corresponding substantiation, noted in the table below: (table provided in attachment)

Submitter Information Verification

Submitter Full Name: Robert Osborne
Organization: UL Solutions
Street Address:
City:
State:
Zip:

Submittal Date: Thu Aug 17 09:29:26 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: CMP-2 incorporated the proposed changes via FR-7573 (210.19), FR-7593 (210.6(D)) and FR-8024 (210.20).

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, and Larry Wildermuth, and Kyle Krueger.

Changes related to the voltage demarcation have been grouped to assist the CMP with review and resolution, with each change, and it's corresponding substantiation, noted in the table below:

Reference	Suggested Revision	Substantiation
210.6(D)	**(D) 1000 Volts ac or 1500 Volts dc Between Conductors.** Circuits exceeding 277 volts, nominal, to ground and not over ~~exceeding~~ 1000 volts ac or 1500 volts dc, nominal, between conductors shall be permitted to supply the following:…	Wording has been standardized to reflect the medium voltage demarcation. The use of common phrases improves usability by ensure consistency and ease of electronic searching. Preferred phrasing is to identify requirements as apply to "… not over 1000 Volts ac, 1500 volts dc, nominal…" and "…over 1000 volts ac, 1500 volts dc, nominal…".
210.19	**Conductors — Minimum Ampacity and Size.** Branch-circuit conductors ~~for circuits not exceeding 1000 volts ac or 1500 volts dc~~ shall be sized in accordance …	With the identification in the title and scope of the Article that the requirements apply to certain voltage ranges, the inclusion of this detail in this section is unnecessary.
210.20	**Overcurrent Protection.** Branch-circuit conductors and equipment ~~for circuits not exceeding 1000 volts ac or 1500 volts dc~~ shall be protected by …	With the identification in the title and scope of the Article that the requirements apply to certain voltage ranges, the inclusion of this detail in this section is unnecessary.

Public Input No. 3086-NFPA 70-2023 [Global Input]

This Global Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document.
Articles may need to be revised to comply with the NEC Style Manual Section 2.2 for Numbering Conventions.

Statement of Problem and Substantiation for Public Input

This Global Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document.
Articles may need to be revised to comply with the NEC Style Manual Section 2.2 for Numbering Conventions. The Changes in 2.2.1 are requirements that may need to be revised.
2.2.1 Parallel Numbering Required. Technical committees shall use the following section numbers for the same purposes within articles. This requirement shall not apply to Articles 90, 100, and 110. If the article does not contain listing or reconditioning requirements, the subdivisions shall not be included in the article.
Required Parallel Numbering Format
XXX.1 Scope.
XXX.2 Listing Requirements.
XXX.3 Reconditioned Equipment.
XXX.3(A) Permitted to be Installed.
XXX.3(B) Not Permitted to be Installed.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 11:17:37 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: [CMP-2] In Article 210, CMP-2 relocated the section on Reconditioned Equipment from 210.2 to 210.3 (FR-7517) and relocated the section on Other Articles from 210.3 to 210.14 (FR-7520). ... [CMP-3] CMP-3 made several revisions to comply with Section 2.2 of the NEC Style Manual for parallel numbering in Articles 300, 335, 590, 722, 724, 725, 726, and 760.

Public Input No. 4251-NFPA 70-2023 [New Article after 100]

Demonstrated Load. Historical demand watt information recorded over at least a 24-month period for the same occupancy class identifed in the International Building Code (watts/square meter)

Type your content here ...

Statement of Problem and Substantiation for Public Input

This is a correlating and necessary definition -- inspired by the Canadian Electrical Code -- to accompany a proposal for related demonstrated load proposal in Section 220.86.

Part I -- Installment 5 of the Canadian Electrical Code defines "Demonstrated Load" as the historical demand watt information recorded over 24 months for the same type of facility. In effect, the Canadian Electrical Code defers to the professional judgement of electrical designers over prescriptive methods enforced in plan inspection and approval procedures.

Submitter Information Verification

Submitter Full Name: Michael Anthony

Organization: Standards Michigan LLC

Affiliation: IEEE Education & Healthcare Facilities Committee

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 07:52:12 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: No revision processed for CMP-2 utilized the term “demonstrated load”. A similar concept is addressed in 220.87; however, the historical demand is referred to as ‘metered data’. This is a term that does not require a definition.

Public Input No. 3281-NFPA 70-2023 [Definition: Bathroom.]

Bathroom.

An area ~~including a sink with~~ which includes one or more of the following used primarily for bathing or hygiene : a sink a toilet, a urinal, a tub, a shower, a bidet, or similar plumbing fixtures. ~~(CMP-2)~~

Statement of Problem and Substantiation for Public Input

The definition of a bathroom reads “An area including a sink with one or more of the following: a toilet, a urinal, a tub, a shower, a bidet, or similar plumbing fixtures.”

Absent a sink an area with a toilet, a urinal, a tub, a shower, a bidet, or similar plumbing fixtures does not meet the definition of a bathroom. Earlier this year, I had a customer insist that the placement of overcurrent protective devices (main panelboard) in a room (dwelling unit) that did not include a sink the room contained only a bathtub (no shower) was not a bathroom as defined by the NEC and because the room did not contain showering facilities was therefore not a violation of 240.24 (E).

This revised definition is intended to help eliminate ambiguity and a “loophole” regarding what is and is not a bathroom. If overcurrent protective devices are prohibited in a room that contains a sink and a toilet for example, overcurrent protective devices should also be prohibited in an area that contains only a bathtub.

Submitter Information Verification

Submitter Full Name: Gary Hein

Organization: [Not Specified]

Street Address:

City:

State:

Zip:

Submittal Date: Thu Aug 31 13:48:21 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: The proposed change in the definition of bathroom could have unintended consequences. Using the proposed definition, a room in a dwelling with just a toilet or just a sink, or just a tub would now be considered a bathroom and require a 20-amp circuit.

Public Input No. 735-NFPA 70-2023 [Definition: Bathroom.]

~~Bathroom~~ Restroom .

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

Statement of Problem and Substantiation for Public Input

Bathroom usually implies there is a bathtub/shower. However, that is not what the NEC means. As a result, the universal (in USA) term restroom should be used to eliminate confusion and ambiguity.

Submitter Information Verification

Submitter Full Name: Conrad Ko
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Apr 26 01:52:05 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The existing defined term “Bathroom” is used in many locations throughout the Code. Changing this term to “Restroom” does not add clarity. This definition does not imply that there is a bathtub/shower.

Public Input No. 1344-NFPA 70-2023 [Definition: Branch Circuit, Individual. (Individual Branch ...]

Branch Circuit, Individual. (Individual Branch Circuit)

A branch circuit that supplies only ~~one utilization equipment~~ a single (outlet) utilization equipment is connected to . (CMP-2)

Statement of Problem and Substantiation for Public Input

I don't see why there are so many definitions of different branch circuits if they all are required to connect to outlets anyway. The enhanced content of NFPA says hardwired utilization equipment is connected to an appliance outlet. I feel clarification is needed.

Submitter Information Verification

Submitter Full Name: William Snyder
Organization: RCC Solutions
Affiliation: High Voltage Live show
Street Address:
City:
State:
Zip:

Submittal Date: Sun Jul 09 02:31:14 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The proposed language does not add clarity. An individual branch circuit is a branch circuit that supplies only one utilization equipment, and it is not necessary that only one outlet exist as long as the individual branch circuit is serving only one utilization equipment.

Public Input No. 453-NFPA 70-2023 [Definition: Branch Circuit, Individual. (Individual Branch ...]

Branch Circuit, Individual. (Individual Branch Circuit)

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

Delete definition, the definition of branch circuit already covers the installation of a single outlet or multiple outlets. If there is no outlet at the motor, then the definition should remain intact.

If definition is to remain in 2026 NEC, add new Informational Note:

Informational Note: Hard-wired equipment has no outlet, only cord-and-plug connected utilization equipment (appliances) have an outlet, see definition of branch circuit, appliance and branch circuit, general purpose.

Statement of Problem and Substantiation for Public Input

I have maintained and always believed there is no outlet, this is nothing more than a termination. If an outlet is present, a substantiation from Code Making Panel 2 of where the outlet is located would be helpful.

Here are some locations to consider - at the circuit breaker, the load side of the disconnecting means, the wiring method itself, at the motor termination, and where the wiring method terminates at the motor (apparently a free floating outlet in an infinite space).

If there is no outlet, 210.8(F), Ex. 2 needs to be completed deleted from the 2026 NEC.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1740-NFPA 70-2023 [Definition: Branch Circuit, Motor. (Motor Branch Circuit)]	

Submitter Information Verification

Submitter Full Name: James Stallcup
Organization: Volt Online Academy
Street Address:
City:
State:
Zip:
Submittal Date: Tue Mar 14 13:18:58 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: This public input did not follow the rules established as part of Section 4.3.4.1 of the Regulations Governing the Development of NFPA Standards. Substantiation has not been provided to delete the defined term Branch Circuit, Individual. The term outlet referenced in the substantiation for this public input is a defined term found in Article 100 and does exist in power distribution systems. The substantiation is incorrect in stating that there is no outlet. This term is used in the NEC and deleting it could cause confusion. The proposed informational note is not correct and conflicts with the definition of an outlet.

Public Input No. 175-NFPA 70-2023 [Definition: Counter (Countertop).]

Counter (Countertop).

A fixed or stationary surface typically intended for food preparation ~~and~~ or serving, personal lavation, or laundering or a similar surface that presents a routine risk of spillage of larger quantities of liquids upon outlets mounted directly on or in the surface. (CMP-2)

Informational Note No. 1: See UL 498, *Receptacles and Attachment Plugs*, and UL 943, *Ground-Fault Circuit Interrupters*, which establish the performance evaluation criteria and construction criteria.

Informational Note No. 2: See 406.5(E), 406.5(G)(1), and 406.5(H) for information on receptacles for counters and countertops distinguished from receptacles for work surfaces.

Statement of Problem and Substantiation for Public Input

Countertops are not always used for both food preparation and serving. The current definition only makes it a countertop if it is used for both food preparation and serving. That will permit the use of a receptacle assembly listed for use in work surfaces that is only subjected to an 8 ounce spill test. This type of area should require the receptacle assembly be listed for countertops and subjected to the 64 ounce spill test. This change will clarify that.

Submitter Information Verification

Submitter Full Name: Don Ganiere
Organization: none
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 17 12:40:11 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7503-NFPA 70-2024

Statement: The definition is modified to recognize beverage preparation and beverage serving in addition to food as the definition clearly references the risk of spillage of liquids. This change also separates preparation from serving as either and not both are important in the application of this defined term.

Public Input No. 2053-NFPA 70-2023 [Definition: Demand Factor.]

Demand Factor.

~~The ratio of~~ A percentage used to determine the maximum ~~demand of a system, or part of a system, to the total connected load of~~ portion of the connected load to be used by a system or ~~the part~~ portion of ~~the~~ a system ~~under consideration~~ . (CMP-2)

Statement of Problem and Substantiation for Public Input

The existing definition has two problems: 1. The definition uses the word to be defined in its definition thereby creating circular logic. 2. The definition identifies demand factor as a ratio, however Articles 220 and 225 consistently utilize it as a percentage.

Submitter Information Verification

Submitter Full Name:	James Degnan
Organization:	King County Metro
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Fri Aug 11 12:45:39 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: While the NEC Style Manual excludes the use of a defined term within a definition (in 2.1.2.5), this definition only uses a single word from that defined term (“demand”), and not the defined term “Demand Factor”). This is not an uncommon practice for defined multi-word phrases. The NEC Style Manual includes several examples where this occurs - see 2.1.2.6.1, 2.1.2.6.2, 2.1.2.6.3, and 2.1.2.9. Both “ratios” and “percentages” are mathematical expressions used for comparisons. The current definition is accurate and has been in use for decades.

Public Input No. 2035-NFPA 70-2023 [Definition: Dormitory Unit.]

Dormitory ~~Unit~~ .

A building or a space in a building in which group sleeping accommodations are provided for ~~more than 16~~ persons ~~who are~~ not members of the same family in one room, or a series of closely associated rooms, under joint occupancy and single management ~~, with or without meals, but without individual cooking facilities.~~ . (CMP 2)

Statement of Problem and Substantiation for Public Input

The term "dormitory" is defined in IBC, which then applies to all other I-codes. IBC & IFC include many specific requirements relating to R-2 construction of dwelling units and sleeping units that meet the definition of dormitories. The proposed language would harmonize the NEC definition to match IBC definition. Deviations in definitions between building code and electrical code cause disagreements between AHJs and enforcement of requirements.

Submitter Information Verification

Submitter Full Name: Josh Wiley
Organization: Jordan Skala Engineers
Street Address:
City:
State:
Zip:

Submittal Date: Fri Aug 11 11:04:12 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The suggested changes do not align with the international building code nor NFPA 5000. The text suggested to be removed is included in the building codes. Removing this text would have unintended consequences, one of which could include expanding this defined term to apply to hotels. The restrictions around number of persons and those pertaining to meals and cooking facilities are necessary to both align with building codes and limit the application of the term.

Public Input No. 798-NFPA 70-2023 [Definition: Dormitory Unit.]

Dormitory ~~Unit~~ .

A building or a space in a building in which group sleeping accommodations are provided for more than 16 persons who are not members of the same family in one room, or a series of closely associated rooms, under joint occupancy and single management, with or without meals, but without individual cooking facilities. [***101:*** 3.3.68] (CMP 2)

Informational Note: Rooms within dormitories intended for the use of individuals for combined living and sleeping purposes are guest rooms or guest suites. Examples of dormitories are college dormitories, fraternity and sorority houses, and military barracks. [***101:*** A.3.3.68] (CMP 2)

Statement of Problem and Substantiation for Public Input

OBJECTIVE:
• USABILITY of NEC® and consistent CORRELATION with the defined term's EXTRACTION source NFPA 101® Life Safety Code® regarding INDIVIDUAL guest rooms and individual guest suites of dormitories versus the ENTIRE dormitory occupancy. NEC® Correlation Committee [NEC-AAC] take note.

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NOTA BENE: Sections 3.3.68 and A.3.3.68 in 2024 NFPA 101® Life Safety Code® had been editorially numbered as Sections 3.3.66 and A.3.3.66, respectively, in 2018 and 2021 NFPA 101® Life Safety Code® and as Sections 3.3.64 and A.3.3.64, respectively, in 2015 NFPA 101® Life Safety Code®.

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BACKGROUND:
The existing NFPA 70® definition content is a verbatim extraction of the same definition originating in NFPA 101®. This extraction within NEC must be so indicated as such, in accordance with NEC® Style Manual 2.1.12.3.2 [2023]/4.3.2.2 [2020], and 2.1.2.6.3 [2023]/2.2.2.3.3 [2020] and with Manual of Style for NFPA Technical Committee Documents 2.6.1.5, 2.6.1(3), 2.6.1.1, 2.6.2.2, and 2.6.2.4.3. Further, "Any editing of the extracted text shall be confined to making the style consistent with that of the NEC® Style Manual and then only with the concurrence of the committee having primary jurisdiction. Such concurrence shall be obtained through the staff liaison for the source document." The present definition title violates this rule [2023 NEC® Style Manual 2.1.12.3.2, 2020 NEC® Style Manual 4.3.2.2].

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Users of NEC® have encountered interpretational discrepancies with the present confusing wording. Presently, interpretation confusion exists to readers of NEC® regarding the use of the term "dormitory UNIT" versus the present definition's ambiguous clause " ... group SLEEPING ACCOMMODATIONS are provided for more than 16 persons who are not members of the same family IN ONE ROOM, OR A SERIES OF CLOSELY ASSOCIATED ROOMS, ...". Because of misinterpretation that the "UNIT" MUST accommodate "more than 16 persons", specific dormitory rooms intended for an individual student or a few individual students have been deemed wrongly to NOT constitute a dormitory UNIT because those individual rooms cannot accommodate "MORE THAN 16 PERSONS".

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The phrase "IN ONE ROOM, OR A SERIES OF CLOSELY ASSOCIATED ROOMS" refers to "who are NOT MEMBERS of the SAME FAMILY", and does NOT refer to the "group SLEEPING ACCOMMODATIONS" having to be within in ONE room or ONE suite. Consequently, "dormitory" refers to the ENTIRE building or the ENTIRE space within that building AS AN OCCUPANCY that must accommodate MORE THAN 16 persons, and NOT to EACH specific sleeping room accommodating more than 16 persons.

.
Misuse of the term "dormitory UNIT" has effectively DIMINISHED SAFETY for what are colloquially called "dormitory rooms" that are now wrongly NOT treated as guest rooms or guest suites WITHIN a DORMITORY OCCUPANY. These so-called dormitory UNITS (INDIVIDUAL ROOMS) are being misinterpreted such that intended GFCI, AFCI and other protection requirements do NOT APPLY for DORMITORY bedrooms, for DORMITORY living rooms, and for closets and hallways INSIDE the so-called dormitory UNIT if that "UNIT" accommodates FEWER THAN 17 OCCUPANTS.

.
NFPA 101® Informational Annex A has long ago addressed this misinterpretation: "A.3.3.68 Dormitory. Rooms within dormitories intended for the use of individuals for combined living and sleeping purposes are guest rooms or guest suites. Examples of dormitories are college dormitories, fraternity and sorority houses, and military barracks.". Further, "Guest Room" and "Guest Suite" are ALREADY explicitly defined terms in both NFPA 70® and NFPA 101® [3.3.136 for "Guest Room"; 3.3.285.1 for "Guest Suite"].

It is essential that the terminology and usage for dormitories and for guest rooms and guest suites of dormitories in NFPA 70® must be clarified at this time, CONSISTENT with NFPA 101®, to avoid confusion BETWEEN Codes in categorizing of the same individual rooms of a dormitory. Per 2023 NEC® Style Manual 2.1.12.3.2, "A section or paragraph being extracted from another document shall represent a complete thought and shall be entirely extracted. The context of the original material shall not be compromised or violated." and similarly per Manual of Style for NFPA Technical Committee Documents 2.6.1; merely altering one word of the title does not negate that this is in fact an NFPA 101® extract.

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Related Public Inputs address the corresponding changes elsewhere in NFPA 70® that must be revised accordingly.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 799-NFPA 70-2023 [Section No. 210.17]	Correlated usage of defined terms "Dormitory", "Guest Room", and "Guest Suite".
Public Input No. 800-NFPA 70-2023 [Section No.	Correlated usage of defined terms "Dormitory", "Guest Room", and

210.12(C)]	"Guest Suite".
Public Input No. 801-NFPA 70-2023 [Section No. 210.60]	Correlated usage of defined terms "Dormitory", "Guest Room", and "Guest Suite".
Public Input No. 802-NFPA 70-2023 [Section No. 240.24(B)(2)]	Correlated usage of defined terms "Dormitory", "Guest Room", and "Guest Suite".
Public Input No. 803-NFPA 70-2023 [Section No. 215.18(A)]	Correlated usage of defined terms "Dormitory", "Guest Room", and "Guest Suite".
Public Input No. 804-NFPA 70-2023 [Section No. 225.42(A)]	Correlated usage of defined terms "Dormitory", "Guest Room", and "Guest Suite".
Public Input No. 805-NFPA 70-2023 [Section No. 230.67(A)]	Correlated usage of defined terms "Dormitory", "Guest Room", and "Guest Suite".
Public Input No. 806-NFPA 70-2023 [Section No. 406.12]	Correlated usage of defined terms "Dormitory", "Guest Room", and "Guest Suite".
Public Input No. 799-NFPA 70-2023 [Section No. 210.17]	
Public Input No. 800-NFPA 70-2023 [Section No. 210.12(C)]	
Public Input No. 801-NFPA 70-2023 [Section No. 210.60]	
Public Input No. 802-NFPA 70-2023 [Section No. 240.24(B)(2)]	
Public Input No. 804-NFPA 70-2023 [Section No. 225.42(A)]	
Public Input No. 805-NFPA 70-2023 [Section No. 230.67(A)]	
Public Input No. 806-NFPA 70-2023 [Section No. 406.12]	

Submitter Information Verification

Submitter Full Name: Brian Rock
Organization: Hubbell Incorporated
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 12 15:24:28 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7506-NFPA 70-2024

Statement: The language is modified as extracted text from NFPA 101 Section 3.3.68 to add clarity and consistency within the NEC and between it and other NFPA documents.

Public Input No. 720-NFPA 70-2023 [Definition: Dwelling Unit.]

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. Excludes garages and sheds if they are separate buildings or have a lockable door between it and the living areas. (CMP-2)

Statement of Problem and Substantiation for Public Input

Reduced ambiguity by stating that dwelling unit only includes living areas for the purpose of the Code.

Submitter Information Verification

Submitter Full Name: Conrad Ko
Organization: [Not Specified]
Street Address:
City:
State:
Zip:

Submittal Date: Tue Apr 25 23:58:24 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The proposed language does not add clarity. This is a definition of a dwelling unit, adding language that suggests what is excluded can cause confusion if not all inclusive of every type of structure that is not a dwelling unit.

Public Input No. 2476-NFPA 70-2023 [Definition: Dwelling, Multifamily. (Multifamily Dwelling)]

Dwelling, Multifamily. (Multifamily Dwelling)

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

Informational Note; For purposes of applying this definition a townhouse shall be considered a single family dwelling. See, 2021 IRC Chapter 2 definitions for townhouse.

Statement of Problem and Substantiation for Public Input

For enforcement reasons of 230.85 an informational note should be added to clarify a townhouse as a single family dwelling. This will help clarify the NEC definition of 3 or more dwelling units as a multifamily building. Discussions have occurred if emergency disconnects are required to be installed on townhome units with 3 or more attached dwellings by definition the 2021 IRC considers these single family dwelling units.

Submitter Information Verification

Submitter Full Name: Eric Hanson
Organization: City of Bloomington, MN
Street Address:
City:
State:
Zip:
Submittal Date: Fri Aug 18 08:05:09 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The suggested changes are not accepted. The phrase “shall be considered a single family dwelling” is written as a requirement and definitions cannot include requirements. Reference NEC Style Manual Section 2.1.10 which includes the requirements for informational notes and specifically Section 2.1.10.2, “Language”, which states “Informational notes shall not be written in mandatory language and shall not contain requirements, make interpretations, or make recommendations.”. Language stating that a townhouse shall be considered a single-family dwelling was not accepted because single family dwelling is not the correct terminology and adding this language could cause confusion as a townhouse could include a 2-family dwelling.

Public Input No. 4523-NFPA 70-2023 [Definition: Ground-Fault Circuit Interrupter, Special Purpo...]

Ground-Fault Circuit Interrupter, Special Purpose (SPGFCI). (Special Purpose Ground-Fault Circuit Interrupter)

A device intended for the ~~detection of ground-fault currents~~ protection of personnel , used in circuits with voltage to ground greater than 150 volts, or when the use of a Class A GFCI is not practical, that functions to de-energize a circuit or portion ~~of a circuit~~ thereof within an established period of time when a ground-fault current exceeds the values established for Class C, D, or E devices. (CMP-2)

Informational Note: See UL 943C, *Outline of Investigation for Special Purpose Ground-Fault Circuit Interrupters*, for information on Classes C, D, or E special purpose ground-fault circuit interrupters.

Additional Proposed Changes

File Name	Description	Approved
ESW-2023-41.pdf	SPGFCIs are Personnel Protection	

Statement of Problem and Substantiation for Public Input

SPGFCIs are tested and certified to the same time interval limits of Class A GFCIs. The major differences are the trip threshold level, and the ability for SPGFCIs to be applied at levels higher than Class A devices can be.
With regards to the trip threshold, the 20mA level is still below the level of ventricular fibrillation according to Dalziel's published data. While 20 mA is higher than the let-go threshold for the general population, the SPGFCI solves that problem by requiring grounding monitor/interruption so that a high impedance ground fault is highly unlikely to occur, and a majority of ground fault current will flow in parallel to a person's body, thereby ensuring that any ground fault is de-energized in 20 mS or less.
The way this definition was written previously did not correlate to how it is described in the UL 943C Outline of Investigation for Special Purpose GFCIs, and did not accommodate for applications that are below 150 volts to ground, or less.

Submitter Information Verification

Submitter Full Name: Tim Piemonte
Organization: Littelfuse
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 16:58:59 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The proposed phrasing creates a conditional requirement in the definition, which violates NEC Style Manual Section 2.1.2.5 which states “. . . Definitions shall not contain requirements or recommendations.” Use of the term practical is not accepted as the term practicable is a more appropriate term to be used. The addition of the phrase “protection of personnel” is not added as the UL Outline of Investigation, UL 943C, does not include the same phrase.

Public Input No. 1834-NFPA 70-2023 [Definition: Laundry Area.]

Laundry ~~Area~~ Room .

~~An area~~ A room containing or designed to contain a laundry tray, clothes washer, or clothes dryer. (CMP-2)

Statement of Problem and Substantiation for Public Input

The prevalence of stacked laundry units installed in dedicated closets makes a distinction important. A laundry area could be considered the closet that the unit(s) are located in as they are often separated by a door. With additional requirements for lighting outlets added to the code defining the area around the laundry equipment as a room may prevent lighting outlets from being required in inaccessible areas or otherwise being installed in location where they provide no functional illumination.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1835-NFPA 70-2023 [Definition: Laundry Area.]	
Public Input No. 1836-NFPA 70-2023 [Section No. 210.70(A)(1)]	
Public Input No. 1835-NFPA 70-2023 [Definition: Laundry Area.]	
Public Input No. 1836-NFPA 70-2023 [Section No. 210.70(A)(1)]	

Submitter Information Verification

Submitter Full Name: IEC National
Organization: IEC
Affiliation: Matthew Grover
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 06 09:06:58 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The suggestion to remove “area” is not accepted as the use of the term is necessary. There are consequences related to accepting this suggested change that would reduce electrical safety. The fact is that an “Area” may not be a room. As an example, a closet may not constitute the dimensions to be considered a room but may still be an area where a washing machine and dryer and other laundry equipment could be located and would meet the definition of a “Laundry Area”.

Public Input No. 1835-NFPA 70-2023 [Definition: Laundry Area.]

Laundry Area.

An area ~~containing or designed to contain a~~ intended for operation or access of a laundry tray, clothes washer, or clothes dryer by a person . (CMP-2)

Statement of Problem and Substantiation for Public Input

The prevalence of stacked laundry units installed in dedicated closets makes a distinction important. A laundry area could be considered the closet that the unit(s) are located in as they are often separated by a door. With additional requirements for lighting outlets added to the code defining the laundry area as the space occupied by a person using the equipment keeps requirements for illumination, or other future requirements focused on the occupied portion of the space, where illumination is important for safety.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1834-NFPA 70-2023 [Definition: Laundry Area.]	
Public Input No. 1836-NFPA 70-2023 [Section No. 210.70(A)(1)]	
Public Input No. 1834-NFPA 70-2023 [Definition: Laundry Area.]	
Public Input No. 1836-NFPA 70-2023 [Section No. 210.70(A)(1)]	

Submitter Information Verification

Submitter Full Name: IEC National
Organization: IEC
Affiliation: Matthew Grover
Street Address:
City:
State:
Zip:

Submittal Date: Sun Aug 06 09:13:44 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The suggested language does not add clarity and would be difficult to enforce. Determining intentions is not enforceable.

Public Input No. 1711-NFPA 70-2023 [New Definition after Definition: Automatic.]

Basement

Any story of a building or structure wholly or partly below grade.

Statement of Problem and Substantiation for Public Input

The term “basement” is used at least 8 times in this Code in at least 4 different Chapters including Chapters 1, 2, 3 and 7. Many requirements are based upon equipment or circuits being located in basements, yet this Code does not define this term. Does this include the bottom floor of a split-entry ranch? Does it include sub-basements too? What about a floor that is located only 6” below grade? Many other Codes and Standards include a definition of the term “basement” including NFPA 1, 101, 30, 30A, 30B, 33, 34, 35, 400 and 5000. The 2021 IBC and IRC also include a definition of “basement”. Even dictionaries define the term "basement". Why doesn’t the NEC? Which definition should NEC users refer too?

The 2021 edition of the NFPA Glossary of Terms indicates that several variations of the definition of basement are used throughout other NFPA Codes and Standards. My proposed wording is based on these other variations, but is worded to better fit the NEC. It’s time to include this term in the NEC to help make this document more “user friendly”, and installations more standardized.

This definition is especially important when it comes to Article 210 requirements as it has several requirements pertaining to basements including GFCI protection, lighting outlets, and receptacle outlets. A definition for the term "basement" is equally as import as definitions for the terms "kitchen", "bathroom", "garage", "habitable room", and "laundry area". These latter terms are presently defined in Article 100, while installers are left with a myriad of other choices when it comes to choosing an appropriate definition for "basement".

Submitter Information Verification

Submitter Full Name:	Russ Leblanc
Organization:	Leblanc Consulting Services
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sat Jul 29 10:13:16 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The proposed definition includes a story of a building that is partly below grade which would classify an area of the structure beyond what would be classified as a basement by building codes and other industry reference codes and standards.

Public Input No. 3279-NFPA 70-2023 [New Definition after Definition: Automatic.]

Bathing Area

An area used for bathing which includes one or more of the following a bathtub, showering facilities or similar plumbing fixtures used for bathing.

Statement of Problem and Substantiation for Public Input

The definition of a bathroom reads “An area including a sink with one or more of the following: a toilet, a urinal, a tub, a shower, a bidet, or similar plumbing fixtures.”

Absent a sink an area with a toilet, a urinal, a tub, a shower, a bidet, or similar plumbing fixtures does not meet the definition of a bathroom. Earlier this year, I had a customer insist that the placement of overcurrent protective devices (main panelboard) in a room (dwelling unit) that did not include a sink the room contained only a bathtub (no shower) was not a bathroom as defined by the NEC and because the room did not contain showering facilities was therefore not a violation of 240.24 (E).

This new definition is intended to help eliminate ambiguity and a “loophole” regarding what is and is not a bathroom. If overcurrent protective devices are prohibited in a room that contains a sink and a toilet for example, overcurrent protective devices should also be prohibited in an area that contains only a bathtub for example.

Submitter Information Verification

Submitter Full Name:	Gary Hein
Organization:	[Not Specified]
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Thu Aug 31 12:59:56 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The term Bathing area is not used in the NEC and is not proposed for use by any other Public Input. Also, adding this defined term in the proposed location would violate the NEC Style manual section 2.1.2.2 which states that Definitions of terms used in the document shall only be located in Article 100.

Public Input No. 2186-NFPA 70-2023 [New Definition after Definition: Bathroom.]

Basement. Any story of a building wholly or partly below grade plane that is not considered the first story above grade plane.

Statement of Problem and Substantiation for Public Input

The term 'basement' is not defined and adding the definition will provide clarity in applying the requirements contained in 210.8(A)(5), 210.8(B)(12), 210.52(G)(3), 210.70(C), and 334.15(C).
The proposed definition exists in "NFPA 5000 Building Construction and Safety Code." The proposed revisions will bring clarity to Code users.

Submitter Information Verification

Submitter Full Name:	Mike Holt
Organization:	Mike Holt Enterprises Inc
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Aug 14 13:22:08 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The proposed definition includes an application of a building that is partly below grade which would classify an area of the structure beyond what would be classified as a basement by building codes and other industry reference codes and standards.

Public Input No. 1395-NFPA 70-2023 [New Definition after Definition: Collector Rings.]

TITLE OF NEW CONTENT

Column

A decorative or load bearing structure that extends from floor to ceiling, is isolated from other walls or columns, and has an overall width of up to 5 m (16').

Statement of Problem and Substantiation for Public Input

This new definition of column correlates with the newly proposed 210.52A2(5). Adopting this new definition prevents users of the code from defaulting to a standard dictionary definition of column when considering wall space placement of receptacles at a dwelling.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1397-NFPA 70-2023 [New Section after 210.52(A)(4)]	
Public Input No. 1397-NFPA 70-2023 [New Section after 210.52(A)(4)]	

Submitter Information Verification

Submitter Full Name: Norman Feck
Organization: State of Colorado
Affiliation: self
Street Address:
City:
State:
Zip:

Submittal Date: Thu Jul 13 08:07:18 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: This term is not currently used within Article 210 in the context of a building structural or decorative element. Only terms used in the National Electrical Code should be placed in Article 100. The companion public input number 1397 seeking to add requirements for a column was not accepted.

Public Input No. 1864-NFPA 70-2023 [New Definition after Definition: Generator, On-Site Standby...]

Grade Level

100 NEW - 210.8 (A) (2) Define/clarify what is "Grade Level" for applying 210.8 (A) (2) and other code article that reference "grade level. This addition will help ensure the consistent application of the requirements that are benchmarked to "grade level".

Statement of Problem and Substantiation for Public Input

100 NEW - 210.8 (A) (2) Define/clarify what is "Grade Level" for applying 210.8 (A) (2) and other code article that reference "grade level. This addition will help ensure the consistent application of the requirements that are benchmarked to "grade level".

Submitter Information Verification

Submitter Full Name: Gary Hein
Organization: [Not Specified]
Street Address:
City:
State:
Zip:

Submittal Date: Sun Aug 06 16:49:16 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The public input does not include proposed changes in legislative text as required by Section 4.3.4.1(C) of the Regulations Governing the Development of NFPA Standards. The phrase "grade level" is deleted in 210.8(B), list item (2). [See Detail FR-7908.]

Public Input No. 4308-NFPA 70-2023 [New Definition after Definition: Ground-Fault Circuit Inter...]

TITLE OF NEW CONTENT

Ground-Fault Circuit Interrupter, High Frequency (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 the frequency weighted differential current exceeds the values established for a Class A-HF device. (CMP-2)

Informational Note: See UL 943, Standard for Ground-Fault Circuit Interrupters, for further information. Class A-HF ground-fault circuit interrupters do not trip when the frequency weighted differential current is less than 4 mA.

Statement of Problem and Substantiation for Public Input

A. Class A GFCIs trip on safe appliances

There is a technological incompatibility between common loads in the home and GFCIs. The incompatibility is often realized in the form of “nuisance tripping”, where a GFCI trips and no electrical hazard is present. This incompatibility is especially pertinent in the context of home appliances, which are subject to continuously updated, mandatory, Department of Energy efficiency requirements. In order for appliances to meet efficiency standards, home appliance manufacturers incorporate components that operate at frequencies higher than the mains frequency of 60-Hertz. These technologies include switch-mode power supplies, electronically commutated motors, and LED drivers.

It should be noted that technologies used to make home appliances more efficient are similar to technologies used to make central air conditioners more efficient.

Presently, there are major inconsistencies in GFCI performance above 60-Hertz. To study effects of this variation, UL has conducted an independent study testing 3 different types of appliances, from 3 different manufacturers, connecting each of these appliances to 10 different GFCIs. All three appliances contain high frequency components - such components are found in virtually all modern home appliances. A link to the study is here:

https://collateral-library-production.s3.amazonaws.com/uploads/asset_file/attachment/54854/Study_of_High_Frequency_Spectrum_for_120_V_Household_Appliances.pdf

There are a few notable items from the UL study:
1) GFCI trip thresholds are all over the place. At certain frequencies, GFCI trip thresholds differ by roughly 150%.
2) The appliances are safe. When compared to present leakage current requirements and possible future requirements, all appliances pass by a wide margin.
3) The three appliance models tested are representative of many more models that are essentially identical as defined by Department of Energy.
4) GFCIs trip on all the appliances tested.

B. Conclusion

There has been significant expansion of Class A GFCI requirements in recent NEC code cycles.

These new locations contain appliances which are significantly more complex than appliances in past GFCI locations such as bathrooms and kitchen countertops. While a Class A GFCI may be suitable for protection on circuits powering hair dryers and blenders, there are Class A GFCIs that are not suitable for protection on more complex appliances which are subject to efficiency requirements. GFCIs must be modernized if they are required to be connected to more complex loads. One example of such modernization is a Class A-HF GFCI.

While it is AHAM’s preference that all permanently connected Class A GFCIs be modernized, home appliance manufacturers understand that such requirements may not get the necessary votes in the UL 943 standard. AHAM looks forward to CMP2 feedback on this alternative approach to nuisance tripping relief.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4315-NFPA 70-2023 [Section No. 210.8 [Excluding any Sub-Sections]]	New definition is used in 210.8 PI
Public Input No. 4315-NFPA 70-2023 [Section No. 210.8 [Excluding any Sub-Sections]]	

Submitter Information Verification

Submitter Full Name: Greg Woyczynski
Organization: Association of Home Appliance Manufacturers

Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 10:45:44 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The term is not used in the NEC and the companion public input, PI 4315, was not accepted.

Public Input No. 73-NFPA 70-2023 [New Definition after Definition: Valve Actuator Motor (VAM)...]

Residential Vehicle Bay-

A single vehicle bay shall be considered to be 7' tall by 8' wide.

Statement of Problem and Substantiation for Public Input

There is currently confrontation between installers and inspectors on when you need to add a second outlet for a garage door as required by 210.52(G)(1). Defining what constitutes a single bay would eliminate the conflict of a double-wide garage door and whether or not that single garage door is one bay or two.

Submitter Information Verification

Submitter Full Name: Jesse Duvuvei

Organization: Middle Department Inspection Agency

Street Address:

City:

State:

Zip:

Submittal Date: Sat Jan 07 18:38:41 EST 2023

Committee: NEC-P02

Committee Statement

Resolution: The suggested language is not accepted as adding precise dimensions would exclude many vehicle bays that do not fall within the dimensions proposed without substantiation on why those vehicle bays should not be subjected to the requirements for all vehicle bays. The suggested changes are not accepted. The phrase “shall be considered . . ” is written as a requirement and definitions cannot include requirements. Reference NEC Style Manual Section 2.1.10 which includes the requirements for informational notes and specifically Section 2.1.10.2, “Language”, which states “Informational notes shall not be written in mandatory language and shall not contain requirements, make interpretations, or make recommendations.”.

Public Input No. 4266-NFPA 70-2023 [New Definition after Definition: Wireways, Nonmetallic. (No...]

TITLE OF NEW CONTENT Work Area

Type your content here ...The area or spaces in a building where construction, maintenance, fabrication, or vocational educational shop activities take place using electrical hand tools, portable lighting equipment, or tempoary use of electrical power as part of the normal operation of that space.

Statement of Problem and Substantiation for Public Input

My intent is to require GFCI requirements for 15 and 20 ampere, 120 Volt receptacles used in spaces within a building where construction type activities take place as part of the normal operation of those spaces. Currently, there is no GFCI requirements for receptacles in these spaces. By having a definition of these spaces, it would be easier to define these spaces in one term and place it in Article 100. Please see my public input for a new 210.8 (G)

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3630-NFPA 70-2023 [New Section after 210.8]	
Public Input No. 3630-NFPA 70-2023 [New Section after 210.8]	

Submitter Information Verification

Submitter Full Name:	Charles Kennedy
Organization:	GLTS
Affiliation:	Greater Lawrence Technical School
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Thu Sep 07 08:59:45 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The language of public input 3630 was not accepted and as such this term is not used in the Code. Therefore, a definition for the term “Work Area” is not necessary. The proposed definition would be difficult to enforce and could cause further confusion.

Public Input No. 4311-NFPA 70-2023 [New Section after 110.79]

Article 120 Branch-Circuit, Feeder, and Service Load Calculations.

Part I. General

120.1 Scope .

This article provides requirements for calculating branch-circuit, feeder, and service loads. Part I provides general requirements for calculation methods. Part II provides calculation methods for branch-circuit loads. Part III and Part IV provide calculation methods for feeder and service loads. Part V provides calculation methods for farm loads. Part VI provides calculation methods for health care facilities. Part VII provides calculation methods for marinas, boatyards, floating buildings, and commercial and noncommercial docking facilities.

Informational Note No. 1: See Informative Annex D for examples.

Informational Note No. 2: See Informational Note Figure 1 20.1 for information on the organization of this article.

Figure Informational Note Figure 1 20.1 Branch-Circuit, Feeder, and Service Load Calculation Methods.

120.3 Other Articles for Specific-Purpose Calculations .

Table 1 20. 3 shall provide references for specific-purpose calculation requirements not located in Chapters 5 , 6 , or 7 that amend or supplement the requirements of this article.

Table 1 20.3 Specific-Purpose Calculation References

Calculation	Article	Section (or Part)
Air-conditioning and refrigerating equipment, branch-circuit conductor sizing	440	Part IV
Capacitors	460	460.8
Fixed electric heating equipment for pipelines and vessels, branch-circuit sizing	427	427.4
Fixed electric space-heating equipment, branch-circuit sizing	424	424.3
Fixed outdoor electric deicing and snow-melting equipment, branch-circuit sizing	426	426.4
Fixed resistance and electrode industrial process heating equipment	425	425.4
Motors, feeder demand factor	430	430.26
Motors, multimotor and combination-load equipment	430	430.25
Motors, several motors or a motor(s) and other load(s)	430	430.24
Over 1000-volt ac and 1500-volt dc branch-circuit calculations	235	235.19
Over 1000-volt feeder calculations	215	215.2(B)
Phase converters, conductors	455	455.6
Storage-type water heaters	422	422.11

120.5 Calculations .

(1) **Voltages .**

Unless other voltages are specified, for purposes of calculating branch-circuit and feeder loads, nominal system voltages of 120, 120/240, 208Y/120, 240, 347, 480Y/277, 480, 600Y/347, and 600 volts shall be used.

(1) **Fractions of an Ampere .**

Calculations shall be permitted to be rounded to the nearest whole ampere, with decimal fractions smaller than 0.5 dropped.

(1) **Floor Area .**

The floor area for each floor shall be calculated from the outside dimensions of the building, dwelling unit, or other area involved. For dwelling units, the calculated floor area shall not include open porches or unfinished areas not adaptable for future use as a habitable room or occupiable space.

Part II. Branch-Circuit Load Calculation s

120 .10 General .

Branch-circuit loads shall be calculated in accordance with the following sections :

(1) 1 20.1 4 for other loads — all occupancie s

(2) 1 20.1 6 for additions to existing installation s

(3) 1 20.4 1 for dwelling unit s

(4) 1 20.4 2 for lighting loads for non-dwelling occupancie s

(5) 1 20.4 4 for hotel and motel occupancie s

120.11 Maximum Load .

The total load on a branch circuit shall not exceed the rating of the branch circuit nor the maximum loads specified in 1 20.11(A) through (C) under the conditions specified therein.

(1) **Motor-Operated and Combination Loads .**

Where a circuit supplies only motor-operated loads, the conductor sizing requirement specified in 430.2 2 shall apply. Where a circuit supplies only air-conditioning equipment, refrigerating equipment, or both, the requirements of 440. 6 shall apply. For circuits supplying loads consisting of motor-operated utilization equipment that is fastened in place and has a motor larger than 1 ⁄8 hp in combination with other loads, the total calculated load shall be based on 125 percent of the largest motor load plus the sum of the other loads in accordance with 430.2 4 .

(1) **Inductive and LED Lighting Loads .**

For circuits supplying lighting units that have ballasts, transformers, autotransformers, or LED drivers, the calculated load shall be based on the total ampere ratings of such units and not on the total watts of the lamps.

(1) **Electric Cooking Appliances .**

Applying demand factors for ranges, wall-mounted ovens, counter-mounted cooking units, and other household cooking appliance loads in excess of 1 3 ⁄4 kW shall be permitted in accordance with Table 1 20.5 5 , including Notes 4, 5, and 6.

120.14 Other Loads — All Occupancies .

Branch-circuit load calculations shall include calculation of a minimum load on each outlet as calculated in 1 20.14(A) through (K) and then summed to establish the load on the branch circuit.

In all occupancies, the minimum load for each outlet for general-use receptacles and outlets not used for general illumination shall not be less than that calculated in 1 20.14(A) through (K), with the loads shown being based on nominal branch-circuit voltages.

Exception: The loads of outlets serving switchboards and switching frames in telephone exchanges shall be waived from the calcul ations.

(1) **Specific Appliances or Loads .**

An outlet for a specific appliance or other load not covered in 1 20.14(B) through (K) shall be calculated based on the ampere rating of the appliance or load served.

(1) **Electric Dryers and Electric Cooking Appli ances in Dwellings and Household Cooking Appliances Used in Instructional Programs .**

Load calculations shall be permitted as specified in 1 20.5 4 for electric dryers and in 1 20.5 5 for electric ranges and other cooking appliances.

(1) **Motor Outlets .**

The conductor sizing requirements specified in 430.22, 430.24, and 440.6 shall be used to determine the loads for motor outlets.

(1) **Luminaires .**

An outlet supplying a luminaire(s) shall be calculated based on the maximum volt-ampere rating of the equipment and lamps for which the luminaire(s) is rated.

(1) **Heavy-Duty Lampholders .**

Outlets for heavy-duty lampholders shall be calculated at a minimum of 600 volt-amperes.

(1) **Sign and Outline Lighting .**

Sign and outline lighting outlets shall be calculated at a minimum of 1200 volt-amperes for each required branch circuit specified in 600.5(A) .

(1) **Show Windows .**

Show windows shall be calculated in accordance with either of the following :

(1) The unit load per outlet as required in other provisions of this sectio n

(2) At 200 volt-amperes per linear 300 mm (1 ft) of show windo w

(1) **Fixed Multioutlet Assemblies .**

Fixed multioutlet assemblies used in other than dwelling units or the guest rooms or guest suites of hotels or motels shall be calculated in accordance with the following :

(1) Where appliances are unlikely to be used simultaneously, each 1.5 m (5 ft) or fraction thereof of each separate and continuous length shall be considered as one outlet of not less than 180 volt-amperes .

(2) Where appliances are likely to be used simultaneously, each 300 mm (1 ft) or fraction thereof shall be considered as an outlet of not less than 180 volt-amperes .

For the purposes of this section, the calculation shall be permitted to be based on the portion that contains receptacles.

(1) **Receptac le Outlets .**

Except as covered in 1 20.4 1 and 1 20.14(J) , receptacle outlets shall be calculated at not less than 180 volt-amperes for each single or for each multiple receptacle on one yoke. A single piece of equipment consisting of a multiple receptacle comprised of four or more receptacles shall be calculated at not less than 90 volt-amperes per receptacle. This provision shall not be applicable to the receptacle outlets specified in 210.11(C)(1) and (C)(2).

(1) **Receptacle Outlets in Office Buildings .**

In office buildings, the receptacle loads shall be calculated to be the larger of the following :

(1) The calculated load from 1 20.14(I)

(2) 11 volt-amperes/ m^2 (1 volt-ampere/f t^2)

(1) **Other Outlets .**

Other outlets not covered in 1 20.14(A) through (J) shall be calculated based on 180 volt-amperes per outlet.

120.16 Loads for Additions to Existing Installations .

(1) **Dwelling Units .**

Loads added to an existing dwelling unit(s) shall comply with the following as applicable :

(1) Loads for structural additions to an existing dwelling unit or for a previously unwired portion of an existing dwelling unit shall be calculated in accordance with 1 20.1 4 .

(2) Loads for new circuits or extended circuits in previously wired dwelling units shall be calculated in accordance with 1 20.1 4 .

(1) **Other Than Dwelling Units .**

Loads for new circuits or extended circuits in other than dwelling units shall be calculated in accordance with either 1 20.4 2 or 1 20.1 4 , as applicable.

Part III. Feeder and Service Load Calculation s

120.40 General .

The calculated load of a feeder or service shall not be less than the sum of the loads on the branch circuits supplied, as determined by Part II of this article, after any applicable demand factors permitted or required by Part III, IV, V, VI, or VII have been applied.

Informational Note No. 1: See Informative Annex D, Examples D1(a) through D10, for examples of feeder and service load calculations.

Informational Note No. 2: See 220.11(B) for the maximum load in amperes permitted for lighting units operating at less than 100 percent power factor.

120.41 Dwelling Units, Minimum Unit Load .

In one-family, two-family, and multifamily dwellings, the minimum unit load shall be not less than 33 volt-amperes/ m^2 (3 volt-amperes/f t^2).

Unit loads include the following lighting and receptacle outlets, and no additional load calculations shall be required:

(1) All general-use receptacle outlets of 20-ampere rating or less, including receptacles connected to the circuits specified in 210.11(C)(3) and (C)(4)

(2) The receptacle outlets specified in 210.52(E) and (G)

(3) The lighting outlets specified in 210.7 0

The minimum lighting load shall be determined using the minimum unit load and the floor area as determined in 1 20.5(C) for dwelling occupancies. Motors rated less than 1 ⁄8 hp and connected to a lighting circuit shall be considered part of the minimum lighting load.

120.42 Lighting Load for Non-Dwelling Occupancies.

(1) **General.**

A unit load of not less than that specified in Table 120.42(A) for non-dwelling occupancies and the floor area determined in 120.5(C) shall be used to calculate the minimum lighting load. Motors rated less than 1⁄8 HP and connected to a lighting circuit shall be considered general lighting load.

Informational Note: The unit values of Table 120.42(A) are based on minimum load conditions and 80 percent power factor and might not provide sufficient capacity for the installation contemplated.

Table 120.42(A) General Lighting Loads by Non-Dwelling Occupancy

Type of Occupancy	Unit Load	
	Volt-amperes/ m^2	Volt-amperes/ ft^2
Automotive facility	16	1.5
Convention center	15	1.4
Courthouse	15	1.4
Dormitory	16	1.5
Exercise center	15	1.4
Fire station	14	1.3
Gymnasium[1]	18	1.7
Health care clinic	17	1.6
Hospital	17	1.6
Hotel or motel, or apartment house without provisions for cooking by tenants[2]	18	1.7
Library	16	1.5
Manufacturing facility[3]	24	2.2
Motion picture theater	17	1.6
Museum	17	1.6
Office[4]	14	1.3
Parking garage[5]	3	0.3
Penitentiary	13	1.2
Performing arts theater	16	1.5
Police station	14	1.3
Post office	17	1.6
Religious facility	24	2.2
Restaurant[6]	16	1.5
Retail[7, 8]	20	1.9
School/university	16	1.5

Type of Occupancy	Unit Load	
	Volt-amperes / m^2	Volt-amperes / ft^2
Sports arena	16	1.5
Town hall	15	1.4
Transportation	13	1.2
Warehouse	13	1.2
Workshop	18	1.7

Note: The 125 percent multiplier for a continuous load as specified in 210.20(A) is included, therefore no additional multiplier shall be required when using the unit loads in this table for calculating the minimum lighting load for a specified occupancy.

[1] Armories and auditoriums are considered gymnasium-type occupancies.

[2] Lodge rooms are similar to hotels and motels.

[3] Industrial commercial loft buildings are considered manufacturing-type occupancies.

[4] Banks are office-type occupancies.

[5] Commercial (storage) garages are considered parking garage occupancies.

[6] Clubs are considered restaurant occupancies.

[7] Barber shops and beauty parlors are considered retail occupancies.

[8] Stores are considered retail occupancies.

(1) **Energy Code .**

Where the building is designed and constructed to comply with an energy code adopted by the local authority, the lighting load shall be permitted to be calculated using the unit values specified in the energy code where the following conditions are met :

(1) A power monitoring system is installed that will provide continuous information regarding the total general lighting load of the building .

(2) The power monitoring system will be set with alarm values to alert the building owner or manager if the lighting load exceeds the values set by the energy code. Automatic means to take action to reduce the connected load shall be permitted .

(3) The demand factors specified in 120.45 are not applied to the general lighting load .

(4) The continuous load multiplier of 125 percent shall be applied .

120.43 Office Buildings .

In office buildings, the receptacle loads shall be calculated to be the larger of the following:

(1) The calculated load from 120.14(I) after Table 120.47 demand factors have been applied

(2) 11 volt-amperes/m^2 or 1 volt-ampere/ft^2

120.44 Hotel and Motel Occupancies .

In guest rooms or guest suites of hotels and motels, the following lighting and receptacle outlets are included in the minimum unit load in Table 120.42(A) , and no additional load calculations shall be required for such outlets :

(1) All general-use receptacle outlets of 20-ampere rating or less, including receptacles connected to the circuits in 210.11(C)(3) and (C)(4)

(2) The receptacle outlets specified in 210.52(E)(3)

(3) The lighting outlets specified in 210.7 0

120.45 General Lighting .

The demand factors specified in Table 1 20.4 5 shall apply to that portion of the total branch-circuit load calculated for general illumination. They shall not be applied in determining the number of branch circuits for general illumination.

Table 1 20.45 Lighting Load Demand Factors

T ype of Occupancy	Portion of Lighting Load to Which Demand Factor Applie s (Volt-Amperes)	Deman d Factor (%)
Dwelling units	First 3000 at	100
	From 3001 to 120,000 at	35
	Remainder over 120,000 at	25
Hotels and motels, including apartment houses without provision for cooking by tenants*	First 20,000 or less at	60
	From 20,001 to 100,000 at	50
	Remainder over 100,000 at	35
Warehouses (storage)	First 12,500 or less at	100
	Remainder over 12,500 at	50
All others	Total volt-amperes	100

*The demand factors of this table shall not apply to the calculated load of feeders or services supplying areas in hotels and motels where the entire lighting is likely to be used at one time, as in ballrooms or dining rooms.

120.46 Show-Window and Track Lighting .

(1)

(a) **Show Windows .**

For show-window lighting, a load of not less than 660 volt-amperes/linear meter or 200 volt-amperes/linear foot shall be included for a show window, measured horizontally along its base.

Informational Note: See 1 20.14(G) for branch circuits supplying show windows.

(1)

(a) **Track Lighting .**

For track lighting in other than dwelling units or guest rooms or guest suites of hotels or motels, an additional load of 150 volt-amperes shall be included for every 600 mm (2 ft) of lighting track or fraction thereof. Where multicircuit track is installed, the load shall be considered to be divided equally between the track circuits.

Exception: If the track lighting is supplied through a device that limits the current to the track, the load shall be permitted to be calculated based on the rating of the device used to limit the current.

120.47 Receptacle Loads — Other Than Dwelling Units .

Receptacle loads calculated in accordance with 1 20.14(H) and (I) shall be permitted to be made subject to the demand factors given in Table 1 20.4 5 or Table 1 20.4 7 .

Table 1 20.47 Demand Factors for Non-Dwelling Receptacle Loads

P ortion of Receptacle Load to Which Demand Factor Applies (Volt-Amperes)	Demand Factor (%)
First 10 kVA or less at	100

Portion of Receptacle Load to Which Demand Factor Applies (Volt-Amperes)	Demand Factor (%)
Remainder over 10 kVA at	50

120.50 Motors and Air-Conditioning Equipment.

(1)

(a) **Motors.**

The conductor sizing requirements specified in 430.24 and 430.25 and the feeder demand factor calculation method specified in 430.26 shall be used to determine motor loads.

(1)

(a) **Air-Conditioning Equipment.**

The conductor sizing requirements specified in Part IV of Article 440 shall be used to determine air-conditioning loads for hermetic refrigerant motor-compressors.

120.51 Fixed Electric Space Heating.

Fixed electric space-heating loads shall be calculated at 100 percent of the total connected load. However, in no case shall a feeder or service load current rating be less than the rating of the largest branch circuit supplied.

Exception: If reduced loading of the conductors results from units operating on duty-cycle or intermittently, or from all units not operating at the same time, the authority having jurisdiction shall be permitted to grant permission for feeder and service conductors to have an ampacity less than 100 percent if the conductors have an ampacity for the load so determined.

120.52 Small-Appliance and Laundry Loads — Dwelling Unit.

(1) **Small-Appliance Circuit Load.**

In each dwelling unit, the load shall be calculated at 1500 volt-amperes for each 2-wire small-appliance branch circuit as covered by 210.11(C)(1). Where the load is subdivided through two or more feeders, the calculated load for each shall include not less than 1500 volt-amperes for each 2-wire small-appliance branch circuit. These loads shall be permitted to be included with the general lighting load and subjected to the demand factors provided in Table 120.45.

Exception: The individual branch circuit permitted by 210.52(B)(1), Exception No. 2, shall be permitted to be excluded from the calculation required by 120.52.

(1) **Laundry Circuit Load.**

A load of not less than 1500 volt-amperes shall be included for each 2-wire laundry branch circuit installed as covered by 210.11(C)(2). This load shall be permitted to be included with the general lighting load and shall be subjected to the demand factors provided in Table 120.45.

120.53 Appliance Load — Dwelling Unit(s).

Applying a demand factor of 75 percent to the nameplate rating load of four or more appliances rated 1⁄4 hp or greater, or 500 watts or greater, that are fastened in place, and that are served by the same feeder or service in a one-family, two-family, or multifamily dwelling shall be permitted. This demand factor shall not apply to the following:

(1) Household electric cooking equipment that is fastened in place

(2) Clothes dryers

(3) Space heating equipment

(4) Air-conditioning equipment

(5) Electric vehicle supply equipment (EVSE)

120.54 Electric Clothes Dryers — Dwelling Unit(s).

The load for household electric clothes dryers in a dwelling unit(s) shall be either 5000 watts (volt-amperes) or the nameplate rating, whichever is larger, for each dryer served. The use of the demand factors in Table 120.54 shall be permitted. Where two or more single-phase dryers are supplied by a 3-phase, 4-wire feeder or service, the total load shall be calculated on the basis of twice the maximum number connected between any two phases. Kilovolt-amperes (kVA) shall be considered equivalent to kilowatts (kW) for loads calculated in this section.

Table 120.54 Demand Factors for Household Electric Clothes Dryers

Number of Dryers	Demand Factor (%)
1–4	100
5	85
6	75
7	65
8	60
9	55
10	50
11	47
12–23	47% minus 1% for each dryer exceeding 11
24–42	35% minus 0.5% for each dryer exceeding 23
43 and over	25%

120.55 Electric Cooking Appliances in Dwelling Units and Household Cooking Appliances Used in Instructional Programs.

The load for household electric ranges, wall-mounted ovens, counter-mounted cooking units, and other household cooking appliances individually rated in excess of 1 3⁄4 kW shall be permitted to be calculated in accordance with Table 120.55. Kilovolt-amperes (kVA) shall be considered equivalent to kilowatts (kW) for loads calculated under this section.

Where two or more single-phase ranges are supplied by a 3-phase, 4-wire feeder or service, the total load shall be calculated on the basis of twice the maximum number connected between any two phases.

Table 120.55 Demand Factors and Loads for Household Electric Ranges, Wall-Mounted Ovens, Counter-Mounted Cooking Units, and Other Household Cooking Appliances over 1 3⁄4 kW Rating (Column C to be used in all cases except as otherwise permitted in Note 3.)

Number of Appliances	Demand Factor (%) (See Notes)		Column C
	Column A . (Less than 3 1/2 kW Rating)	Column B . (3 1/2 kW through 8 3/4 kW Rating)	. Maximum Demand (kW) . (See Notes) . (Not over 12 kW Rating)
1	80	80	8
2	75	65	11
3	70	55	14
4	66	50	17
5	62	45	20
6	59	43	21
7	56	40	22
8	53	36	23
9	51	35	24
10	49	34	25
11	47	32	26
12	45	32	27
13	43	32	28
14	41	32	29
15	40	32	30
16	39	28	31
17	38	28	32
18	37	28	33
19	36	28	34
20	35	28	35

Number of Appliances	Demand Factor (%) (See Notes)		Column C
	Column A (Less than 3 1⁄2 kW Rating)	Column B (3 1⁄2 kW through 8 3⁄4 kW Rating)	Maximum Demand (kW) (See Notes) (Not over 12 kW Rating)
21	34	26	36
22	33	26	37
23	32	26	38
24	31	26	39
25	30	26	40
26–30	30	24	15 kW + 1 kW for each range
31–40	30	22	
41–50	30	20	25 kW + 3⁄4 kW for each range
51–60	30	18	
61 and over	30	16	

Notes:

(1) *Over 12 kW through 27 kW ranges all of same rating.* For ranges individually rated more than 12 kW but not more than 27 kW, the maximum demand in Column C shall be increased 5 percent for each additional kilowatt of rating or major fraction thereof by which the rating of individual ranges exceeds 12 kW.

(1) *Over 8 3⁄4 kW through 27 kW ranges of unequal ratings.* For ranges individually rated more than 8 3⁄4 kW and of different ratings, but none exceeding 27 kW, an average value of rating shall be calculated by adding together the ratings of all ranges to obtain the total connected load (using 12 kW for any range rated less than 12 kW) and dividing by the total number of ranges. Then the maximum demand in Column C shall be increased 5 percent for each kilowatt or major fraction thereof by which this average value exceeds 12 kW.

(1) *Over 1 3⁄4 kW through 8 3⁄4 kW.* In lieu of the method provided in Column C, adding the nameplate ratings of all household cooking appliances rated more than 1 3⁄4 kW but not more than 8 3⁄4 kW and multiplying the sum by the demand factors specified in Column A or Column B for the given number of appliances shall be permitted. Where the

rating of cooking appliances falls under both Column A and Column B, the demand factors for each column shall be applied to the appliances for that column, and the results added together.

(1) Calculating the branch-circuit load for one range in accordance with Table 120.55 shall be permitted.

(1) The branch-circuit load for one wall-mounted oven or one counter-mounted cooking unit shall be the nameplate rating of the appliance.

(1) The branch-circuit load for a counter-mounted cooking unit and not more than two wall-mounted ovens, all supplied from a single branch circuit and located in the same room, shall be calculated by adding the nameplate rating of the individual appliances and treating this total as equivalent to one range.

(1) This table shall also apply to household cooking appliances rated over 1 3⁄4 kW and used in instructional programs.

Informational Note No. 1: See Informative Annex D for examples.

Informational Note No. 2: See Table 120.56 for demand factors for commercial cooking equipment.

120.56 Kitchen Equipment — Other Than Dwelling Unit(s).

Calculating the load for commercial electric cooking equipment, dishwasher booster heaters, water heaters, and other kitchen equipment in accordance with Table 120.56 shall be permitted. Other kitchen equipment shall include equipment that is fastened in place and rated 1⁄4 hp or greater, or 500 watts or greater. These demand factors shall be applied to all equipment that has either thermostatic control or intermittent use as kitchen equipment. These demand factors shall not apply to space-heating, ventilating, or air-conditioning equipment.

However, in no case shall the feeder or service calculated load be less than the sum of the largest two kitchen equipment loads.

Table 120.56 Demand Factors for Kitchen Equipment — Other Than Dwelling Unit(s)

Number of Units of Equipment	Demand Factor (%)
1	100
2	100
3	90
4	80
5	70
6 and over	65

120.57 Electric Vehicle Supply Equipment (EVSE) Load.

The EVSE load shall be calculated at either 7200 watts (volt-amperes) or the nameplate rating of the equipment, whichever is larger.

120.60 Noncoincident Loads.

If it is unlikely that two or more noncoincident loads will be in use simultaneously, using only the largest load(s) that will be used at one time for calculating the total load of a feeder or service shall be permitted. If a motor or air-conditioning load is part of the noncoincident load and is not the largest of the noncoincident loads, 125 percent of either the motor load or air-conditioning load, whichever is larger, shall be used in the calculation.

120.61 Feeder or Service Neutral Load.

(1)

(a) **Basic Calculation.**

The feeder or service neutral load shall be the maximum unbalance of the load determined by this article. The maximum unbalanced load shall be the maximum net calculated load between the neutral conductor and any one ungrounded conductor.

Exception: For 3-wire, 2-phase or 5-wire, 2-phase systems, the maximum unbalanced load shall be the maximum net calculated load between the neutral conductor and any one ungrounded conductor multiplied by 140 percent.

(1)

(a) **Permitted Reductions .**

A service or feeder supplying the following loads shall be permitted to have an additional demand factor of 70 percent applied to the amount in 1 20.61(B)(1) and a portion of the amount in 1 20.61(B)(2) .

(1) Household Electric Ranges, Wall-Mounted Ovens, Counter-Mounted Cooking Units, and Dryers . A feeder or service supplying household electric ranges, wall-mounted ovens, counter-mounted cooking units, and electric dryers, where the maximum unbalanced load has been determined in accordance with Table 120.5 5 for ranges and Table 120.5 4 for dryers.

(2) Unbalanced Load in Excess of 200 Amperes . That portion of the unbalanced load in excess of 200 amperes where the feeder or service is supplied from a 3-wire dc or single-phase ac system; a 4-wire, 3-phase system; a 3-wire, 2-phase system; or a 5-wire, 2-phase system.

Informational Note: See Informative Annex D, Examples D1(a), D1(b), D2(b), D4(a), and D5(a) for examples of unbalanced feeder or service neutral loads.

(1)

(a) **Prohibited Reductions .**

There shall be no reduction of the neutral or grounded conductor capacity applied to the amount in 1 20.61(C)(1) , or portion of the amount in (C)(2), from that determined by the basic calculation :

(1) Any portion of a 3-wire circuit consisting of 2 ungrounded conductors and the neutral conductor of a 4-wire, 3-phase, wye-connected syste m

(2) That portion consisting of nonlinear loads supplied from a 4-wire, wye-connected, 3-phase syste m

Informational Note: A 3-phase, 4-wire, wye-connected power system used to supply power to nonlinear loads might necessitate that the power system design allows for the possibility of high harmonic neutral conductor currents.

120.70 Energy Management Systems (EMSs) .

If an energy management system (EMS) is used to limit the current to a feeder or service in accordance with 750.3 0 , a single value equal to the maximum ampere setpoint of the EMS shall be permitted to be used in load calculations for the feeder or service.

The setpoint value of the EMS shall be considered a continuous load for the purposes of load calculations.

Part IV. Optional Feeder and Service Load Calculation s

120.80 General .

Optional feeder and service load calculations shall be permitted in accordance with Part IV.

120.82 Dwelling Unit .

(1) **Feeder and Service Load .**

This section applies to a dwelling unit having the total connected load served by a single 120/240-volt or 208Y/120-volt set of 3-wire service or feeder conductors with an ampacity of 100 or greater. It shall be permissible to calculate the feeder and service loads in accordance with this section instead of the method specified in Part III of this article. The calculated load shall be the result of adding the loads from 1 20.82(B) and (C). Feeder and service-entrance conductors whose calculated load is determined by this optional calculation shall be permitted to have the neutral load determined by 1 20.6 1 .

(1) **General Loads .**

The general calculated load shall be not less than 100 percent of the first 10 kVA plus 40 percent of the remainder of the following loads :

(1) 33 volt-amperes/ m^2 or 3 volt-amperes/f t^2 for general lighting and general-use receptacles. The floor area for each floor shall be calculated from the outside dimensions of the dwelling unit. The calculated floor area shall not include open porches, garages, or unused or unfinished spaces not adaptable for future use .

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2) .

(3) The nameplate rating of the following:

(4) All appliances that are fastened in place, permanently connected, or located to be on a specific circui t

(5) Ranges, wall-mounted ovens, counter-mounted cooking unit s

(6) Clothes dryers that are not connected to the laundry branch circuit specified in 120.82(B)(2)

(7) Water heater s

(8) The nameplate ampere or kVA rating of all permanently connected motors not included in 120.82(B)(3) .

(1) **Heating and Air-Conditioning Load .**

The largest of the following six selections (load in kVA) shall be included :

(1) 100 percent of the nameplate rating(s) of the air conditioning and cooling .

(2) 100 percent of the nameplate rating(s) of the heat pump when the heat pump is used without any supplemental electric heating .

(3) 100 percent of the nameplate rating(s) of the heat pump compressor and 65 percent of the supplemental electric heating for central electric space-heating systems. If the heat pump compressor is prevented from operating at the same time as the supplementary heat, it does not need to be added to the supplementary heat for the total central space heating load .

(4) 65 percent of the nameplate rating(s) of electric space heating if less than four separately controlled units .

(5) 40 percent of the nameplate rating(s) of electric space heating if four or more separately controlled units .

(6) 100 percent of the nameplate ratings of electric thermal storage and other heating systems where the usual load is expected to be continuous at the full nameplate value. Systems qualifying under this selection shall not be calculated under any other selection in 1 20.82(C) .

120.83 Existing Dwelling Unit .

This section shall be permitted to be used to determine if the existing service or feeder is of sufficient capacity to serve additional loads. Where the dwelling unit is served by a 120/240-volt or 208Y/120-volt, 3-wire service or feeder, calculating the total load in accordance with 1 20.83(A) or (B) shall be permitted.

(1) Where Additional Air-Conditioning Equipment or Electric Space-Heating Equipment Is Not to Be Installed . The percentages listed in Table 1 20.83(A) shall be used for existing and additional new loads.

Table 120.83(A) Without Additional Air-Conditioning or El ectric Space-Heating Equipment

L oad (kVA)	Percent of Load
First 8 kVA of load at	100
Remainder of load at	40

Load calculations shall include the following :

(1) General lighting and general-use receptacles at 33 volt-amperes/ m ^{2} or 3 volt-amperes/f t ^{2} as determined by 1 20.4 2

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)

(3) The nameplate rating of the following:

(4) All appliances that are fastened in place, permanently connected, or located to be on a specific circui t

(5) Ranges, wall-mounted ovens, counter-mounted cooking unit s

(6) Clothes dryers that are not connected to the laundry branch circuit specified in item (2)

(7) Water heater s

(1) Where Additional Air-Conditioning Equipment or Electric Space-Heating Equipment Is to Be Installed . The percentages listed in Table 1 20.83(B) shall be used for existing and additional new loads. The larger connected load of air conditioning or space heating, but not both, shall be used.

Table 120.83(B) With Additional Air-Conditioning or Electric Space-Heating Equipment

L oad	Percent of Load
Air-conditioning equipment	100
Central electric space heating	100
Less than four separatel y . controlled space-heating units	100
First 8 kVA of all other loads	100

Load	Percent of Load
Remainder of all other loads	40

Other loads shall include the following :

(1) General lighting and general-use receptacles at 33 volt-amperes/ m^2 or 3 volt-amperes/ft^2 as determined by 220.42

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)

(3) The nameplate rating of the following:

(4) All appliances that are fastened in place, permanently connected, or located to be on a specific circuit

(5) Ranges, wall-mounted ovens, counter-mounted cooking units

(6) Clothes dryers that are not connected to the laundry branch circuit specified in item (2)

(7) Water heaters

120.84 Multifamily Dwelling.

(1) **Feeder or Service Load.**

It shall be permissible to calculate the load of a feeder or service that supplies three or more dwelling units of a multifamily dwelling in accordance with Table 120.84(B) instead of Part III of this article if all the following conditions are met :

(1) No dwelling unit is supplied by more than one feeder .

(2) Each dwelling unit is equipped with electric cooking equipment.

> Exception: When the calculated load for multifamily dwellings without electric cooking in Part III of this article exceeds that calculated under Part IV for the identical load plus electric cooking (based on 8 kW per unit), the lesser of the two loads shall be permitted to be used.

(1) Each dwelling unit is equipped with either electric space heating or air conditioning, or both. Feeders and service conductors whose calculated load is determined by this optional calculation shall be permitted to have the neutral load determined by 220.61 .

(1) **House Loads.**

House loads shall be calculated in accordance with Part III of this article and shall be in addition to the dwelling unit loads calculated in accordance with Table 120.84(B) .

Table 120.84(B) Optional Calculations — Demand Factors for Three or More Multifamily Dwelling Units

Number of Dwelling Units	Demand Factor (%)
3–5	45
6–7	44
8–10	43
11	42
12–13	41
14–15	40
16–17	39
18–20	38
21	37

N umber o f . Dwelling Units	Demand Facto r . (%)
22–23	36
24–25	35
26–27	34
28–30	33
31	32
32–33	31
34–36	30
37–38	29
39–42	28
43–45	27
46–50	26
51–55	25
56–61	24
62 and over	23

(1) **Calculated Loads .**

The calculated load to which the demand factors of Table 120.84(B) apply shall include the following :

(1) 33 volt-amperes/ m ^{2} or 3 volt-amperes/f t ^{2} for general lighting and general-use receptacle s

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)

(3) The nameplate rating of the following:

- (4) All appliances that are fastened in place, permanently connected, or located to be on a specific circui t
- (5) Ranges, wall-mounted ovens, counter-mounted cooking unit s
- (6) Clothes dryers that are not connected to the laundry branch circuit specified in item (2)
- (7) Water heater s

(8) The nameplate ampere or kVA rating of all permanently connected motors not included in item (3)

(9) The larger of the air-conditioning load or the fixed electric space-heating loa d

120.85 Two Dwel ling Units .

Where two dwelling units are supplied by a single feeder or service and the calculated load under Part III of this article exceeds that for three identical units calculated under 1 20.8 4 , the lesser of the two loads shall be permitted to be used.

120.86 Schools .

The calculation of a feeder or service load for schools shall be permitted in accordance with Table 120.8 6 in lieu of Part III of this article where equipped with electric space heating, air conditioning, or both. The connected load to which the demand factors of Table 120.8 6 apply shall include all of the interior and exterior lighting, power, water heating, cooking, other loads, and the larger of the air-conditioning load or space-heating load within the building or structure.

Feeders and service conductors whose calculated load is determined by this optional calculation shall be permitted to have the neutral load determined by 1 20.6 1 . Where the building or structure load is calculated by this optional method, feeders within the building or structure shall have ampacity as permitted in Part III of this article; however, the ampacity of an individual feeder shall not be required to be larger than the ampacity for the entire building.

This section shall not apply to portable classroom buildings.

Table 120.86 Optional Method — Demand Factors for Feeders and Service Conductors for Schools

Connected Load		Demand Factor (%)	Calculated Loads (VA)
Total VA/m^2	Total VA/ft^2		
0–33	0–3	100	Amount × 100%
Over 33–220	Over 3–20	75	(Amount × 75%) + 3
Remainder over 220	Remainder over 20	25	(Amount × 25%) + 15.75

120.87 Determining Existing Loads.

The calculation of a feeder or service load for existing installations shall be permitted to use actual maximum demand to determine the existing load under all of the following conditions:

(1) The maximum demand data is available for a 1-year period.

Exception: If the maximum demand data for a 1-year period is not available, the calculated load shall be permitted to be based on the maximum demand (the highest average kilowatts reached and maintained for a 15-minute interval) continuously recorded over a minimum 30-day period using a recording ammeter or power meter connected to the highest loaded phase of the feeder or service, based on the initial loading at the start of the recording. The recording shall reflect the maximum demand of the feeder or service by being taken when the building or space is occupied and shall include by measurement or calculation the larger of the heating or cooling equipment load, and other loads that might be periodic in nature due to seasonal or similar conditions. This exception shall not be permitted if the feeder or service has a renewable energy system (i.e., solar photovoltaic or wind electric) or employs any form of peak load shaving.

(1) The maximum demand at 125 percent plus the new load does not exceed the ampacity of the feeder or rating of the service.

(2) The feeder has overcurrent protection in accordance with 240.4, and the service has overload protection in accordance with 230.90.

120.88 New Restaurants.

Calculation of a service or feeder load, where the feeder serves the total load, for a new restaurant shall be permitted in accordance with Table 120.88 in lieu of Part III of this article.

The overload protection of the service conductors shall be in accordance with 230.90 and 240.4.

Feeder conductors shall not be required to be of greater ampacity than the service conductors.

Service or feeder conductors whose calculated load is determined by this optional calculation shall be permitted to have the neutral load determined by 120.61.

Table 120.88 Optional Method — Permitted Load Calculations for Service and Feeder Conductors for New Restaurants

Total Connected Load (kVA)	All Electric Restaurant	Not All Electric Restaurant
	Calculated Loads (kVA)	Calculated Loads (kVA)
0–200	80%	100%
201–325	10% (amount over 200) + 160.0	50% (amount over 200) + 200.0
326–800	50% (amount over 325) + 172.5	45% (amount over 325) + 262.5
Over 800	50% (amount over 800) + 410.0	20% (amount over 800) + 476.3

Note: Add all electrical loads, including both heating and cooling loads, to calculate the total connected load. Select the one demand factor that applies from the table, then multiply the total connected load by this single demand factor.

Part V. Farm Load Calculations

120.100 General .

Farm loads shall be calculated in accordance with Part V.

120.102 Farm Loads — Buildings and Other Loads .

(1)

(a) **Dwelling Unit .**

The feeder or service load of a farm dwelling unit shall be calculated in accordance with the provisions for dwellings in Part III or IV of this article. Where the dwelling has electric heat and the farm has electric grain-drying systems, Part IV of this article shall not be used to calculate the dwelling load where the dwelling and farm loads are supplied by a common service.

(1)

(a) **Other Than Dwelling Unit .**

Where a feeder or service supplies a farm building or other load having two or more separate branch circuits, the load for feeders, service conductors, and service equipment shall be calculated in accordance with demand factors not less than indicated in Table 120.102(B) .

Table 120.102(B) Method for Calculating Farm Loads for Other Than Dwelling Unit

A mpere Load at 240 Volts Maximum	Demand Facto r . (%)
The greater of the following:	
All loads that are expected to operate simultaneously, or	100
125 percent of the full load current of the largest motor, or	
First 60 amperes of the load	
Next 60 amperes of all other loads	50
Remainder of other loads	25

120.103 Farm Loads — Total .

Where supplied by a common service, the total load of the farm for service conductors and service equipment shall be calculated in accordance with the farm dwelling unit load and demand factors specified in Table 1 20.10 3 . Where there is equipment in two or more farm equipment buildings or for loads having the same function, such loads shall be calculated in accordance with Table 1 20.102(B) and shall be permitted to be combined as a single load in Table 220.10 3 for calculating the total load.

Table 120.103 M ethod for Calculating Total Farm Load

Individual Loads Calculated in Accordance with Table 220.102	Demand Facto r . (%)
Largest load	100
Second largest load	75
Third largest load	65

Individual Loads Calculated in Accordance with Table 220.102	Demand Factor (%)
Remaining loads	50

Note: To this total load, add the load of the farm dwelling unit calculated in accordance with Part III or IV of this article. Where the dwelling has electric heat and the farm has electric grain-drying systems, Part IV of this article shall not be used to calculate the dwelling load.

Part VI. Health Care Facilities

120.110 Receptacle Loads.

Receptacle loads calculated in accordance with 120.14(H) and (I) and supplied by branch circuits not exceeding 150 volts to ground shall be permitted to be subjected to the demand factors provided in Table 120.110(1) and Table 120.110(2) for health care facilities.

Informational Note No. 1: See Article 100 for the definitions of patient care space categories.

Informational Note No. 2: See 120.14(I) for the calculation of receptacle outlet loads.

Table 120.110(1) Demand Factors for Receptacles Supplied by General-Purpose Branch Circuits in Category 1 and Category 2 Patient Care Spaces

Portion of Receptacle Load to Which Demand Factor Applies (Volt-Amperes)	Demand Factor (%)
First 5000 or less	100
From 5001 to 10,000	50
Remainder over 10,000	25

Table 120.110(2) Demand Factors for Receptacles Supplied by General-Purpose Branch Circuits in Category 3 and Category 4 Patient Care Spaces

Portion of Receptacle Load to Which Demand Factor Applies (Volt-Amperes)	Demand Factor (%)
First 10,000 or less	100
Remainder over 10,000	50

Part VII. Marinas, Boatyards, Floating Buildings, and Commercial and Noncommercial Docking Facilities

120.120 Receptacle Loads.

General lighting and other loads in marinas, boatyards, floating buildings, and commercial and noncommercial docking facilities shall be calculated in accordance with Part III of this article and, in addition, the demand factors set forth in Table 120.120 shall be permitted for each service or feeder circuit supplying receptacles that provide shore power for boats. These calculations shall be permitted to be modified as indicated in Notes (1) and (2) of Table 120.120. Where demand factors of Table 120.120 are applied, the demand factor specified in 120.61(B) shall not be permitted.

Informational Note: These demand factors could be inadequate in areas of extreme hot or cold temperatures with loaded circuits for heating, air-conditioning, or refrigerating equipment.

Table 120.120 Demand Factors for Shore Power Receptacle Loads

Number of Shore Power Receptacles	Sum of the Rating of the Receptacles (%)
1–4	100
5–8	90
9–14	80
15–30	70
31–40	60
41–50	50

Number of Shore Power Receptacles	Sum of the Rating of the Receptacles (%)
51–70	40
>71	30

Notes:

1. Where shore power accommodations provide two receptacles specifically for an individual boat slip and these receptacles have different voltages (e.g., one 30-ampere, 125-volt and one 50-ampere, 125/250-volt), only the receptacle with the larger kilowatt demand shall be required to be calculated.

2. For each shore powered pedestal being installed that includes an individual kilowatt-hour submeters for each slip and is being calculated using the criteria listed in Table 120.120, the total demand amperes shall be permitted to be multiplied by 0.9 to achieve the final demand amperes of the facility.

3. If a circuit feeding a boat hoist and shore power for the same boat slip is shared, only the load with the larger kilowatt demand shall be required to be counted in the load calculation.

Statement of Problem and Substantiation for Public Input

The requirements found in the current Article 220 for load calculations applies generally to all installations, and therefore is more appropriately suited for Chapter 1 of the NEC. This PI adds the requirements for load calculations to a new Article 120 with no change to the technical content. See the accompanied PI deleting the old Article 220 in Chapter 2.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4294-NFPA 70-2023 [Article 220]	
Public Input No. 1604-NFPA 70-2023 [New Article after 210]	
Public Input No. 4329-NFPA 70-2023 [New Article after 220]	
Public Input No. 4334-NFPA 70-2023 [Article 225]	
Public Input No. 1611-NFPA 70-2023 [New Article after 225]	
Public Input No. 1613-NFPA 70-2023 [Article 235]	
Public Input No. 1604-NFPA 70-2023 [New Article after 210]	
Public Input No. 1611-NFPA 70-2023 [New Article after 225]	
Public Input No. 1613-NFPA 70-2023 [Article 235]	
Public Input No. 4294-NFPA 70-2023 [Article 220]	
Public Input No. 4329-NFPA 70-2023 [New Article after 220]	
Public Input No. 4334-NFPA 70-2023 [Article 225]	

Submitter Information Verification

Submitter Full Name: Kyle Krueger
Organization: NECA
Affiliation: NECA
Street Address:
City:
State:
Zip:

Submittal Date: Thu Sep 07 10:51:19 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Insufficient substantiation has been provided to move Article 220 to Chapter 1. Chapters 1-4 apply generally to all electrical installations. CMP-2 acknowledges that placement of articles is within the purview of the Correlating Committee. This action represents the recommendation from CMP-2.

Public Input No. 2626-NFPA 70-2023 [Section No. 210.1]

210.1 Scope.

This article provides the general requirements for branch circuits not over 1000 volts ac, 1500 volts dc, nominal.

Informational Note: See ~~Part II of~~ Article 235, Part II for requirements for branch circuits over 1000 volts ac, 1500 volts dc, nominal.

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.
4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 23 21:17:21 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7515-NFPA 70-2024
Statement: This revision brings this text into alignment with Style Manual Section 4.1.4, regarding the use of Parts.

4.1.4 References to an Entire Article requires that references shall not be made to an entire article, except for Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.

Public Input No. 1317-NFPA 70-2023 [Section No. 210.2]

210.2 Reconditioned Equipment.

The following reconditioned equipment shall not be ~~reconditioned~~ permitted :

(1) Equipment that provides ground-fault circuit-interrupter protection for personnel

(2) Equipment that provides arc-fault circuit-interrupter protection

Statement of Problem and Substantiation for Public Input

This public input is a part of a series of public inputs that seeks to align the language found across the NEC pertaining to how reconditioned equipment is addressed in the NEC.

The following sections us the language that says “Reconditioned _____ shall not be permitted.”
404.16, 406.2, 408.2,410.2, 470.2, 495.2, 495.49,695.2,700.2,701.2,702.2,708.2,

This change suggests the appropriate way to address reconditioned equipment in the NEC. The NEC is an installation code governing the installation of solutions and in many locations throughout the NEC the solution is either permitted or not permitted. This suggested language would bring all references towards reconditioned equipment in alignment.

Submitter Information Verification

Submitter Full Name:	Thomas Domitrovich
Organization:	Eaton Corporation
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sat Jul 08 11:20:29 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: FR-7517-NFPA 70-2024

Statement: This revision aligns with the NEC Style Manual requirements of Section 2.2.1 titled “Parallel Numbering Required,” and recognizes the fact that the National Electrical Code is an installation requirements document and cannot control what happens to products that are not installed. This change makes it clear that the requirement pertains to reconditioned equipment requiring that it not be installed.

Public Input 1317 – The phrase “shall not be permitted” is not accepted as it is no different than shall not. The phrase “shall not be installed” is clear and concise.

Public Input No. 2598-NFPA 70-2023 [Section No. 210.2]

210.~~2~~ 3 Reconditioned Equipment.

The following reconditioned equipment shall not be ~~reconditioned~~ installed :

(1) Equipment that provides ground-fault circuit-interrupter protection for personnel

(2) Equipment that provides arc-fault circuit-interrupter protection

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to comply with the NEC Style Manual Section 2.2.1 regarding reconditioned equipment.
2.2.1 Parallel Numbering Required. Technical committees shall use the following section numbers for the same purposes within articles. This requirement shall not apply to Articles 90, 100, and 110. If the article does not contain listing or reconditioning requirements, the subdivisions shall not be included in the article.
Required Parallel Numbering Format
XXX.1 Scope.
XXX.2 Listing Requirements.
XXX.3 Reconditioned Equipment.
XXX.3(A) Permitted to be Installed.
XXX.3(B) Not Permitted to be Installed.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Submitter Information Verification

Submitter Full Name:	David Williams
Organization:	Delta Charter Township
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Wed Aug 23 19:19:53 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: FR-7517-NFPA 70-2024

Statement: This revision aligns with the NEC Style Manual requirements of Section 2.2.1 titled “Parallel Numbering Required,” and recognizes the fact that the National Electrical Code is an installation requirements document and cannot control what happens to products that are not installed. This change makes it clear that the requirement pertains to reconditioned equipment requiring that it not be installed.

Public Input 1317 – The phrase “shall not be permitted” is not accepted as it is no different than shall not. The phrase “shall not be installed” is clear and concise.

Public Input No. 979-NFPA 70-2023 [Section No. 210.3]

210.3 Other Articles for Specific-Purpose Branch Circuits.

Table 210.3 lists references for specific equipment and applications not located in Chapters 5, 6, and 7 that amend or supplement the requirements of this article.

Table 210.3 Specific-Purpose Branch Circuits

Equipment	Article	Section
Air-conditioning and refrigerating equipment	-	440.6, 440.31, and 440.32
Busways	-	368.17
Central heating equipment other than fixed electric space-heating equipment	-	422.12
Fixed electric heating equipment for pipelines and vessels	-	427.4
Fixed electric space-heating equipment	-	424.4
Fixed outdoor electrical deicing and snow-melting equipment	-	426.4
Infrared lamp industrial heating equipment	-	422.48 and 424.3
Motors, motor circuits, and controllers	430, Part III	-
Switchboards and panelboards	-	408.52

Statement of Problem and Substantiation for Public Input

4.1.4 of the NEC(r) Style Manual prohibits references to an entire article, except article 100 or where referenced to provide necessary context. As the branch circuit overload requirements are found in Part III of Article 430, it is suggested that this table be updated accordingly in compliance with the style manual.

Submitter Information Verification

Submitter Full Name: Richard Holub
Organization: The DuPont Company, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 08 09:44:48 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7520-NFPA 70-2024

Statement: This revision brings this text into alignment with Style Manual Section 4.1.4, regarding the use of Parts.

4.1.4 References to an Entire Article requires that references shall not be made to an entire article, except for Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.

Part III was added as the title of Part III is ""Motor and branch-circuit overload protection".

Part IV was added as the title of part IV is “motor branch circuit short circuit and ground fault protection.”

Section 210.3 is moved to 210.14 to accommodate the change to moving 210.2 for reconditioned equipment to 210.3 in accordance with the NEC Style Manual section 2.2.1.

Public Input No. 2196-NFPA 70-2023 [Section No. 210.4]

210.4 Multiwire Branch Circuits.

(A) General.

Branch circuits recognized by this article shall be permitted as multiwire circuits. A multiwire circuit shall be permitted to be considered as multiple circuits. Except as permitted in 300.3(B)(4), all conductors of a multiwire branch circuit shall originate from the equipment containing the branch-circuit overcurrent protective device or protective devices.

Informational Note No. 1: A 3-phase, 4-wire, wye-connected power system used to supply power to nonlinear loads might necessitate that the power system design allow for the possibility of high harmonic currents on the neutral conductor.

Informational Note No. 2: See 300.13(B) for continuity of grounded conductors on multiwire circuits.

(B) Disconnecting Means.

Each multiwire branch circuit shall be provided with a means that will simultaneously disconnect all ungrounded conductors at the point where the branch circuit originates.

Informational Note: See 240.15(B) for information on the use of single-pole circuit breakers as the disconnecting means.

(C) Line-to-Neutral Loads.

Multiwire branch circuits shall supply only line-to-neutral loads.

Exception No. 1: A multiwire branch circuit that supplies only one utilization equipment shall be permitted to supply line-to-line loads.

Exception No. 2: A multiwire branch circuit shall be permitted to supply line-to-line loads if all ungrounded conductors of the multiwire branch circuit are opened simultaneously by the branch-circuit overcurrent device.

(D) Grouping.

The ungrounded and grounded circuit conductors of each multiwire branch circuit shall be grouped in accordance with 200.4(B).

(E) Device Removal.

In multiwire branch circuits, the continuity of a grounded conductor shall not depend on device connections such as lampholders, receptacles, and so forth where the removal of such devices would interrupt the continuity.

Statement of Problem and Substantiation for Public Input

Relocating this requirement to new subdivision 210.4(E) from 300.13(B) would group all the rules regarding multiwire branch circuits together. This places all multiwire branch requirements in 210.4. The proposed revisions will bring clarity to Code users.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:

Submittal Date: Mon Aug 14 13:55:13 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The suggested change would move a wiring method from Chapter 3 and is not accepted. The reference to informational Note No. 2 which states “See 300.13(B) for continuity of grounded conductors on multiwire circuits” is adequate and provides the User of the Code appropriate information to achieve what this submitter was seeking. Wiring methods must remain in Chapter 3 for clarity and usability.

Public Input No. 3060-NFPA 70-2023 [Section No. 210.5(C)]

(C) Identification of Ungrounded Conductors.

Ungrounded conductors shall be identified in accordance with 210.5(C)(1) ~~or~~ through (~~2~~ 3), as applicable.

(1) Branch Circuits Supplied from One Nominal Voltage System

If the premises wiring system has branch circuits supplied from one nominal voltage system, branch circuit ungrounded conductors shall be identified in accordance with 310.6(C).

(2) Branch Circuits Supplied from More Than One Nominal Voltage System.

Where the premises wiring system has branch circuits supplied from more than one nominal voltage system, each ungrounded conductor of a branch circuit shall be identified by phase or line and by nominal voltage system at all termination, connection, and splice points in accordance with 210.5(C)(1)(a) and (C)(1)(b). Different systems within the same premises that have the same nominal voltage shall be permitted to use the same identification.

(a) *Means of Identification.* The means of identification shall be permitted to be by separate color coding, marking tape, tagging, or other approved means.

(b) *Posting of Identification Means.* The method used for conductors originating within each branch-circuit panelboard or similar branch-circuit distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each branch-circuit panelboard or similar branch-circuit distribution equipment. The label shall be of sufficient durability to withstand the environment involved and shall not be handwritten.

Exception: In existing installations where a voltage system(s) already exists and a different voltage system is being added, it shall be permissible to mark only the new system voltage. Existing unidentified systems shall not be required to be identified at each termination, connection, and splice point in accordance with 210.5(C)(1)(a) and (C)(1)(b). Labeling shall be required at each voltage system distribution equipment to identify that only one voltage system has been marked for a new system(s). The new system label(s) shall include the words “other unidentified systems exist on the premises.”

(~~2~~ 3) Branch Circuits Supplied from Direct-Current Systems.

Where a branch circuit is supplied from a dc system operating at more than 60 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means; each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 210.5(C)(2)(a) and (b). The identification methods utilized for conductors originating within each branch-circuit panelboard or similar branch-circuit distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each branch-circuit panelboard or similar branch-circuit distribution equipment.

(a) *Positive Polarity, Sizes 6 AWG or Smaller.* Where the positive polarity of a dc system does not serve as the connection point for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:

(2) A continuous red outer finish

(3) A continuous red stripe durably marked along the conductor’s entire length on insulation of a color other than green, white, gray, or black

(4) Imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)

(5) An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black

(f) *Negative Polarity, Sizes 6 AWG or Smaller.* Where the negative polarity of a dc system does not serve as the connection point for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:

(1) A continuous black outer finish

(2) A continuous black stripe durably marked along the conductor’s entire length on insulation of a color other than green, white, gray, or red

(3) Imprinted minus signs (–) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)

(4) An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted minus signs (–) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red

Statement of Problem and Substantiation for Public Input

Adding new second level subdivision to give Code users the knowledge on how to identify branch circuits supplied from a single nominal voltage system. 310.6(C) provides the requirements on how to properly identify ungrounded conductors from one nominal voltage system by simply having a finish that is distinguishable from grounded conductors or equipment grounding conductors. Re-numbered the following first level subdivisions with no technical change to comply with the NEC Style Manual.

Submitter Information Verification

Submitter Full Name:	Mike Holt
Organization:	Mike Holt Enterprises Inc
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Tue Aug 29 09:53:56 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: FR-7523-NFPA 70-2024

Statement: New second level subdivision is added to give users of the Code clear requirements for the proper identification of branch circuits supplied from a single nominal voltage system. The reference to Section 310.6(C) provides the link to the requirements on how to properly identify these ungrounded conductors from one nominal voltage system. The remainder of 210.5(C) has been renumbered to accommodate the addition.

In addition, the word “enclosed” was appropriately located and the words "branch-circuit" were removed, where necessary, to align with the new defined term “enclosed panelboard” and for technical accuracy.

Public Input No. 781-NFPA 70-2023 [Section No. 210.5(C)(1)]

(1) Branch Circuits Supplied from More Than One Nominal Voltage System.

Where the premises wiring system has branch circuits supplied from more than one nominal voltage system, each ungrounded conductor of a branch circuit shall be identified by phase or line and by nominal voltage system at all termination, connection, and splice points in accordance with 210.5(C)(1)(a) and (C)(1)(b). Different systems within the same premises that have the same nominal voltage shall be permitted to use the same identification.

(a) *Means of Identification.* The means of identification shall be permitted to be by separate color coding, marking tape, tagging, or other approved means.

(b) *Posting of Identification Means.* The method used for conductors originating within each enclosed branch-circuit panelboard or similar branch-circuit distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each branch-circuit panelboard or similar branch-circuit distribution equipment. The label shall be of sufficient durability to withstand the environment involved and shall not be handwritten.

Exception: In existing installations where a voltage system(s) already exists and a different voltage system is being added, it shall be permissible to mark only the new system voltage. Existing unidentified systems shall not be required to be identified at each termination, connection, and splice point in accordance with 210.5(C)(1)(a) and (C)(1)(b). Labeling shall be required at each voltage system distribution equipment to identify that only one voltage system has been marked for a new system(s). The new system label(s) shall include the words “other unidentified systems exist on the premises.”

Statement of Problem and Substantiation for Public Input

The word "enclosed" is added to make the requirement technically correct. The word "within" in the existing requirement literally requires the panelboard (a defined term that does not require it be within something) be within something. Also see the definition of "enclosed panelboard."

Submitter Information Verification

Submitter Full Name: Palmer Hickman
Organization: Electrical Training Alliance
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 09 16:34:56 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7523-NFPA 70-2024

Statement: New second level subdivision is added to give users of the Code clear requirements for the proper identification of branch circuits supplied from a single nominal voltage system. The reference to Section 310.6(C) provides the link to the requirements on how to properly identify these ungrounded conductors from one nominal voltage system. The remainder of 210.5(C) has been renumbered to accommodate the addition.

In addition, the word “enclosed” was appropriately located and the words "branch-circuit" were removed, where necessary, to align with the new defined term “enclosed panelboard” and for technical accuracy.

Public Input No. 782-NFPA 70-2023 [Section No. 210.5(C)(2)]

(2) Branch Circuits Supplied from Direct-Current Systems.

Where a branch circuit is supplied from a dc system operating at more than 60 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means; each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 210.5(C)(2)(a) and (b). The identification methods utilized for conductors originating within each enclosed branch-circuit panelboard or similar branch-circuit distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each branch-circuit panelboard or similar branch-circuit distribution equipment.

(a) *Positive Polarity, Sizes 6 AWG or Smaller.* Where the positive polarity of a dc system does not serve as the connection point for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:

(2) A continuous red outer finish

(3) A continuous red stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or black

(4) Imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)

(5) An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black

(f) *Negative Polarity, Sizes 6 AWG or Smaller.* Where the negative polarity of a dc system does not serve as the connection point for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:

(1) A continuous black outer finish

(2) A continuous black stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or red

(3) Imprinted minus signs (–) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)

(4) An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted minus signs (–) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red

Statement of Problem and Substantiation for Public Input

The word "enclosed" is added to make the requirement technically correct. The word "within" in the existing requirement literally requires the panelboard (a defined term that does not require it be within something) be within something. Also see the definition of "enclosed panelboard."

Submitter Information Verification

Submitter Full Name: Palmer Hickman

Organization: Electrical Training Alliance

Street Address:

City:

State:

Zip:

Submittal Date: Tue May 09 16:42:26 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: FR-7523-NFPA 70-2024

Statement: New second level subdivision is added to give users of the Code clear requirements for the proper identification of branch circuits supplied from a single nominal voltage system. The reference to Section 310.6(C) provides the link to the requirements on how to properly identify these ungrounded conductors from one nominal voltage system. The remainder of 210.5(C) has been renumbered to accommodate the addition.

In addition, the word “enclosed” was appropriately located and the words "branch-circuit" were removed, where necessary, to align with the new defined term “enclosed panelboard” and for technical accuracy.

Public Input No. 4348-NFPA 70-2023 [Section No. 210.6(A)]

(A) Occupancy Limitation.

In dwelling units and guest rooms or guest suites of hotels, motels, and similar occupancies, the voltage shall not exceed 120 volts, nominal, between conductors that supply the terminals of the following:

(1) Luminaires

(2) Cord-and-plug-connected loads 1440 volt-amperes ~~, nominal,~~ or less, or less than ¼ hp

Statement of Problem and Substantiation for Public Input

There appears to be a typographical error here. The sentence is confusing to interpret as written - is 1440 VA is the maximum below which 120V is the limit and plug and cord connected loads over 1440 can have higher voltage? If so the comma should be moved to after the first "or less" in this sentence instead of after "nominal." Recommend deleting the use of nominal in this sentence as there do not appear to be other uses of the volt-ampere unit in the code appended the term with nominal.

Submitter Information Verification

Submitter Full Name: Rebekah Hren
Organization: IPPNC LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 12:22:06 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The word nominal is consistent with its use in other parts of this article as well as throughout the NEC and in some cases added per public inputs made during this code cycle. Refer to 3.5.1.1 Sentence Structure of the NEC Style Manual, as this exact phrase is used to demonstrate proper sentence structure.

Public Input No. 969-NFPA 70-2023 [Section No. 210.6(A)]

(A) Occupancy Limitation.

In dwelling units and guest rooms or guest suites of hotels, motels, and similar occupancies, the voltage shall not exceed 120 volts, nominal, between conductors that supply the terminals of the following:

(1) Luminaires

(2) Cord-and-plug-connected loads 1440 volt-amperes, nominal, or less or less than ¼ hp

Exception: The voltage shall be permitted to exceed 120 volts between conductors where a label is permanently affixed to every outlet and visible after installation, without opening any covers, that gives a warning that labels the line-to-line voltage. It should read the following or similar:

WARNING! Shock Hazard! 208 volts

Turn off branch circuit or switch before removing or inserting.

Statement of Problem and Substantiation for Public Input

A warning/caution label is a suitable alternative to lower voltages for preventing electric shock. An example for the exception has the respective labels reading:

WARNING! Shock Hazard
208 volts
Turn off branch circuit or switch before removing or inserting.

WARNING! Shock Hazard
277 volts
Turn off branch circuit or switch before removing or inserting.

Submitter Information Verification

Submitter Full Name: Conrad Ko
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 07 14:49:13 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: There is no substantiation provided for allowing higher voltages in these occupancies. A sign or marking does not remove the electrical hazard.

Public Input No. 3630-NFPA 70-2023 [New Section after 210.8]

TITLE OF NEW CONTENT 210.8 (G) Work Areas

Type your content here ...

All 125 Volt, 15- and 20- ampere receptacles supplied by single phase branch circuits rated 150 Volts or less to ground shall have ground fault circuit interrupter protection for personnel.

Statement of Problem and Substantiation for Public Input

OSHA requires GFCi protection for Construction and whenever cord and plug connected equipment is used for maintenance or construction activities using an extension cord. In industry and in vocational education facilities, we have many defined spaces where maintenance or construction type activities take place as a normal operation of that space. Many of these spaces are located in the basement areas of buildings with ground level contact to earth. These areas see higher levels of activities than the average homeowner's basement or garage where the same potential contact to the earth exists. For over 20 years in vocational education, I've been installing or replacing receptacles with GFCI protection in these spaces due to the nature of their use and the recognized potential contact to the earth. I continue to see new spaces built without a requirement for GFCI protection. A local Community College recently built a new building housing Electrical and HVAC vocational spaces on the ground floor where electricity is used daily for instructional and experimental projects by students using non-GFCI protected circuits that were installed as part of the designed scope of that space. Making these areas require GFCI protection would improve electrical safety for the unknowing end user and bring these areas in line with the other spaces defined in the NEC that share similar potential shock hazards.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4266-NFPA 70-2023 [New Definition after Definition: Wireways, Nonmetallic. (No...]	
Public Input No. 4266-NFPA 70-2023 [New Definition after Definition: Wireways, Nonmetallic. (No...]	

Submitter Information Verification

Submitter Full Name: Charles Kennedy
Organization: GLTS
Affiliation: Greater Lawrence Technical School
Street Address:
City:
State:
Zip:

Submittal Date: Tue Sep 05 10:44:00 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The suggested language could cause confusion with 210.8(B) which would include work areas. The term “work area” is too vague and hard to enforce as work areas could exist in many locations.

Public Input No. 1503-NFPA 70-2023 [Section No. 210.8]

210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.

A listed Class A GFCI shall provide protection in accordance with 210.8(A) through (F). The GFCI shall be installed in a readily accessible location.

Informational Note: See 215.9 for GFCI protection on feeders.

For the purposes of this section, the distance from receptacles shall be measured as the shortest path the power supply cord connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier.

(A) Dwelling Units.

All 125-volt through 250-volt receptacles installed in the following locations and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel:

(1) Bathrooms

(2) Garages and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

(4) Crawl spaces — at or below grade level

(5) Basements

(6) Kitchens

(7) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(8) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(9) Boathouses

(10) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(11) Laundry areas

(12) Indoor damp and wet locations

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: A receptacle supplying only a permanently installed premises security system shall be permitted to omit ground-fault circuit-interrupter protection.

Exception No. 3: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of supporting a ceiling luminaire or ceiling-suspended fan shall be permitted to omit ground-fault circuit-interrupter protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Exception No. 4: Factory-installed receptacles that are not readily accessible and are mounted internally to bathroom exhaust fan assemblies shall not require GFCI protection unless required by the installation instructions or listing.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

(B) Outdoor Outlets.

For dwellings, all outdoor outlets, other than those covered in 210.8(A), Exception No. 1, including outlets installed in the following locations, and supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, shall be provided with GFCI protection:

(1) Garages that have floors located at or below grade level

(2) Accessory buildings

(3) Boathouses

If equipment supplied by an outlet covered under the requirements of this section is replaced, the outlet shall be supplied with GFCI protection.

Exception No. 1: GFCI protection shall not be required on lighting outlets other than those covered in 210.8(D).

Exception No. 2: GFCI protection shall not be required for listed HVAC equipment. This exception shall expire September 1, 2026.

(C) Other Than Dwelling Units.

All 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, and all receptacles supplied by three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less, installed in the following locations shall be provided with GFCI protection:

(1) Bathrooms

(2) Kitchens

(3) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(4) Buffet serving areas with permanent provisions for food serving, beverage serving, or cooking

(5) Rooftops

(6) Outdoors

(7) Sinks where receptacles or cord-and-plug-connected fixed or stationary appliances are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(8) Indoor damp or wet locations

(9) Locker rooms with associated showering facilities

(10) Garages, accessory buildings, service bays, and similar areas other than vehicle exhibition halls and showrooms

(11) Crawl spaces at or below grade level

(12) Unfinished areas of basements

(13) Aquariums, bait wells, and similar open aquatic vessels or containers, such as tanks or bowls, where receptacles are installed within 1.8 m (6 ft.) from the top inside edge or rim or from the conductive support framing of the vessel or container

(14) Laundry areas

(15) Bathtubs and shower stalls where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: Receptacles on rooftops shall not be required to be readily accessible other than from the rooftop.

Exception No. 3: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial establishments where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program in accordance with 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or that has a design not compatible with GFCI protection.

Exception No. 4: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial laboratories where the receptacles are used to supply equipment if removal of power would introduce a greater hazard.

Exception No. 5: Receptacles located in patient bed locations of Category 2 (general care) or Category 1 (critical care) spaces of health care facilities shall be permitted to comply with 517.21.

Exception No. 6: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of serving a ceiling luminaire or ceiling-suspended fan shall be permitted to omit GFCI protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

(~~C~~ D) Crawl Space Lighting Outlets.

GFCI protection shall be provided for lighting outlets not exceeding 120 volts installed in crawl spaces.

(~~D~~ E) Specific Appliances.

GFCI protection shall be provided for the branch circuit or outlet supplying the following appliances rated 150 volts or less to ground and 60 amperes or less, single- or 3-phase:

(1) Automotive vacuum machines

(2) Drinking water coolers and bottle fill stations

(3) High-pressure spray washing machines

(4) Tire inflation machines

(5) Vending machines

(6) Sump pumps

(7) Dishwashers

(8) Electric ranges

(9) Wall-mounted ovens

(10) Counter-mounted cooking units

(11) Clothes dryers

(12) Microwave ovens

(~~E~~ F) Equipment Requiring Servicing.

GFCI protection shall be provided for the receptacles required by 210.63.

~~**(F)** Outdoor Outlets.~~

~~For dwellings, all outdoor outlets, other than those covered in 210.8(A), Exception No. 1, including outlets installed in the following locations, and supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, shall be provided with GFCI protection:~~

(1) ~~Garages that have floors located at or below grade level~~

(2) ~~Accessory buildings~~

(3) ~~Boathouses~~

~~If equipment supplied by an outlet covered under the requirements of this section is replaced, the outlet shall be supplied with GFCI protection.~~

~~*Exception No. 1: GFCI protection shall not be required on lighting outlets other than those covered in 210.8(C).*~~

~~*Exception No. 2: GFCI protection shall not be required for listed HVAC equipment. This exception shall expire September 1, 2026.*~~

Statement of Problem and Substantiation for Public Input

The current layout refers to dwelling units, then non-dwelling units, then specific applications with (C) thru (E) then goes back to dwelling units. The purposed switch of section (F) to follow (A) is to keep dwelling unit requirements in line with each other for ease of use of the code.

Submitter Information Verification

Submitter Full Name:	IEC National
Organization:	IEC
Affiliation:	Jake Gray
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sat Jul 22 10:23:59 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The suggested change was not accepted as the current structure of this section is understood. Renumbering of the subsections could create confusion.

Public Input No. 264-NFPA 70-2023 [Section No. 210.8]

210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.

A listed Class A GFCI shall provide protection in accordance with 210.8(A) through (F). The GFCI shall be installed in a readily accessible location.

<u>Exception: Receptacles on rooftops shall not be required to be readily accessible other than from the rooftop.</u>

Informational Note: See 215.9 for GFCI protection on feeders.

For the purposes of this section, the distance from receptacles shall be measured as the shortest path the power supply cord connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier.

(A) Dwelling Units.

All 125-volt through 250-volt receptacles installed in the following locations and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel:

(1) Bathrooms

(2) Garages and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

(4) Crawl spaces — at or below grade level

(5) Basements

(6) ~~Kitchens~~

(7) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(8) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(9) Boathouses

(10) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(11) Laundry areas

(12) Indoor damp and wet locations

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: ~~A receptacle~~ <u>GFCI protection shall not be required for a receptacle</u> supplying only a permanently installed premises security system ~~shall be permitted to omit ground-fault circuit-interrupter protection~~ .

Exception No. 3: ~~Listed~~ <u>GFCI protection shall not be required for listed</u> weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of supporting a ceiling luminaire or ceiling-suspended fan ~~shall be permitted to omit ground-fault circuit-interrupter protection~~ . If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Exception No. 4: Factory-installed receptacles that are not readily accessible and are mounted internally to bathroom exhaust fan assemblies shall not require GFCI protection unless required by the installation instructions or listing.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

(B) Other Than Dwelling Units.

All 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, and all receptacles supplied by three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less, installed in the following locations shall be provided with GFCI protection:

(1) Bathrooms

(2) ~~Kitchens~~

(3) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(4) Buffet serving areas with permanent provisions for food serving, beverage serving, or cooking

(5) Rooftops

(6) Outdoors

(7) Sinks where receptacles or cord-and-plug-connected fixed or stationary appliances are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(8) Indoor damp or wet locations

(9) Locker rooms with associated showering facilities

(10) Garages, accessory buildings, service bays, and similar areas other than vehicle exhibition halls and showrooms

(11) Crawl spaces at or below grade level

(12) Unfinished areas of basements

(13) Aquariums, bait wells, and similar open aquatic vessels or containers, such as tanks or bowls, where receptacles are installed within 1.8 m (6 ft.) from the top inside edge or rim or from the conductive support framing of the vessel or container

(14) Laundry areas

(15) Bathtubs and shower stalls where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: Receptacles ~~on rooftops shall not be required to be readily accessible other than from the rooftop. Exception No. 3: Receptacles~~ or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial establishments where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program in accordance with 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or that has a design not compatible with GFCI protection.

Exception No. ~~4~~ 3 : Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial laboratories where the receptacles are used to supply equipment if removal of power would introduce a greater hazard.

Exception No. ~~5~~ 4 : Receptacles located in patient bed locations of Category 2 (general care) or Category 1 (critical care) spaces of health care facilities shall be permitted to comply with 517.21.

Exception No. ~~6~~ 5 : ~~Listed~~ GFCI protection shall not be required for l isted weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of serving a ceiling luminaire or ceiling-suspended fan ~~shall be permitted to omit GFCI protection~~ . If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

(C) Crawl Space Lighting Outlets.

GFCI protection shall be provided for lighting outlets not exceeding 120 volts installed in crawl spaces.

(D) Specific Appliances.

GFCI protection shall be provided for the branch circuit or outlet supplying the following appliances rated 150 volts or less to ground and 60 amperes or less, single- or 3-phase:

(1) Automotive vacuum machines

(2) Drinking water coolers and bottle fill stations

(3) High-pressure spray washing machines

(4) Tire inflation machines

(5) Vending machines

(6) Sump pumps

(7) Dishwashers

(8) Electric ranges

(9) Wall-mounted ovens

(10) Counter-mounted cooking units

(11) Clothes dryers

(12) Microwave ovens

(E) Equipment Requiring Servicing.

GFCI protection shall be provided for the receptacles required by 210.63.

(F) Outdoor Outlets.

For dwellings, all outdoor outlets, other than those covered in 210.8(A), Exception No. 1, including outlets installed in the following locations, and supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, shall ~~be provided with GFCI protection~~ be GFCI-protected :

(1) Garages that have floors located at or below grade level

(2) Accessory buildings

(3) Boathouses

If equipment supplied by an outlet covered under the requirements of this section is replaced, the outlet shall be ~~supplied with~~ GFCI- ~~protection~~ -protected .

Exception No. 1: GFCI protection shall not be required on lighting outlets other than those covered in 210.8(C).

Exception No. 2: GFCI protection shall not be required for listed HVAC equipment. This exception shall expire September 1, 2026.

Statement of Problem and Substantiation for Public Input

What was formerly an exception to 210.8(B) regarding rooftops should be moved to 210.8. The exception does not except a requirement in (B), it excepts the requirement for ready access. That is in the charging language of the rule (210.8), not 210.8(B).
210.8(A)(6) is marked for deletion because (A)(7) covers it. You can not have a kitchen, as defined in Article 100, without being in a location that is described in (A)(7).
210.8(A) Ex 2 and Ex 3 are marked for revision to address a grammatical absurdity. As written, the subject in s the receptacle and the verb is “omit.” A receptacle can not “omit” a requirement, only the words in the book can.
210.8(B)(2) is marked for deletion because (B)(3) covers it. You cannot have a kitchen, as defined in Article 100, without being in a location that is described in (A)(7).
210.8(A) Ex 6 is marked for revision to address a grammatical absurdity. As written, the subject in s the receptacle and the verb is “omit.” A receptacle cannot “omit” a requirement, only the words in the book can.
210.8(F) is revised because the only way to comply is with a receptacle. If the outlet must be supplied with GFCI protection, the protective device must be at the outlet. The intent is to provide a GFCI-protected outlet.

Submitter Information Verification

Submitter Full Name:	Ryan Jackson
Organization:	Self-employed
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Wed Feb 01 13:58:00 EST 2023
Committee:	NEC-P02

Committee Statement

Resolution: FR-7788-NFPA 70-2024. The following items from PI 264 were not accepted: 210.8(F): Section 210.8(F) suggested changes were not accepted as clarity is not added and the existing language is sufficient. The existing language does not indicate that GFCI protection must be provided as a wiring device only. The language uses the word “protection” which indicates protection is provided either at the device or upstream of the device. 210.8(A) and 210.8(B): The removal of Kitchens from list item (6) in 210.8(A) and list item (2) in 210.8(B) is not accepted as it could create confusion. Identifying “kitchens” clearly in 210.8 adds clarity and increases usablity of the Code. A kitchen is well defined and not in all cases does 210.8(A)(7) cover a kitchen. Not all of the criteria in 210.8(A)(7) are included for kitchens. 210.8(A)(7) says “or cooking” and the definition of a kitchen says “and cooking”.

Statement: The exception for receptacles on rooftops was moved to the parent text of 210.8 as this exception applies regardless of what type of occupancy. Type of occupancy doesn’t dictate the accessible nature of the receptacle.

Public Input No. 3789-NFPA 70-2023 [Section No. 210.8]

210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.

A listed Class A GFCI shall provide protection in accordance with 210.8(A) through (F). The GFCI shall be installed in a readily accessible location.

Informational Note: See 215.9 for GFCI protection on feeders.

For the purposes of this section, the distance from receptacles shall be measured as the shortest path the power supply cord connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier.

(A) Dwelling Units.

All 125-volt through 250-volt receptacles installed in the following locations and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel:

(1) Bathrooms

(2) Garages and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

(4) Crawl spaces — at or below grade level

(5) Basements

(6) Kitchens

(7) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(8) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(9) Boathouses

(10) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(11) Laundry areas

(12) Indoor damp and wet locations

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: A receptacle supplying only a permanently installed premises security system shall be permitted to omit ground-fault circuit-interrupter protection.

Exception No. 3: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of supporting a ceiling luminaire or ceiling-suspended fan shall be permitted to omit ground-fault circuit-interrupter protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Exception No. 4: Factory-installed receptacles that are not readily accessible and are mounted internally to bathroom exhaust fan assemblies shall not require GFCI protection unless required by the installation instructions or listing.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

(B) Other Than Dwelling Units.

All 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, and all receptacles supplied by three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less, installed in the following locations shall be provided with GFCI protection:

(1) Bathrooms

(2) Kitchens

(3) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(4) Buffet serving areas with permanent provisions for food serving, beverage serving, or cooking

(5) Rooftops

(6) Outdoors

(7) Sinks where receptacles or cord-and-plug-connected fixed or stationary appliances are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(8) Indoor damp or wet locations

(9) Locker rooms with associated showering facilities

(10) Garages, accessory buildings, service bays, and similar areas other than vehicle exhibition halls and showrooms

(11) Crawl spaces at or below grade level

(12) Unfinished areas of basements

(13) Aquariums, bait wells, and similar open aquatic vessels or containers, such as tanks or bowls, where receptacles are installed within 1.8 m (6 ft.) from the top inside edge or rim or from the conductive support framing of the vessel or container

(14) Laundry areas

(15) Bathtubs and shower stalls where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: Receptacles on rooftops shall not be required to be readily accessible other than from the rooftop.

Exception No. 3: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial establishments where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program in accordance with 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or that has a design not compatible with GFCI protection.

Exception No. 4: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial laboratories where the receptacles are used to supply equipment if removal of power would introduce a greater hazard.

Exception No. 5: Receptacles located in patient bed locations of Category 2 (general care) or Category 1 (critical care) spaces of health care facilities shall be permitted to comply with 517.21.

Exception No. 6: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of serving a ceiling luminaire or ceiling-suspended fan shall be permitted to omit GFCI protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Exception No. 7 Luminares that are not redily accessable that are cord and plug connected the outlet shall be of the twistlock type, and not require GFCI protection for personnel.

Exception no. 8 Electric motors that have a cord and plug connection as a disconnect to facilitate removal for service shall not require GFCI protection, provided the plug is a twist lock, or pin and sleeve type.

(C) Crawl Space Lighting Outlets.

GFCI protection shall be provided for lighting outlets not exceeding 120 volts installed in crawl spaces.

(D) Specific Appliances.

GFCI protection shall be provided for the branch circuit or outlet supplying the following appliances rated 150 volts or less to ground and 60 amperes or less, single- or 3-phase:

(1) Automotive vacuum machines

(2) Drinking water coolers and bottle fill stations

(3) High-pressure spray washing machines

(4) Tire inflation machines

(5) Vending machines

(6) Sump pumps

(7) Dishwashers

(8) Electric ranges

(9) Wall-mounted ovens

(10) Counter-mounted cooking units

(11) Clothes dryers

(12) Microwave ovens

(E) Equipment Requiring Servicing.

GFCI protection shall be provided for the receptacles required by 210.63.

(F) Outdoor Outlets.

For dwellings, all outdoor outlets, other than those covered in 210.8(A), Exception No. 1, including outlets installed in the following locations, and supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, shall be provided with GFCI protection:

(1) Garages that have floors located at or below grade level

(2) Accessory buildings

(3) Boathouses

If equipment supplied by an outlet covered under the requirements of this section is replaced, the outlet shall be supplied with GFCI protection.

Exception No. 1: GFCI protection shall not be required on lighting outlets other than those covered in 210.8(C).

Exception No. 2: GFCI protection shall not be required for listed HVAC equipment. This exception shall expire September 1, 2026.

Additional Proposed Changes

File Name	Description	Approved
.1693946508911	210.8(b)10 code change	

Statement of Problem and Substantiation for Public Input

In commercial buildings such as a heavy duty Truck service garage, may have ceiling heights of 15' or higher. with LED luminares that come with a cord attached to the fixture from the factory, it is probable that service or removal of the fixture may be needed for service. An outlet located next to the luminare would be needed in order remove the luminare. At a ceiling height of 15' in the center of the garage would place that Outlet there for service to the fixture, and not for "personal" use.
In the case of an electric motor, if a Pump motor, or other motor that would require the removal of the motor for cleaning, or to empty a container, these outlets are NOT for personel use, and are for equipment ONLY.
should not be required to have GFCI protection. I see that in machine shops it is not uncommon to have a pump motor for a hydraulic tank on a lathe for cooling liquid, that must be unplugged and the metal shavings be cleaned out of the pump collection container. the recetacle could be a twist lock, and this outlet is for a specific motor.

Submitter Information Verification

Submitter Full Name: David Fannick

Organization: David W. Fannick Electrical Sa

Street Address:

City:

State:

Zip:

Submittal Date: Tue Sep 05 16:28:22 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: Exception No. 7 for luminaires proposes a locking- type cord and plug connection but this solution does not remove the electrical shock hazard. In addition, a luminaire that is not readily accessible doesn’t mean the receptacle is not readily accessible. Exception No. 8 for electric motors would cover all areas of 210.8(B), the substantiation was given for only one area. There are unintended consequences that reach beyond where the substantiation was noted.

Public Input No. 4107-NFPA 70-2023 [Section No. 210.8]

210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.

A listed Class A GFCI shall provide protection in accordance with 210.8(A) through (F). The GFCI shall be installed in a readily accessible location.

Informational Note: See 215.9 for GFCI protection on feeders.

For the purposes of this section, the distance from receptacles shall be measured as the shortest path the power supply cord connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier.

(A) Dwelling Units.

All 125-volt through 250-volt receptacles installed in the following locations and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel:

(1) Bathrooms

(2) Garages and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

(4) Crawl spaces — at or below grade level

(5) Basements

(6) Kitchens

(7) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(8) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(9) Boathouses

(10) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(11) Laundry areas

(12) Indoor damp and wet locations

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: A receptacle supplying only a permanently installed premises security system shall be permitted to omit ground-fault circuit-interrupter protection.

Exception No. 3: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of supporting a ceiling luminaire or ceiling-suspended fan shall be permitted to omit ground-fault circuit-interrupter protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Exception No. 4: Factory-installed receptacles that are not readily accessible and are mounted internally to bathroom exhaust fan assemblies shall not require GFCI protection unless required by the installation instructions or listing.

Exception No. 6: GFCI protection shall not be required for a receptacle serving an electric range, wall-mounted oven, counter-mounted cooking unit, or microwave oven if all of the following conditions are met:

a. The appliance is located within a dedicated space.

b. In normal use, the appliance is not easily moved or is fastened in place

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

(B) Other Than Dwelling Units.

All 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, and all receptacles supplied by three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less, installed in the following locations shall be provided with GFCI protection:

(1) Bathrooms

(2) Kitchens

(3) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(4) Buffet serving areas with permanent provisions for food serving, beverage serving, or cooking

(5) Rooftops

(6) Outdoors

(7) Sinks where receptacles or cord-and-plug-connected fixed or stationary appliances are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(8) Indoor damp or wet locations

(9) Locker rooms with associated showering facilities

(10) Garages, accessory buildings, service bays, and similar areas other than vehicle exhibition halls and showrooms

(11) Crawl spaces at or below grade level

(12) Unfinished areas of basements

(13) Aquariums, bait wells, and similar open aquatic vessels or containers, such as tanks or bowls, where receptacles are installed within 1.8 m (6 ft.) from the top inside edge or rim or from the conductive support framing of the vessel or container

(14) Laundry areas

(15) Bathtubs and shower stalls where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: Receptacles on rooftops shall not be required to be readily accessible other than from the rooftop.

Exception No. 3: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial establishments where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program in accordance with 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or that has a design not compatible with GFCI protection.

Exception No. 4: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial laboratories where the receptacles are used to supply equipment if removal of power would introduce a greater hazard.

Exception No. 5: Receptacles located in patient bed locations of Category 2 (general care) or Category 1 (critical care) spaces of health care facilities shall be permitted to comply with 517.21.

Exception No. 6: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of serving a ceiling luminaire or ceiling-suspended fan shall be permitted to omit GFCI protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

(C) Crawl Space Lighting Outlets.

GFCI protection shall be provided for lighting outlets not exceeding 120 volts installed in crawl spaces.

(D) Specific Appliances.

GFCI protection shall be provided for the branch circuit or outlet supplying the following appliances rated 150 volts or less to ground and 60 amperes or less, single- or 3-phase:

(1) Automotive vacuum machines

(2) Drinking water coolers and bottle fill stations

(3) High-pressure spray washing machines

(4) Tire inflation machines

(5) Vending machines

(6) Sump pumps

(7) Dishwashers

(8) Electric ranges

(9) Wall-mounted ovens

(10) Counter-mounted cooking units

(11) Clothes dryers

(12) Microwave ovens

Exception No. 1: GFCI protection shall not be required for an outlet supplying an electric range, wall-mounted oven, counter-mounted cooking unit, or microwave oven if all of the following conditions are met:

a. The appliance is located within a dedicated space.

b. In normal use, the appliance is not easily moved or is fastened in place

(E) Equipment Requiring Servicing.

GFCI protection shall be provided for the receptacles required by 210.63.

(F) Outdoor Outlets.

For dwellings, all outdoor outlets, other than those covered in 210.8(A), Exception No. 1, including outlets installed in the following locations, and supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, shall be provided with GFCI protection:

(1) Garages that have floors located at or below grade level

(2) Accessory buildings

(3) Boathouses

If equipment supplied by an outlet covered under the requirements of this section is replaced, the outlet shall be supplied with GFCI protection.

Exception No. 1: GFCI protection shall not be required on lighting outlets other than those covered in 210.8(C).

Exception No. 2: GFCI protection shall not be required for listed HVAC equipment. This exception shall expire September 1, 2026.

Statement of Problem and Substantiation for Public Input

A. GFCIs trip on safe appliances

There is a technological incompatibility between common loads in the home and GFCIs. The incompatibility is often realized in the form of “nuisance tripping”, where a GFCI trips and no electrical hazard is present. This incompatibility is especially pertinent in the context of home appliances, which are subject to continuously updated, mandatory, Department of Energy efficiency requirements. In order for appliances to meet efficiency standards, home appliance manufacturers incorporate components that operate at frequencies higher than the mains frequency of 60-Hertz. These technologies include switch-mode power supplies, electronically commutated motors, and LED drivers. More information on technology options to meet efficiency requirements and the related regulations can be found at these publicly available links:

• Conventional cooking appliances
https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=34

• Microwaves
https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=33

Manufacturers of central air conditioners have also reported nuisance tripping issues. It should be noted that technologies used to make these appliances more efficient are the same technologies used to make central air conditioners more efficient.

Presently, there are major inconsistencies in GFCI performance above 60-Hertz.

To study effects of this variation, UL has conducted an independent study testing 3 different types of appliances, from 3 different manufacturers, connecting each of these appliances to 10 different GFCIs. All three appliances contain high frequency components - such components are found in virtually all modern home appliances. A publicly available link to the study is here:

https://collateral-library-production.s3.amazonaws.com/uploads/asset_file/attachment/54854/Study_of_High_Frequency_Spectrum_for_120_V_Household_Appliances.pdf

There are a few notable items from the UL study:
1) GFCI trip thresholds are all over the place. At certain frequencies, GFCI trip thresholds differ by roughly 150%.
2) The appliances are safe. When compared to present leakage current requirements and possible future requirements, all appliances pass by a wide margin.
3) The three appliance models tested are representative of many more models that are essentially identical as defined by Department of Energy.
4) GFCIs trip on all the appliances tested.

B. The National Electrical Code must consider the safety risks of nuisance tripping

If GFCI protection continues to be required, as laid out in the 2023 NEC, while the incompatibility issue remains, there is a high risk of people being adversely impacted by disabled appliances due to nuisance tripping. This risk may be higher than the risk of people being exposed to a leakage current that could cause harm.

CPSC has provided data showing electrocutions from consumer products in recent years.

The electrocution data contains 5 mentions of major cooking appliances (e.g. electric stove). It is unclear whether a GFCI would have prevented these deaths. In the case of microwaves, the electrocutions were repair related. It is unknown if these microwaves were plugged into mains or if the shock came from high voltage internal capacitors which can remain charged after unplugging the appliance. Similarly, one of the stove electrocutions involved a generator. It should also be noted that appliances are required to be marked, cautioning users from service while connected to mains:

In contrast, there are numerous reports of nuisance tripping on home appliances. For example, recently, 65 home providers and contractors reported 1700+ housing units experiencing nuisance tripping in Massachusetts.

The reports cover multiple types of appliances (not just cooking), including products from multiple home appliance manufacturers and multiple GFCI manufacturers.

If a GFCI nuisance trips on a cooking product this affects one's ability to provide for a family, being most impactful to low-income communities that are not well represented in the NEC development process; such households cannot go out to eat.

C. Time is needed to develop updated UL standards

The root cause of incompatibility lies in differences of allowed leakage current in appliance standards and tripping requirements in the GFCI standard.

UL 943 (Standard for Ground-Fault Circuit-Interrupters) requires that Class A ground-fault circuit-interrupters shall trip at a minimum of 6 mA and may trip when measured current exceeds 4 mA. The present UL standard only requires such trip thresholds for 60-Hertz as measured by differential current between line and neutral.

Appliances are operating at a frequency where there are no requirements for when a GFCI shall or shall not trip. It is up to each GFCI manufacturer to set their own high frequency tripping levels which may not be based on safety.

UL 858 (Safety Standard for Household Electric Ranges) allows a maximum leakage current of 2.5 mA on 120 volt products. UL 923 (Safety Standard for Microwave Cooking Appliances) allows a maximum leakage current value of 0.75 mA. These appliance measurements are conducted over a frequency sweep. Such measurements are meant to determine potential harm to a human body, thus measurements are taken across a 500-ohm resistor.

To fix this incompatibility proven by independent testing (see Section A of this substantiation), UL standards must be updated. For example, the GFCI standard, UL 943 must be updated to ensure that devices only trip when presented with a dangerous differential current. A UL 943 update proposal to accomplish this is being considered in the UL Technical Committee.

This proposal will take years to fully ballot and become effective. In addition, home appliance standards will need to be updated to ensure such products are not emitting currents in the "may trip" zone.

Electric ranges, rated more than 120 volts, may be operating above the existing 60-hertz GFCI trip thresholds. Home appliance manufactures have already updated the UL 858 standard to correct this, with updates becoming mandatory in 2025. Furthermore, AHAM will be pursuing similar updates to component standards such as UL 1030 (Safety Standard for Sheathed Heating Elements).

New home appliance requirements have already taken formal steps toward publication with an updated high frequency test achieving consensus in the Technical Committee covering UL 101. It will take time to update all the relevant standards and will take even longer to develop and ship the updated product. Until all of these updates have been made, nuisance tripping will continue to occur, and put people in danger, if no action is taken in the National Electrical Code.

D. Conclusion

There has been significant expansion of GFCI requirements in recent NEC code cycles. These new locations contain appliances which are significantly more complex than appliances in past GFCI locations such as bathrooms and kitchen countertops. While a GFCI may be suitable for protection on circuits powering hair dryers and blenders, they are not suitable for protection on more complex appliances which are subject to efficiency requirements. GFCIs must be modernized before they are required to be connected to more complex loads.

In addition to locations specified in 210.8(A), GFCI requirements for cooking appliances are also found in 210.8(D). For the PI to be effective, exceptions in both sections are needed.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4070-NFPA 70-2023 [Section No. 210.8(A)]	Numbering of Exceptions in 210.8(A)

Submitter Information Verification

Submitter Full Name: Greg Woyczynski
Organization: Association of Home Appliance Manufacturers
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 06 16:46:46 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The two exceptions proposed do not remove the hazard. Placing an appliance within a dedicated space and not being able to be easily moved or is fastened in place does not remove the electrical hazard. Proposed language, such as “not easily moved” and “in normal use,” is vague.

Public Input No. 4269-NFPA 70-2023 [Section No. 210.8]

210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.

A listed Class A GFCI shall provide protection in accordance with 210.8(A) through (F) for ac circuits . The GFCI shall be installed in a readily accessible location. For dc circuits, equivalent protection shall be provided in accordance with 210.8(G) in a readily accessible location.

Informational Note: See 215.9 for GFCI protection on feeders.

For the purposes of this section, the distance from receptacles shall be measured as the shortest path the power supply cord connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier.

(A) Dwelling Units.

All 125-volt through 250-volt receptacles installed in the following locations and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel:

(1) Bathrooms

(2) Garages and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

(4) Crawl spaces — at or below grade level

(5) Basements

(6) Kitchens

(7) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(8) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(9) Boathouses

(10) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(11) Laundry areas

(12) Indoor damp and wet locations

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: A receptacle supplying only a permanently installed premises security system shall be permitted to omit ground-fault circuit-interrupter protection.

Exception No. 3: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of supporting a ceiling luminaire or ceiling-suspended fan shall be permitted to omit ground-fault circuit-interrupter protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Exception No. 4: Factory-installed receptacles that are not readily accessible and are mounted internally to bathroom exhaust fan assemblies shall not require GFCI protection unless required by the installation instructions or listing.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

(B) Other Than Dwelling Units.

All 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, and all receptacles supplied by three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less, installed in the following locations shall be provided with GFCI protection:

(1) Bathrooms

(2) Kitchens

(3) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(4) Buffet serving areas with permanent provisions for food serving, beverage serving, or cooking

(5) Rooftops

(6) Outdoors

(7) Sinks where receptacles or cord-and-plug-connected fixed or stationary appliances are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(8) Indoor damp or wet locations

(9) Locker rooms with associated showering facilities

(10) Garages, accessory buildings, service bays, and similar areas other than vehicle exhibition halls and showrooms

(11) Crawl spaces at or below grade level

(12) Unfinished areas of basements

(13) Aquariums, bait wells, and similar open aquatic vessels or containers, such as tanks or bowls, where receptacles are installed within 1.8 m (6 ft.) from the top inside edge or rim or from the conductive support framing of the vessel or container

(14) Laundry areas

(15) Bathtubs and shower stalls where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: Receptacles on rooftops shall not be required to be readily accessible other than from the rooftop.

Exception No. 3: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial establishments where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program in accordance with 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or that has a design not compatible with GFCI protection.

Exception No. 4: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial laboratories where the receptacles are used to supply equipment if removal of power would introduce a greater hazard.

Exception No. 5: Receptacles located in patient bed locations of Category 2 (general care) or Category 1 (critical care) spaces of health care facilities shall be permitted to comply with 517.21.

Exception No. 6: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of serving a ceiling luminaire or ceiling-suspended fan shall be permitted to omit GFCI protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

(C) Crawl Space Lighting Outlets.

GFCI protection shall be provided for lighting outlets not exceeding 120 volts installed in crawl spaces.

(D) Specific Appliances.

GFCI protection shall be provided for the branch circuit or outlet supplying the following appliances rated 150 volts or less to ground and 60 amperes or less, single- or 3-phase:

(1) Automotive vacuum machines

(2) Drinking water coolers and bottle fill stations

(3) High-pressure spray washing machines

(4) Tire inflation machines

(5) Vending machines

(6) Sump pumps

(7) Dishwashers

(8) Electric ranges

(9) Wall-mounted ovens

(10) Counter-mounted cooking units

(11) Clothes dryers

(12) Microwave ovens

(E) Equipment Requiring Servicing.

GFCI protection shall be provided for the receptacles required by 210.63.

(F) Outdoor Outlets.

For dwellings, all outdoor outlets, other than those covered in 210.8(A), Exception No. 1, including outlets installed in the following locations, and supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, shall be provided with GFCI protection:

(1) Garages that have floors located at or below grade level

(2) Accessory buildings

(3) Boathouses

If equipment supplied by an outlet covered under the requirements of this section is replaced, the outlet shall be supplied with GFCI protection.

Exception No. 1: GFCI protection shall not be required on lighting outlets other than those covered in 210.8(C).

Exception No. 2: GFCI protection shall not be required for listed HVAC equipment. This exception shall expire September 1, 2026.

(G) DC circuits.

A listed device providing ground-fault protection for personnel equivalent to a Class A GFCI shall be provided for the following dc circuits greater than 30 V dc:

(1) Receptacles rated installed in dwelling units in locations as specified in 210.8(A)(1) through (A)(12)

(2) Receptacles rated 100 amperes or less installed in other than dwelling units in locations as specified in 210.8(B)(1) through (B)(15)

(3) Crawl space lighting outlets

(4) Branch circuits and outlets for appliances, rated 60 amperes or less, installed in locations as specified in 210.8(D)(1) through (D)(12)

(5) Receptacles required by 210.63

(6) All outdoor outlets rated 50 amperes or less

Exception: Protection is not required for a Class 2, Class 3, Class 4 or communications circuit.

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee DC Task Group consisting of Danish Zia, Jason Fisher, Randy Dollar, Larry Wildermuth, Scott Higgins, Scott Harding, Mark Earley, Jason Hopkins, Christopher Vance, Chad Kennedy and Derrick Atkins. This Public Input, along with other Public Inputs, was developed with the goal of improving usability and accuracy on requirements associated with DC circuits.

DC residential and commercial installations are emerging in the electrical infrastructure and are expected to be a growing alternative to the traditional AC only utility fed building. Examples include the US DOE Grid-interactive Efficient Buildings project (Note 1), the Purdue University RENEWW house (Note 2), and a DC Microgrid community in Vermont (Note 3). These installations may involve buildings that are distributed entirely with DC, or with an AC/DC hybrid distribution.

The requirements of Section 210.8 provide lifesaving protection for personnel from electrical shock hazards. However, the requirements are currently applied to AC circuits only, even though the same electrical shock hazards exist in DC circuits. As there is continued expansion of DC throughout the infrastructure it is necessary to ensure that the same level of electrical shock protection is provided to personnel in the locations addressed by 210.8. This proposal closes a gap in the Code for DC circuits where similar hazards exist but ground-fault protection may not be provided for the same locations currently addressed in 210.8(A) through (F). An exception is also provided for Class 2, Class 3, Class 4 or communications circuit as the electric shock protection for these are addressed in Chapter 7 and 8.

Note 1 - https://www.energy.gov/sites/default/files/2020/09/f79/bto-geb-project-summary-093020.pdf
Note 2 - https://engineering.purdue.edu/ME/News/2022/purdue-house-runs-entirely-on-dc-power
Note 3 - https://www.efficiencyvermont.com/Media/Default/docs/white-papers/Energy_Resilience.pdf

Submitter Information Verification

Submitter Full Name: Danish Zia
Organization: UL Solutions
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 09:02:58 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Insufficient substantiation was provided to add dc GFCI protection. The Panel seeks more information regarding dc ground faults and let-go thresholds.

Public Input No. 1447-NFPA 70-2023 [New Section after 210.8(A)]

GFCI Protection for Floor Outlet Receptacles

(13) Floor outlet receptacles (protection provided for the circuit of the conductors feeding outlet)

Aslo adding to 210.8(B)

(16) Floor outlet receptacles (protection provided for the circuit of the conductors feeding outlet)

Statement of Problem and Substantiation for Public Input

Current wiring methods do not require GFCI protection to floor outlet receptacles. This location has a great possibility to become wet from spilled liquids that could cause an electrical shock hazard to persons.

Submitter Information Verification

Submitter Full Name: Jason Scott
Organization: IES Residential
Affiliation: IEC
Street Address:
City:
State:
Zip:

Submittal Date: Mon Jul 17 11:21:08 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Substantiation hasn't been provided to expand GFCI protection to other areas covered as part of 210.8(A) and 210.8(B). A floor receptacle is not an area location. The substantiation isn't correct that "current wiring methods do not require GFCI protection to floor outlet receptacles". If they are in any of the locations found in (A) and (B) they would be required to be GFCI protected.

Public Input No. 1096-NFPA 70-2023 [Section No. 210.8(A)]

(A) Dwelling Units.

All 125-volt through 250-volt receptacles installed in the following locations and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel:

(1) Bathrooms

(2) Garages and also accessory buildings that have a floor ~~located at or below~~ accessible from grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

(4) Crawl spaces — at or below grade level

(5) Basements

(6) Kitchens

(7) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(8) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(9) Boathouses

(10) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(11) Laundry areas

(12) Indoor damp and wet locations

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: A receptacle supplying only a permanently installed premises security system shall be permitted to omit ground-fault circuit-interrupter protection.

Exception No. 3: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of supporting a ceiling luminaire or ceiling-suspended fan shall be permitted to omit ground-fault circuit-interrupter protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Exception No. 4: Factory-installed receptacles that are not readily accessible and are mounted internally to bathroom exhaust fan assemblies shall not require GFCI protection unless required by the installation instructions or listing.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

While garages with floors below grade level are somewhat common, garages with floors at grade level are very rare They are almost always an inch or more above grade level. Many sheds (accessory buildings) are built on timber frames and do not have floors at grade level and as a result the code language does not require these accessory building with floors above grade to have GFCI protection. This change will clarify that the protection is required where the floor level of a garage or accessory building is accessible from grade level. The hazard is the same where the floor is a foot above grade as it is with the floor at grade level.

Submitter Information Verification

Submitter Full Name: Don Ganiere

Organization: none

Street Address:

City:

State:

Zip:

Submittal Date: Thu Jun 15 18:29:45 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: FR-7908-NFPA 70-2024

Statement: Existing list Item (2) is separated into two list items (“garages” and “accessory buildings...”) for clarity. In addition, the words “that have a floor located at or below grade level” are removed as the location of the floor does not remove the electrical shock hazard that GFCI is meant to address.

Public Input No. 1334-NFPA 70-2023 [Section No. 210.8(A)]

(A) Dwelling Units.

All 125-volt through 250-volt receptacles installed in the following locations and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel:

(1) Bathrooms

(2) Garages ~~and also accessory buildings that have a floor located at or below grade level~~

(3) Accessory buildings not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(4) Outdoors

(5) Crawl spaces — at or below grade level

(6) Basements

(7) Kitchens

(8) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(9) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(10) Boathouses

(11) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(12) Laundry areas

(13) Indoor damp and wet locations

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: A receptacle supplying only a permanently installed premises security system shall be permitted to omit ground-fault circuit-interrupter protection.

Exception No. 3: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of supporting a ceiling luminaire or ceiling-suspended fan shall be permitted to omit ground-fault circuit-interrupter protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Exception No. 4: Factory-installed receptacles that are not readily accessible and are mounted internally to bathroom exhaust fan assemblies shall not require GFCI protection unless required by the installation instructions or listing.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

This public input does two things. First it separates garages and accessory buildings into two line items. These are two separate locations and should be addressed separately for clarity. Secondly this public input removes the language “floor located at or below grade level” as the location of the floor doesn’t remove the electrical hazard of shock. The presence of that language adds confusion.

Submitter Information Verification

Submitter Full Name: Thomas Domitrovich
Organization: Eaton Corporation
Street Address:
City:
State:
Zip:

Submittal Date: Sat Jul 08 12:10:00 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7908-NFPA 70-2024

Statement: Existing list Item (2) is separated into two list items (“garages” and “accessory buildings...”) for clarity. In addition, the words “that have a floor located at or below grade level” are removed as the location of the floor does not remove the electrical shock hazard that GFCI is meant to address.

Public Input No. 1335-NFPA 70-2023 [Section No. 210.8(A)]

(A) Dwelling Units.

All 125-volt through 250-volt receptacles installed in the following locations and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel:

(1) Bathrooms

(2) Garages and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

(4) Crawl spaces — at or below grade level

(5) Basements

(6) Kitchens

(7) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(8) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(9) Boathouses

(10) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(11) Laundry areas

(12) Indoor damp ~~and~~ or wet locations

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: A receptacle supplying only a permanently installed premises security system shall be permitted to omit ground-fault circuit-interrupter protection.

Exception No. 3: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of supporting a ceiling luminaire or ceiling-suspended fan shall be permitted to omit ground-fault circuit-interrupter protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Exception No. 4: Factory-installed receptacles that are not readily accessible and are mounted internally to bathroom exhaust fan assemblies shall not require GFCI protection unless required by the installation instructions or listing.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

This PI brings 210.8(A) in alignment with 210.8(B). This was fixed in the 2023 cycle for 210.8(B) but was missed in 210.8(A).

Submitter Information Verification

Submitter Full Name: Thomas Domitrovich
Organization: Eaton Corporation
Street Address:
City:
State:
Zip:
Submittal Date: Sat Jul 08 12:14:25 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7704-NFPA 70-2024

Statement: List item (12) is now separated into two list items for clarity to address the issue of the use of the word “and” between indoor damp locations and indoor wet locations. These are two separate areas that are not shown as two list items. This change adds clarity. [Public inputs 182, 1335 and 1949]

Exception No’s 2 and 3 are reworded for clarity. The removal of Kitchens from list item (6) in 210.8(A) and list item (2) in 210.8(B) is not accepted as it could create confusion. Identifying “kitchens” clearly in 210.8 adds clarity and increases usability of the Code. A kitchen is well defined and not in all cases does 210.8(A)(7) cover a kitchen. Not all of the criteria in 210.8(A)(7) are included for kitchens. 210.8(A)(7) says “or cooking” and the definition of a kitchen says “and cooking”. [Public Input 264]

Exception No. 4 is modified to remove “bathroom” as exception should not only apply to bathroom exhaust fans. It would also be a valid exception in utility laundry areas where that GFCI protection would otherwise be required. [Public Inputs 1388, 1764, 3384]

Public Input No. 1388-NFPA 70-2023 [Section No. 210.8(A)]

(A) Dwelling Units.

All 125-volt through 250-volt receptacles installed in the following locations and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel:

(1) Bathrooms

(2) Garages and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

(4) Crawl spaces — at or below grade level

(5) Basements

(6) Kitchens

(7) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(8) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(9) Boathouses

(10) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(11) Laundry areas

(12) Indoor damp and wet locations

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: A receptacle supplying only a permanently installed premises security system shall be permitted to omit ground-fault circuit-interrupter protection.

Exception No. 3: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of supporting a ceiling luminaire or ceiling-suspended fan shall be permitted to omit ground-fault circuit-interrupter protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Exception No. 4: Factory-installed receptacles that are not readily accessible and are mounted internally ~~to bathroom exhaust~~ <u>to exhaust</u> fan assemblies shall not require GFCI protection unless required by the installation instructions or listing.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

A bathroom is not the only location where an exhaust fan can be installed. An exhaust fan is often located in a laundry area. All 125-volt through 250-volt receptacles that are installed in a laundry area and supplied by single-phase branch circuits rated 150 volts or less require GFCI protection. Providing this change in the requirements at 210.8(A) Ex. 4 would reduce confusion between the installer and an inspector as it pertains to electrical inspections.

Submitter Information Verification

Submitter Full Name: Joseph Wages
Organization: Self
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 12 14:55:46 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7704-NFPA 70-2024

Statement: List item (12) is now separated into two list items for clarity to address the issue of the use of the word “and” between indoor damp locations and indoor wet locations. These are two separate areas that are not shown as two list items. This change adds clarity. [Public inputs 182, 1335 and 1949]

Exception No's 2 and 3 are reworded for clarity. The removal of Kitchens from list item (6) in 210.8(A) and list item (2) in 210.8(B) is not accepted as it could create confusion. Identifying "kitchens" clearly in 210.8 adds clarity and increases usability of the Code. A kitchen is well defined and not in all cases does 210.8(A)(7) cover a kitchen. Not all of the criteria in 210.8(A)(7) are included for kitchens. 210.8(A)(7) says "or cooking" and the definition of a kitchen says "and cooking". [Public Input 264]

Exception No. 4 is modified to remove "bathroom" as exception should not only apply to bathroom exhaust fans. It would also be a valid exception in utility laundry areas where that GFCI protection would otherwise be required. [Public Inputs 1388, 1764, 3384]

Public Input No. 1764-NFPA 70-2023 [Section No. 210.8(A)]

(A) Dwelling Units.

All 125-volt through 250-volt receptacles installed in the following locations and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel:

(1) Bathrooms

(2) Garages and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

(4) Crawl spaces — at or below grade level

(5) Basements

(6) Kitchens

(7) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(8) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(9) Boathouses

(10) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(11) Laundry areas

(12) Indoor damp and wet locations

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: A receptacle supplying only a permanently installed premises security system shall be permitted to omit ground-fault circuit-interrupter protection.

Exception No. 3: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of supporting a ceiling luminaire or ceiling-suspended fan shall be permitted to omit ground-fault circuit-interrupter protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Exception No. 4: Factory-installed receptacles that are not readily accessible and are mounted internally ~~to bathroom exhaust~~ <u>to exhaust</u> fan assemblies shall not require GFCI protection unless required by the installation instructions or listing.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

A bathroom is not the only location where an exhaust fan can be installed. An exhaust fan is often located in a laundry area. All 125-volt through 250-volt receptacles that are installed in a laundry area and supplied by single-phase branch circuits rated 150 volts or less require GFCI protection. Providing this change in the requirements at 210.8(A) Ex. 4 would reduce confusion between the installer and an inspector as it pertains to electrical inspections.

Submitter Information Verification

Submitter Full Name: Rudy Garza
Organization: IAEI
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 01 13:55:46 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7704-NFPA 70-2024

Statement: List item (12) is now separated into two list items for clarity to address the issue of the use of the word “and” between indoor damp locations and indoor wet locations. These are two separate areas that are not shown as two list items. This change adds clarity. [Public inputs 182, 1335 and 1949]

Exception No’s 2 and 3 are reworded for clarity. The removal of Kitchens from list item (6) in 210.8(A) and list item (2) in 210.8(B) is not accepted as it could create confusion. Identifying “kitchens” clearly in 210.8 adds clarity and increases usability of the Code. A kitchen is well defined and not in all cases does 210.8(A)(7) cover a kitchen. Not all of the criteria in 210.8(A)(7) are included for kitchens. 210.8(A)(7) says “or cooking” and the definition of a kitchen says “and cooking”. [Public Input 264]

Exception No. 4 is modified to remove “bathroom” as exception should not only apply to bathroom exhaust fans. It would also be a valid exception in utility laundry areas where that GFCI protection would otherwise be required. [Public Inputs 1388, 1764, 3384]

Public Input No. 182-NFPA 70-2023 [Section No. 210.8(A)]

(A) Dwelling Units.

All 125-volt through 250-volt receptacles installed in the following locations and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel:

(1) Bathrooms

(2) Garages and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

(4) Crawl spaces — at or below grade level

(5) Basements

(6) Kitchens

(7) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(8) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(9) Boathouses

(10) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(11) Laundry areas

(12) Indoor damp ~~and~~ or wet locations

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: A receptacle supplying only a permanently installed premises security system shall be permitted to omit ground-fault circuit-interrupter protection.

Exception No. 3: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of supporting a ceiling luminaire or ceiling-suspended fan shall be permitted to omit ground-fault circuit-interrupter protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Exception No. 4: Factory-installed receptacles that are not readily accessible and are mounted internally to bathroom exhaust fan assemblies shall not require GFCI protection unless required by the installation instructions or listing.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

The area does not have to be both damp and wet to trigger the GFCI requirement. Either condition should trigger the requirement. This was corrected in 210.8(B)(6) last code cycle, but was not corrected in 210.8(A)(12).

Submitter Information Verification

Submitter Full Name: Don Ganiere
Organization: none
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 17 13:29:15 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7704-NFPA 70-2024

Statement: List item (12) is now separated into two list items for clarity to address the issue of the use of the word “and” between indoor damp locations and indoor wet locations. These are two separate areas that are not shown as two list items. This change adds clarity. [Public inputs 182, 1335 and 1949]

Exception No’s 2 and 3 are reworded for clarity. The removal of Kitchens from list item (6) in 210.8(A) and list item (2) in

210.8(B) is not accepted as it could create confusion. Identifying “kitchens” clearly in 210.8 adds clarity and increases usability of the Code. A kitchen is well defined and not in all cases does 210.8(A)(7) cover a kitchen. Not all of the criteria in 210.8(A)(7) are included for kitchens. 210.8(A)(7) says “or cooking” and the definition of a kitchen says “and cooking”. [Public Input 264]

Exception No. 4 is modified to remove “bathroom” as exception should not only apply to bathroom exhaust fans. It would also be a valid exception in utility laundry areas where that GFCI protection would otherwise be required. [Public Inputs 1388, 1764, 3384]

Public Input No. 1949-NFPA 70-2023 [Section No. 210.8(A)]

(A) Dwelling Units.

All 125-volt through 250-volt receptacles installed in the following locations and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel:

(1) Bathrooms

(2) Garages and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

(4) Crawl spaces — at or below grade level

(5) Basements

(6) Kitchens

(7) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(8) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(9) Boathouses

(10) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(11) Laundry areas

(12) Indoor damp ~~and~~ or wet locations

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: A receptacle supplying only a permanently installed premises security system shall be permitted to omit ground-fault circuit-interrupter protection.

Exception No. 3: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of supporting a ceiling luminaire or ceiling-suspended fan shall be permitted to omit ground-fault circuit-interrupter protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Exception No. 4: Factory-installed receptacles that are not readily accessible and are mounted internally to bathroom exhaust fan assemblies shall not require GFCI protection unless required by the installation instructions or listing.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

For consistency with section 210.8(B)(8) and for clarity, I propose that the word “and” be replaced with the word “or” in section 210.8(A)(12).

Submitter Information Verification

Submitter Full Name: Rudy Garza
Organization: IAEI
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 08 13:49:21 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7704-NFPA 70-2024

Statement: List item (12) is now separated into two list items for clarity to address the issue of the use of the word “and” between indoor damp locations and indoor wet locations. These are two separate areas that are not shown as two list items. This change adds clarity. [Public inputs 182, 1335 and 1949]

Exception No’s 2 and 3 are reworded for clarity. The removal of Kitchens from list item (6) in 210.8(A) and list item (2) in

210.8(B) is not accepted as it could create confusion. Identifying “kitchens” clearly in 210.8 adds clarity and increases usability of the Code. A kitchen is well defined and not in all cases does 210.8(A)(7) cover a kitchen. Not all of the criteria in 210.8(A)(7) are included for kitchens. 210.8(A)(7) says “or cooking” and the definition of a kitchen says “and cooking”. [Public Input 264]

Exception No. 4 is modified to remove “bathroom” as exception should not only apply to bathroom exhaust fans. It would also be a valid exception in utility laundry areas where that GFCI protection would otherwise be required. [Public Inputs 1388, 1764, 3384]

Public Input No. 3384-NFPA 70-2023 [Section No. 210.8(A)]

(A) Dwelling Units.

All 125-volt through 250-volt receptacles installed in the following locations and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel:

(1) Bathrooms

(2) Garages and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

(4) Crawl spaces — at or below grade level

(5) Basements

(6) Kitchens

(7) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(8) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(9) Boathouses

(10) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(11) Laundry areas

(12) Indoor damp and wet locations

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: A receptacle supplying only a permanently installed premises security system shall be permitted to omit ground-fault circuit-interrupter protection.

Exception No. 3: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of supporting a ceiling luminaire or ceiling-suspended fan shall be permitted to omit ground-fault circuit-interrupter protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Exception No. 4: Factory-installed receptacles that are not readily accessible and are mounted internally ~~to bathroom exhaust~~ to exhaust fan assemblies shall not require GFCI protection unless required by the installation instructions or listing.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

This exception should not only apply to bathrooms. It would also be a valid exception in utility areas where that GFCI protection would otherwise be required.

Submitter Information Verification

Submitter Full Name: Albin Kneggs
Organization: City of Dallas
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 01 18:08:11 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7704-NFPA 70-2024

Statement: List item (12) is now separated into two list items for clarity to address the issue of the use of the word “and” between indoor damp locations and indoor wet locations. These are two separate areas that are not shown as two list items. This change adds clarity. [Public inputs 182, 1335 and 1949]

Exception No’s 2 and 3 are reworded for clarity. The removal of Kitchens from list item (6) in 210.8(A) and list item (2) in 210.8(B) is not accepted as it could create confusion. Identifying “kitchens” clearly in 210.8 adds clarity and increases usability of the Code. A kitchen is well defined and not in all cases does 210.8(A)(7) cover a kitchen. Not all of the criteria in 210.8(A)(7) are included for kitchens. 210.8(A)(7) says “or cooking” and the definition of a kitchen says “and cooking”. [Public Input 264]

Exception No. 4 is modified to remove “bathroom” as exception should not only apply to bathroom exhaust fans. It would also be a valid exception in utility laundry areas where that GFCI protection would otherwise be required. [Public Inputs 1388, 1764, 3384]

Public Input No. 383-NFPA 70-2023 [Section No. 210.8(A)]

(A) Dwelling Units.

All 125-volt through 250-volt receptacles installed in the following locations and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel:

(1) Bathrooms

(2) Garages and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors*. Exception: GFCI protection shall not be required for other than 125-volt, 15- and 20-ampere receptacles installed solely for the connection of a recreational vehicle where the receptacle or the enclosure is marked " For Connection of RV Only".*

(4) Crawl spaces — at or below grade level

(5) Basements

(6) Kitchens

(7) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(8) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(9) Boathouses

(10) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(11) Laundry areas

(12) Indoor damp and wet locations

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: A receptacle supplying only a permanently installed premises security system shall be permitted to omit ground-fault circuit-interrupter protection.

Exception No. 3: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of supporting a ceiling luminaire or ceiling-suspended fan shall be permitted to omit ground-fault circuit-interrupter protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Exception No. 4: Factory-installed receptacles that are not readily accessible and are mounted internally to bathroom exhaust fan assemblies shall not require GFCI protection unless required by the installation instructions or listing.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

This revision is needed to provide some relief for homeowners like myself who often have receptacles installed at their homes in order to plug-in their campers and trailers while they are parked in their driveway or yard. I often set up and plug in my camper in order to make repairs or perform system checks before going on camping trips. Some people even like to “camp” in their own driveways!
The Article 100 definition of “Feeder Assembly” makes it clear that this receptacle is part of a FEEDER when the RV is plugged into the receptacle. The GFCI protection requirements in 210.8(A) do not apply to feeders!
Informational note 1 in Section 551.71(F) indicates that a class A GFCI may experience nuisance tripping from appliances used within the RV. This is why the relief is needed, otherwise it may be impossible to plug-in an RV at home without tripping a GFCI!

Informational note 2 for 551.71(F) reaffirms the argument that when the RV is plugged in, the receptacle is actually part of a feeder and the requirements of 210.8(A)(3) would not be applicable anyways! But relief is still needed for when the homeowner unplugs the RV, and the receptacle is then considered part of a branch circuit again. My proposed revisions will provide this relief. Without this relief, it may be impossible for RV owners to plug-in and power up their campers at home resulting in homeowners coming up with creative and dangerous ways to power their campers! My proposal aims at preventing those creative and dangerous solutions from happening.

551.71(F)(2) provides this relief for 30-amp receptacles, 50-amp receptacles, and receptacles other than 15-amp, or 20-amp, 125-V.

550.32(E) provides this same type of relief for mobile homes-“Where receptacles provide power to a mobile or manufactured home in accordance with 550.10, ground-fault circuit-interrupter protection shall NOT be required.”

My proposal provides relief similar to the relief provided in 551.71(F)(2) and 550.32(E).

Metal hulled boats probably pose a much greater shock hazard than a camper, and yet, even Article 555 does NOT require GFCI protection for shore power receptacles!

Please provide this relief before homeowners start doing dangerous connections to circumvent the GFCI protected receptacle. The less dangerous solution is to simply omit GFCI protection here as it is omitted in Articles 551 and 550 where accumulating leakage current poses an incompatibility problem for what amounts to a GFCI protected feeder when the RV is plugged in!

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:
Submittal Date: Thu Mar 02 13:38:47 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: CMP-2 reaffirms these outlets are required to be GFCI protected. These outlets could be used for applications other than plugging in an RV attachment plug. This GFCI protection requirement is addressed in 551.71(F).

Public Input No. 4070-NFPA 70-2023 [Section No. 210.8(A)]

(A) Dwelling Units.

All 125-volt through 250-volt receptacles installed in the following locations and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel:

(1) Bathrooms

(2) Garages and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

(4) Crawl spaces — at or below grade level

(5) Basements

(6) Kitchens

(7) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(8) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(9) Boathouses

(10) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(11) Laundry areas

(12) Indoor damp and wet locations

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: A receptacle supplying only a permanently installed premises security system shall be permitted to omit ground-fault circuit-interrupter protection.

Exception No. 3: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of supporting a ceiling luminaire or ceiling-suspended fan shall be permitted to omit ground-fault circuit-interrupter protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Exception No. 4: Factory-installed receptacles that are not readily accessible and are mounted internally to bathroom exhaust fan assemblies shall not require GFCI protection unless required by the installation instructions or listing.

Exception No. 5: GFCI protection shall not be required for a receptacle serving a refrigerator or HVAC appliance if all of the following conditions are met:

a. The appliance is located within a dedicated space.

b. The appliance is on an individual branch-circuit.

c. In normal use, the appliance is not easily moved or is fastened in place.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

A. GFCIs trip on safe appliances

There is a technological incompatibility between common loads in the home and GFCIs. The incompatibility is often realized in the form of “nuisance tripping”, where a GFCI trips and no electrical hazard is present. This incompatibility is especially pertinent in the context of home appliances, which are subject to continuously updated, mandatory, Department of Energy efficiency requirements. In order for appliances to meet efficiency standards, home appliance manufacturers incorporate components that operate at frequencies higher than the mains frequency of 60-Hertz. These technologies include switch-mode power supplies, variable-speed drives, and LED drivers. More information on technology options to meet efficiency requirements and the related regulations can be found at these publicly available links:

• Room air conditioners:
https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=52&action=viewlive

• Refrigerators and freezers
https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=37&action=viewlive

• Miscellaneous refrigeration
https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=39&action=viewlive

Manufacturers of central air conditioners have also reported nuisance tripping issues. It should be noted that technologies used to make these appliances more efficient are the same technologies used to make central air conditioners more efficient.

Presently, there are major inconsistencies in GFCI performance above 60-Hertz.

To study effects of this variation, UL has conducted an independent study testing 3 different types of appliances, from 3 different manufacturers, connecting each of these appliances to 10 different GFCIs. All three appliances contain high frequency components - such components are found in virtually all modern home appliances. A publicly available link to the study is here:

https://collateral-library-production.s3.amazonaws.com/uploads/asset_file/attachment/54854/Study_of_High_Frequency_Spectrum_for_120_V_Household_Appliances.pdf

There are a few notable items from the UL study:
1) GFCI trip thresholds are all over the place. At certain frequencies, GFCI trip thresholds differ by roughly 150%.
2) The appliances are safe. When compared to present leakage current requirements and possible future requirements, all appliances pass by a wide margin.
3) The three appliance models tested are representative of many more models that are essentially identical as defined by Department of Energy.
4) GFCIs trip on all the appliances tested.

B. The National Electrical Code must consider the safety risks of nuisance tripping

If GFCI protection continues to be required, as laid out in the 2023 NEC, while the incompatibility issue remains, there is a high risk of people being adversely impacted by disabled appliances due to nuisance tripping. This risk may be higher than the risk of people being exposed to a leakage current that could cause harm.

CPSC has provided data showing electrocutions from consumer products in recent years. The electrocution data contains no mentions of refrigerators or retail HVAC (e.g. room air conditioner).

In stark contrast, there are numerous reports of nuisance tripping on home appliances. For example, recently, 65 home providers and contractors reported 1700+ housing units experiencing nuisance tripping in Massachusetts.

The reports cover multiple types of appliances (not just cooking), including products from multiple home appliance manufacturers and multiple GFCI manufacturers. In a public meeting surrounding these comments, housing coalition membership stated, “refrigerators cause the same problem from experience in affordable housing (100's of units).”

If a GFCI nuisance trips on a refrigerator, hundreds of dollars of food can be lost, severely affecting one’s ability to provide for a family; prescription medicine can also be ruined. If a GFCI nuisance trips on a window air conditioner or heat pump, residents can be exposed to extreme temperatures.

C. Time is needed to develop updated UL standards

The root cause of incompatibility lies in differences of allowed leakage current in appliance standards and tripping requirements in the GFCI standard.

UL 943 (Standard for Ground-Fault Circuit-Interrupters) requires that Class A ground-fault circuit-interrupters shall trip at a minimum of 6 mA and may trip when measured current exceeds 4 mA. The present UL standard only requires such trip thresholds for 60-Hertz as measured by differential current between line and neutral.

Appliances are operating at a frequency where there are no requirements for when a GFCI shall or shall not trip. It is up to each GFCI manufacturer to set their own high frequency tripping levels which may not be based on safety.

UL 60335-2-24 (Standard for Household and Similar Electrical Appliances – Safety, Particular Requirements for Refrigerating Appliances, Ice-Cream Appliances And Ice Makers) allows a maximum leakage current of 0.75 mA. UL 60335-2-40 (Standard for Household and Similar Electrical Appliances – Safety, Particular Requirements for Electrical Heat Pumps, Air Conditioners and Dehumidifiers) allows a maximum leakage current value of 0.75 mA for cord-connected appliances. These appliance measurements are conducted over a frequency sweep. Such measurements are meant to determine potential harm to a human body, thus measurements are taken across a 500-ohm resistor.

To fix the incompatibility proven by independent testing (see Section A of this substantiation), UL standards must be updated. For example, the GFCI standard, UL 943 must be updated to ensure that devices only trip when presented with a dangerous differential current. A UL 943 proposal to accomplish this is being considered by the UL Technical Committee.

This proposal will take years to fully ballot and become effective. In addition, home appliance standards will need to be updated to ensure such products are not emitting currents in the “may trip” zone.

New home appliance requirements have already taken formal steps toward publication with an updated high frequency test achieving consensus in the Technical Committee covering UL 101. It will take time to update all the relevant standards and will take even longer to develop and ship the updated product. Until all of these updates have been made, nuisance tripping will continue to occur, and put people in danger, if no action is taken in the National Electrical Code.

D. Conclusion

There has been significant expansion of GFCI requirements in recent NEC code cycles. These new locations contain appliances which are significantly more complex than appliances in past GFCI locations such as bathrooms and kitchen countertops. While a GFCI may be suitable for protection on circuits powering hair dryers and blenders, they are not suitable for protection on more complex appliances which are subject to efficiency requirements. GFCIs must be modernized before they are required to be connected to more complex loads.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4107-NFPA 70-2023 [Section No. 210.8]	

Submitter Information Verification

Submitter Full Name: Greg Woyczynski

Organization: Association of Home Appliance Manufacturers

Street Address:

City:

State:

Zip:

Submittal Date: Wed Sep 06 15:36:26 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: Placing an appliance on an individual branch circuit or placing the appliance within a dedicated space does not remove the electrical hazard. Proposed language in Exception No. 5, item (c), such as “not easily moved” or “in normal use,” is vague.

Public Input No. 4381-NFPA 70-2023 [Section No. 210.8(A)]

(A) Dwelling Units.

All 125-volt through 250-volt receptacles installed in the following locations and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel:

(1) Bathrooms

(2) Garages and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

(4) Crawl spaces — at or below grade level

(5) Basements Exception: GFCI protection shall not be required on condensate pumps.

(6) Kitchens

(7) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(8) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(9) Boathouses

(10) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(11) Laundry areas

(12) Indoor damp and wet locations

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: A receptacle supplying only a permanently installed premises security system shall be permitted to omit ground-fault circuit-interrupter protection.

Exception No. 3: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of supporting a ceiling luminaire or ceiling-suspended fan shall be permitted to omit ground-fault circuit-interrupter protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Exception No. 4: Factory-installed receptacles that are not readily accessible and are mounted internally to bathroom exhaust fan assemblies shall not require GFCI protection unless required by the installation instructions or listing.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

ACCA has surveyed its members regarding reports of nuisance tripping of condensate pumps that are connected to GFCI receptacles in basements per the NEC. The survey was focused on incidents within the past 12 months where the GFCI receptacle tripped and no defect or grounding condition was found. It also asked what types of cooling and heating equipment were rendered inoperative due to the nuisance tripping, and how extensive that was. The survey results show that such incidents were occurring in 15 different states across the country, and involve equipment types such as furnaces, air-conditioners or heat pumps, air-handler units, boilers, water heaters and other equipment or devices. The estimated total number of units involved was close to 1,000. A summary of the survey results is attached, along with comments detailing their experiences.

The above situation is similar to nuisance tripping of outdoor HVAC equipment that created an exception to 210.8(F) in the 2020 and 2023 NEC. The health and safety concerns related to nuisance tripping rendering HVAC equipment inoperative are the same whether the equipment is located outdoors or in a basement. The health and safety of elderly and impaired people, or other sensitive occupants is threatened when they lose cooling during hot weather. Every year, thousands of people experience a medical crisis related to excessive heat exposure indoors. Many of those people cannot access the location of the condensate pump or panel and obtaining the services of a professional during those times can be difficult. The same can be said for extreme winter conditions if the GFCI trips the condensate pump serving a furnace, boiler or water heater, cutting off the heat to the occupants.

A second concern is the huge damage that can occur due to failure of heating systems in northern climates, especially when pipes freeze and break. Pipes in walls freeze before the interior temperature reaches 32, 40 or even 50 degrees F. Condensing boilers in existing buildings are connected to piping systems that can freeze when circulation of warm water is interrupted for only a few hours. This condition can be exacerbated when high winds penetrate poorly insulated homes in winter.

Another issue involves the potential overflow of condensate when the pump is tripped inoperative. This could lead to considerable flooding in the basement if the condition is not discovered in time.

Submitter Information Verification

Submitter Full Name: David Bixby
Organization: ACCA
Affiliation: ACCA
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 13:36:56 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The suggested language would result in an unprotected receptacle located in the basement that can be used for other equipment. The root cause of the tripping identified was not presented and so it is not confirmed that a compatibility issue exists. The tripping could have been because a ground fault was detected. In addition, this could create a conflict with the requirements in 422.5 where GFCI protection is required for a sump pump.

Public Input No. 862-NFPA 70-2023 [Section No. 210.8(A)]

(A) Dwelling Units.

All 125-volt through 250-volt receptacles installed in the following locations and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel:

(1) Bathrooms

(2) Garages and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

(4) Crawl spaces — at or below grade level

(5) Basements

(6) Kitchens

(7) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(8) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(9) Boathouses

(10) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(11) Laundry areas

(12) Indoor damp and wet locations

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: A receptacle supplying only a permanently installed premises security system shall be permitted to omit ground-fault circuit-interrupter protection.

Exception No. 3: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of supporting a ceiling luminaire or ceiling-suspended fan shall be permitted to omit ground-fault circuit-interrupter protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Exception No. 4: Factory-installed receptacles that are not readily accessible and are mounted internally to bathroom exhaust fan assemblies shall not require GFCI protection unless required by the installation instructions or listing.

Exception No.5 A ceiling receptacle installed for the purpose of powering a garage door opener shall be permitted to omit ground-fault-circuit-interrupter protection.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

While it is important to have ground-fault-circuit-interrupter protection inside of a garage, the ceiling of the garage is not as likely as the rest of the area to have exposure to water. It should therefore be up to the installer to determine whether or not this protection is justified for any specific installation.

Submitter Information Verification

Submitter Full Name: Grant Korte
Organization: E Light
Street Address:
City:
State:
Zip:
Submittal Date: Sun May 21 14:27:58 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Substantiation was not provided to remove GFCI protection for ceiling receptacles powering a garage door opener. Exposure to water is not the only way electric shock can occur.

Public Input No. 2185-NFPA 70-2023 [Sections 210.8(A), 210.8(B)]

Sections 210.8(A), 210.8(B)

(A) Dwelling Units.

All 125-volt through 250-volt receptacles installed in the following locations and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel:

(1) Bathrooms

(2) Garages and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

(4) Crawl spaces — at or below grade level

(5) Basements

(6) Kitchens

(7) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(8) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(9) Boathouses

(10) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(11) Laundry areas

(12) Indoor damp and wet locations

(13) Floor outlets

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: A receptacle supplying only a permanently installed premises security system shall be permitted to omit ground-fault circuit-interrupter protection.

Exception No. 3: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of supporting a ceiling luminaire or ceiling-suspended fan shall be permitted to omit ground-fault circuit-interrupter protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Exception No. 4: Factory-installed receptacles that are not readily accessible and are mounted internally to bathroom exhaust fan assemblies shall not require GFCI protection unless required by the installation instructions or listing.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

(B) Other Than Dwelling Units.

All 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, and all receptacles supplied by three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less, installed in the following locations shall be provided with GFCI protection:

(1) Bathrooms

(2) Kitchens

(3) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(4) Buffet serving areas with permanent provisions for food serving, beverage serving, or cooking

(5) Rooftops

(6) Outdoors

(7) Sinks where receptacles or cord-and-plug-connected fixed or stationary appliances are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(8) Indoor damp or wet locations

(9) Locker rooms with associated showering facilities

(10) Garages, accessory buildings, service bays, and similar areas other than vehicle exhibition halls and showrooms

(11) Crawl spaces at or below grade level

(12) Unfinished areas of basements

(13) Aquariums, bait wells, and similar open aquatic vessels or containers, such as tanks or bowls, where receptacles are installed within 1.8 m (6 ft.) from the top inside edge or rim or from the conductive support framing of the vessel or container

(14) Laundry areas

(15) Bathtubs and shower stalls where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(16) <u>Floor outlets</u>

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: Receptacles on rooftops shall not be required to be readily accessible other than from the rooftop.

Exception No. 3: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial establishments where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program in accordance with 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or that has a design not compatible with GFCI protection.

Exception No. 4: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial laboratories where the receptacles are used to supply equipment if removal of power would introduce a greater hazard.

Exception No. 5: Receptacles located in patient bed locations of Category 2 (general care) or Category 1 (critical care) spaces of health care facilities shall be permitted to comply with 517.21.

Exception No. 6: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of serving a ceiling luminaire or ceiling-suspended fan shall be permitted to omit GFCI protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Statement of Problem and Substantiation for Public Input

Floor outlets are located such that liquid spillage may cause a shock hazard to users. Providing GFCI protection can save lives.

Submitter Information Verification

Submitter Full Name:	IEC National
Organization:	IEC
Affiliation:	Jason Scott IES residential
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Aug 14 13:18:20 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: Substantiation hasn't been provided to expand GFCI protection to other areas covered as part of 210.8(A) and 210.8(B). A floor receptacle is not an area location. The substantiation isn't correct that "current wiring methods do not require GFCI protection to floor outlet receptacles". If they are in any of the locations found in (A) and (B) they would be required to be GFCI protected.

Public Input No. 1897-NFPA 70-2023 [Section No. 210.8(B)]

(B) Other Than Dwelling Units.

All 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, and all receptacles supplied by three-phase branch circuits rated 150 volts or less to ground on any one phase , 100 amperes or less, installed in the following locations shall be provided with GFCI protection:

(1) Bathrooms

(2) Kitchens

(3) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(4) Buffet serving areas with permanent provisions for food serving, beverage serving, or cooking

(5) Rooftops

(6) Outdoors

(7) Sinks where receptacles or cord-and-plug-connected fixed or stationary appliances are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(8) Indoor damp or wet locations

(9) Locker rooms with associated showering facilities

(10) Garages, accessory buildings, service bays, and similar areas other than vehicle exhibition halls and showrooms

(11) Crawl spaces at or below grade level

(12) Unfinished areas of basements

(13) Aquariums, bait wells, and similar open aquatic vessels or containers, such as tanks or bowls, where receptacles are installed within 1.8 m (6 ft.) from the top inside edge or rim or from the conductive support framing of the vessel or container

(14) Laundry areas

(15) Bathtubs and shower stalls where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: Receptacles on rooftops shall not be required to be readily accessible other than from the rooftop.

Exception No. 3: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial establishments where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program in accordance with 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or that has a design not compatible with GFCI protection.

Exception No. 4: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial laboratories where the receptacles are used to supply equipment if removal of power would introduce a greater hazard.

Exception No. 5: Receptacles located in patient bed locations of Category 2 (general care) or Category 1 (critical care) spaces of health care facilities shall be permitted to comply with 517.21.

Exception No. 6: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of serving a ceiling luminaire or ceiling-suspended fan shall be permitted to omit GFCI protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Statement of Problem and Substantiation for Public Input

This public input is being submitted on behalf of the Minnesota Department of Labor and Industry. Currently, the Department's inspection staff includes 14-office/field staff, 12-state field inspectors, 2-virtual inspectors and 50 plus contract electrical inspectors that complete over 170,000 electrical inspections annually.

In the 2023 NEC, it could be argued that GFCI is not required when the system voltage on one phase voltage is above 150 volts to ground. This will clarify that GFCI protection is required.

Submitter Information Verification

Submitter Full Name: Dean Hunter

Organization: Minnesota Department of Labor
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 07 13:07:47 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The proposed language does not add clarity and could have unintended consequences. GFCI protection would be required with the existing language for the application stated by the submitter.

Public Input No. 2091-NFPA 70-2023 [Section No. 210.8(B)]

(B) Other Than Dwelling Units.

All 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, and all receptacles supplied by three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less, installed in the following locations shall be provided with GFCI protection:

(1) Bathrooms

(2) Kitchens

(3) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(4) Buffet serving areas with permanent provisions for food serving, beverage serving, or cooking

(5) Rooftops

(6) Outdoors

(7) Sinks where receptacles or cord-and-plug-connected fixed or stationary appliances are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(8) Indoor damp or wet locations

(9) Locker rooms with associated showering facilities

(10) Garages, accessory buildings, service bays, and similar areas other than vehicle exhibition halls and showrooms

(11) Crawl spaces at or below grade level

(12) Unfinished areas of basements

(13) Aquariums, bait wells, and similar open aquatic vessels or containers, such as tanks or bowls, where receptacles are installed within 1.8 m (6 ft.) from the top inside edge or rim or from the conductive support framing of the vessel or container

(14) Laundry areas

(15) Bathtubs and shower stalls where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: Receptacles on rooftops shall not be required to be readily accessible other than from the rooftop.

Exception No. 3: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial establishments where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program in accordance with 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or that has a design not compatible with GFCI protection.

Exception No. 4: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial laboratories where the receptacles are used to supply equipment if removal of power would introduce a greater hazard.

Exception No. 5: Receptacles located in patient bed locations of Category 2 (general care) or Category 1 (critical care) spaces of health care facilities shall be permitted to comply with 517.21.

Exception No. 6: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of serving a ceiling luminaire or ceiling-suspended fan shall be permitted to omit GFCI protection, unless located in a damp or wet location . If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Statement of Problem and Substantiation for Public Input

The exception should apply only to indoor dry areas. If a WSCR is utilized outdoors, or in a wet or damp location then the humidity and condensation inside the receptacle can lead to faults as with any other receptacle in a damp or wet location. As written, the exception for WSCR would apply to receptacles installed in wet or damp location. Proposed language to correct this oversight.

Submitter Information Verification

Submitter Full Name: Josh Wiley
Organization: Jordan Skala Engineers
Street Address:
City:

State:

Zip:

Submittal Date: Fri Aug 11 18:00:35 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: Insufficient substantiation was provided to include the proposed language. This application of a receptacle within a wet or damp location is like the receptacle in an exhaust fan, which has an exception to GFCI.

Public Input No. 2237-NFPA 70-2023 [Section No. 210.8(B)]

(B) Other Than Dwelling Units.

All 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, and all receptacles supplied by three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less, installed in the following locations shall be provided with GFCI protection:

(1) Bathrooms

(2) Kitchens

(3) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(4) Buffet serving areas with permanent provisions for food serving, beverage serving, or cooking

(5) Rooftops

(6) Outdoors

(7) Sinks where receptacles or cord-and-plug-connected fixed or stationary appliances are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(8) Indoor damp or wet locations

(9) Locker rooms with associated showering facilities

(10) Garages, accessory buildings, service bays, and similar areas other than vehicle exhibition halls and showrooms

(11) Crawl spaces at or below grade level

(12) Unfinished areas of basements

(13) Aquariums, bait wells, and similar open aquatic vessels or containers, such as tanks or bowls, where receptacles are installed within 1.8 m (6 ft.) from the top inside edge or rim or from the conductive support framing of the vessel or container

(14) Laundry areas

(15) Bathtubs and shower stalls where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(16) Welder work areas where welders operate hand tools or portable lighting equipment

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: Receptacles on rooftops shall not be required to be readily accessible other than from the rooftop.

Exception No. 3: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial establishments where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program in accordance with 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or that has a design not compatible with GFCI protection.

Exception No. 4: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial laboratories where the receptacles are used to supply equipment if removal of power would introduce a greater hazard.

Exception No. 5: Receptacles located in patient bed locations of Category 2 (general care) or Category 1 (critical care) spaces of health care facilities shall be permitted to comply with 517.21.

Exception No. 6: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of serving a ceiling luminaire or ceiling-suspended fan shall be permitted to omit GFCI protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Statement of Problem and Substantiation for Public Input

Relocating 630.8 to 210.8(B)(16) because the GFCI requirement is not within the scope of Article 630. Also submitting a public input to remove from 630.8. Placing 'welder work areas' in 210.8(B)(16) will enhance usability for Code users since this is a requirement to provide GFCI protection for the receptacles not the welding machines.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc

Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 15 12:54:34 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The proposed language is vague. It would be difficult to define what a welder work area is. Portable lighting equipment could be anywhere. Article 630 has the requirement in 630.8 requiring GFCI protection and is clear and enforceable.

Public Input No. 3158-NFPA 70-2023 [Section No. 210.8(B)]

(B) Other Than Dwelling Units.

All 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, and all receptacles supplied by three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less, installed in the following locations shall be provided with GFCI protection:

(1) Bathrooms

(2) Kitchens

(3) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(4) Buffet serving areas with permanent provisions for food serving, beverage serving, or cooking

(5) Rooftops

(6) Outdoors

(7) Sinks where receptacles or cord-and-plug-connected fixed or stationary appliances are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(8) Indoor damp or wet locations

(9) Locker rooms with associated showering facilities

(10) Garages, accessory buildings, service bays, and similar areas other than vehicle exhibition halls and showrooms

(11) Crawl spaces at or below grade level

(12) Unfinished areas of basements

(13) Aquariums, bait wells, and similar open aquatic vessels or containers, such as tanks or bowls, where receptacles are installed within 1.8 m (6 ft.) from the top inside edge or rim or from the conductive support framing of the vessel or container

(14) Laundry areas

(15) Bathtubs and shower stalls where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: Receptacles on rooftops shall not be required to be readily accessible other than from the rooftop.

Exception No. 3: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial establishments where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program in accordance with 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or that has a design not compatible with GFCI protection.

Exception No. 4: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial laboratories where the receptacles are used to supply equipment if removal of power would introduce a greater hazard.

Exception No. 5: Receptacles located in patient bed locations of Category 2 (general care) or Category 1 (critical care) spaces of health care facilities shall be permitted to comply with 517.21.

Exception No. 6: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of serving a ceiling luminaire or ceiling-suspended fan shall be permitted to omit GFCI protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

<u>*Exception No. 7 Hardwired or cord and plug connected control equipment in commercial kitchens where function is essential for life safety.*</u>

Additional Proposed Changes

File Name	Description	Approved
How-to-Design-an-Efficient-and-Functional-Commercial-Kitchen.png	Captive Aire Hood system	

Statement of Problem and Substantiation for Public Input

It came to my attention while installing a Captive Aire hood system in a commercial kitchen that the NEC would require the circuit to be class A protected. The breaker would not hold on this equipment I reached out to the manufacturer and they instructed me to remove the GFCI device.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1346-NFPA 70-2023 [Section No. 210.8 [Excluding any Sub-Sections]]	Equipment that is not compatible with Class A protection
Public Input No. 1346-NFPA 70-2023 [Section No. 210.8 [Excluding any Sub-Sections]]	

Submitter Information Verification

Submitter Full Name: William Snyder
Organization: RCC Solutions
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 19:35:39 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Hardwired control equipment would not be addressed in 210.8(B) as this section is for receptacles located in areas identified. If the appliance is cord and plug connected and located in these areas identified in 210.8(B), GFCI protection must be provided. Insufficient substantiation was provided to reduce the current level of protection afforded by 210.8(B).

Public Input No. 9-NFPA 70-2023 [Section No. 210.8(B)]

(B) Other Than Dwelling Units.

All 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, and all receptacles supplied by three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less, installed in the following locations shall be provided with GFCI protection:

(1) Bathrooms

(2) Kitchens

(3) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(4) Buffet serving areas with permanent provisions for food serving, beverage serving, or cooking

(5) Rooftops

(6) Outdoors

(7) Sinks where receptacles or cord-and-plug-connected fixed or stationary appliances are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(8) Indoor damp or wet locations

(9) Locker rooms with associated showering facilities

(10) Garages, accessory buildings, service bays, and similar areas other than vehicle exhibition halls and showrooms

(11) Crawl spaces at or below grade level

(12) Unfinished areas of basements

(13) Aquariums, bait wells, and similar open aquatic vessels or containers, such as tanks or bowls, where receptacles are installed within 1.8 m (6 ft.) from the top inside edge or rim or from the conductive support framing of the vessel or container

(14) Laundry areas

(15) Bathtubs and shower stalls where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

Exception No. 1: Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2: Receptacles on rooftops shall not be required to be readily accessible other than from the rooftop.~~Exception No~~

. ~~- 3: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial establishments where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program in accordance with 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or that has a design not compatible with GFCI protection.~~

Exception No. 4: Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial laboratories where the receptacles are used to supply equipment if removal of power would introduce a greater hazard.

Exception No. 5: Receptacles located in patient bed locations of Category 2 (general care) or Category 1 (critical care) spaces of health care facilities shall be permitted to comply with 517.21.

Exception No. 6: Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of serving a ceiling luminaire or ceiling-suspended fan shall be permitted to omit GFCI protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

Statement of Problem and Substantiation for Public Input

This exception allows a user to unilaterally decide not to provide GFCI protection is they decide it will create a "greater hazard". No criteria is required for this decision. I challenge the committee to come up with a dozen examples of where the risk of a power drop would create a greater hazard then potential electrocution. I then ask that what competent organization would not require the equipment to be hard wired and not plugged in instead. The risk of the equipment being unplugged accidently would mitigate against this method of powering if a "greater hazard" could occur. Hence, I content that this exception is improperly used in many scenarios to justify avoiding meeting the code requirements. I have seen this used improperly in many laboratories and pilot plant areas and suspect it occurs elsewhere. Most code officials are not in a position to credibly argue that a "greater hazard" is not created. I strongly encourage the committee to remove this exception as it creates a significant and inadvertent loophole.

Submitter Information Verification

Submitter Full Name: Richard Palluzi
Organization: Richard Palluzi LLC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 07:09:47 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7912-NFPA 70-2024

Statement: Exception No. 3 has been replaced with language from the 2020 Edition of the NEC which was deleted during the NEC 2023 Code cycle. This change brings back the exception for industrial establishments for outdoor receptacle outlets and removes the previous exception for receptacles and equipment within 6 ft. of sinks. The assured equipment grounding conductor program that was previously optional has been modified to be required for that equipment supplied by receptacle outlets that would create a greater hazard if power is interrupted or is of a design that is not compatible with GFCI protection for an additional consideration should GFCI protection not be provided.

Public Input No. 3237-NFPA 70-2023 [Section No. 210.8(C)]

(C) Crawl Space Lighting Outlets.

GFCI protection shall be provided for lighting outlets not exceeding 120 volts installed in crawl spaces <u>at or below grade</u> .

Statement of Problem and Substantiation for Public Input

Similar to the requirements written in 210.8(A) and (B) for receptacles, the additional language would clarify that the crawl space luminaire is only required to be GFCI protected when the space is at or below grade. Without a definition in Article 100, the language is difficult to enforce because installers and inspectors have different ideas of where a crawl space could be located which could be either above ground in an attic area or below a building.

Submitter Information Verification

Submitter Full Name: Dean Hunter
Organization: Minnesota Department of Labor
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 30 16:04:31 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Adding “at or below grade” was not accepted as the proximity to grade does not remove the electrical shock hazard that GFCI is meant to address.

Public Input No. 92-NFPA 70-2023 [Section No. 210.8(C)]

(C) Crawl Space Lighting Outlets.

GFCI protection shall be provided for lighting outlets not exceeding ~~120 volts~~ 120-volts nominal installed in crawl spaces.

Statement of Problem and Substantiation for Public Input

Presently this Section does not specify whether the “120 volts” is the “nominal voltage” or “circuit voltage”, but 110.4 says the voltage considered shall be that at which the CIRCUIT operates, does this literally mean GFCI protection is NOT required for lighting outlets operating at 121V, 122V, or 125V? Yes, apparently it does if “nominal voltage” is not specified here.
I certainly don’t think that is the intent of these requirements. This revision is needed to clarify that “120-volt” is referring to the nominal voltage rather than the circuit operating voltage.
There are several other sections in the Code where this language needs clarification too. I will be submitting PI for those sections and as many other sections as I can where this conundrum seems to exists.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 16-NFPA 70-2023 [Sections 210.12(B), 210.12(C), 210.12(D)]	“nominal voltage” versus “voltage of a circuit”
Public Input No. 23-NFPA 70-2023 [Sections 210.11(C)(3), 210.11(C)(4)]	“nominal voltage” versus “voltage of a circuit”

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 11 09:32:31 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7724-NFPA 70-2024
Statement: Adding the word “nominal” for 120 volts nominal is accepted and consistent with the use of the term in other areas of Article 210.

Public Input No. 195-NFPA 70-2023 [Section No. 210.8(D)]

(D) Specific Appliances.

GFCI protection shall be provided for the ~~branch circuit or~~ outlet supplying the following appliances rated 150 volts or less to ground and 60 amperes or less, single- or 3-phase:

(1) Automotive vacuum machines

(2) Drinking water coolers and bottle fill stations

(3) High-pressure spray washing machines

(4) Tire inflation machines

(5) Vending machines

(6) Sump pumps

(7) Dishwashers

(8) Electric ranges

(9) Wall-mounted ovens

(10) Counter-mounted cooking units

(11) Clothes dryers

(12) Microwave ovens

Statement of Problem and Substantiation for Public Input

There is no reason to specify branch circuit or outlet as the point of protection. Any GFCI on the line side of the outlet will provide the required protection. The current language would prohibit the use of GFCI deice on the line side of the branch circuit OCPD as permitted by 215.9. There is no reason for this section to prohibit the use of upstream GFCI protection.

Submitter Information Verification

Submitter Full Name: Don Ganiere
Organization: none
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jan 19 12:51:44 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: Removing the words “branch circuit or” does not add clarity. The existing language ensures that a circuit breaker or wiring device type GFCI can be used.

Public Input No. 2092-NFPA 70-2023 [Section No. 210.8(D)]

(D) Specific Appliances.

GFCI protection shall be provided for the branch circuit or outlet supplying the following appliances rated ~~150 volts~~ 250 volts or less to ground and ~~60~~ 50 amperes or less, single-phase, or 100 amperes or less 3-phase:

(1) Automotive vacuum machines

(2) Drinking water coolers and bottle fill stations

(3) High-pressure spray washing machines

(4) Tire inflation machines

(5) Vending machines

(6) Sump or dewatering pumps (except in elevator pits)

(7) Dishwashers

(8) ~~Electric ranges~~

(9) ~~Wall-mounted ovens~~

(10) ~~Counter-mounted cooking units~~

(11) ~~Clothes dryers~~

(12) ~~Microwave ovens~~

(13) Gas or Electric cooking equipment

(14) Laundry equipment including washers, dryers, ironers, & steamers

Statement of Problem and Substantiation for Public Input

1) Harmonize requirement for GFCI for branch circuits 50a or less 1Φ or 100a or less 3Φ between 210.8 (A), (B), & (C). Currently (C) requires 60A branch circuits while (A) & (B) only require GFCI to 50A 1Φ, and has no increased ampacity requirement for 3Φ that is noted in (B). Please not that an informational note pointing to SPGFCI should also be added.
2) Harmonize requirement for GFCI on branch circuits 250V or less between 210.8 (A), (B), & (C). Currently if an appliance is hardwired, then GFCI is not required, but it is required if is cord & plug. The hazard is present with laundry & cooking equipment whether it is hardwired or cord & plug connected.
3) ASME A17.1 (Elevator code) prevents elevator sump pumps from having GFCI on fire service elevators. The sump pump is legally required equipment, and in the event of a fire needs to be running to prevent water from sprinklers from building up in the elevator pit.
4) Sump pumps & dewatering pumps are similar in function but very different in use. Sump pumps are for occasional use, while dewatering pumps are for continuous use.
5) The same hazard that is present in an electric range in a commercial kitchen is present for all other cooking equipment. By using narrow language, only that specific piece of equipment requires GFCI, while the multitude of other hardwired cooking appliances sitting next to the electric range do not require GFCI. E.G. grills, griddles, fryers, ovens, induction cookers, broilers, woks, chef's stations, steam cookers, combi-oven, toasters, etc. Proposed language streamlines the requirement, resolves ambiguity in equipment, and makes the requirement easier to enforce.
6) 210.52 (A) (10) recognizes the hazard in laundry areas for cord & plug appliances. Previous edition only required commercial dryers to be GFCI but not the washers, extractors, tumblers, ironers, steamers, and other similar equipment used for laundering clothes. Proposed language streamlines the requirement to include all laundry equipment.

Submitter Information Verification

Submitter Full Name: Josh Wiley
Organization: Jordan Skala Engineers
Street Address:
City:
State:
Zip:
Submittal Date: Fri Aug 11 18:02:22 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7736-NFPA 70-2024

Statement: This first level subdivision is modified to align with the existing requirements found in 210.8(B) for three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less. Appliances in three-phase applications are in use that are beyond the 60 A value currently stated and GFCI devices are commercially available at this amperage rating.

The following items from public input 2092 were not accepted:

1) The voltage was not changed from 150 volts or less to ground as the existing language is adequate and clear.

2) The branch-circuit rating was not moved from 60 Amperes to 50 Amperes as substantiation was not provided to reduce the level of protection currently afforded by 210.8(D).

3) Adding dewatering pumps was not accepted as this is not a defined term and could cause confusion.

4) An exception for elevator pits is not accepted as the GFCI protection requirements can be found in Article 620 as part of 620.6.

5) Removing list items (8) through (12) was also not accepted as substantiation was not provided to reduce the current level of protection afforded by these requirements. Substantiation was provided as part of SR 7596 during the 2023 Code cycle when these items were added. The panel statement noted that the CPSC database demonstrated 104 electrocutions from 2011-2020, of which 81 percent were working on an appliance or other type of appliance or equipment.

Public Input No. 2227-NFPA 70-2023 [Section No. 210.8(D)]

(D) Specific Appliances.

GFCI protection shall be provided for the branch circuit or outlet supplying the following appliances rated 150 volts or less to ground and 60 amperes or less, single- or 3-phase:

(1) Automotive vacuum machines

(2) Drinking water coolers and bottle fill stations

(3) High-pressure spray washing machines

(4) Tire inflation machines

(5) Vending machines

(6) Sump pumps

(7) Dishwashers

(8) Electric ranges

(9) Wall-mounted ovens

(10) Counter-mounted cooking units

(11) Clothes dryers

(12) Microwave ovens

<u>When appliances are replaced on an existing branch-circuit or outlet where GFCI protection is required, the replacement appliances must be GFCI protected.</u>

Statement of Problem and Substantiation for Public Input

The added text matches other GFCI requirements like 406.4(D) for receptacle replacements or 680.21(D) for pool motor replacements and increases safety against shock hazards in the list item appliances when they are to be replaced.

Submitter Information Verification

Submitter Full Name:	Mike Holt
Organization:	Mike Holt Enterprises Inc
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Tue Aug 15 12:20:32 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The suggested language would be difficult to enforce with appliances like microwaves and similar which are often store - bought and installed by the occupant and not subject to inspection by the AHJ. Permits are typically not required to install such appliances, hence enforcement would be very difficult.

Public Input No. 2549-NFPA 70-2023 [Section No. 210.8(D)]

(D) Specific Appliances.

GFCI protection shall be provided for the branch circuit or outlet supplying the following appliances rated 150 volts or less to ground and 60 amperes or less, single- or 3-phase:

(1) Automotive vacuum machines

(2) Drinking water coolers and bottle fill stations

(3) High-pressure spray washing machines

(4) Tire inflation machines

(5) Vending machines

(6) Sump pumps

(7) Dishwashers

(8) Electric ranges

(9) Wall-mounted ovens

(10) Counter-mounted cooking units

(11) Clothes dryers

(12) Microwave ovens

(13) Disposals

Additional Proposed Changes

File Name	Description	Approved
.1692576170888		

Statement of Problem and Substantiation for Public Input

210.8 (A) and (B) address certain appliances, garbage disposals if they are plug-in type. 210.8(D) addresses appliances that are hard wired or plug-in types wherever they maybe. The only appliance that I see as electricians or inspector that is not on this list is Garbage Disposals. I do not have any tests or substantiation for the need. Logic tells me that with the hands in the water that has an electric appliance, the electric appliance requires GFCI protection. As the electrical inspector for a hotel with restaurants, I enforced the 60 amp 3 phase dishwasher GFCI protection but the commercial garbage disposal is left unprotected.

Submitter Information Verification

Submitter Full Name: Roger Chick
Organization: Electrical Training
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 20 19:56:16 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Many cord- and- plug-connected garbage disposals are GFCI protected by the existing language found in 210.8. Therefore, the proposed change would only impact hard -wired garbage disposals. Insufficient substantiation was provided to include hard-wired garbage disposals in the list.

Public Input No. 29-NFPA 70-2023 [Section No. 210.8(D)]

(D) Specific Appliances.

~~GFCI protection shall be provided for the branch circuit or outlet supplying the following appliances~~ For branch circuits rated 150 volts or less to ground and 60 amperes or less, single- or 3-phase~~:~~ , GFCI protection shall be provided for the branch circuit or outlet supplying the following appliances.

(1) Automotive vacuum machines

(2) Drinking water coolers and bottle fill stations

(3) High-pressure spray washing machines

(4) Tire inflation machines

(5) Vending machines

(6) Sump pumps

(7) Dishwashers

(8) Electric ranges

(9) Wall-mounted ovens

(10) Counter-mounted cooking units

(11) Clothes dryers

(12) Microwave ovens

Statement of Problem and Substantiation for Public Input

This revision is needed to clarify that the branch circuit voltage matters! With the present wording the branch circuit voltage is completely irrelevant as it is never mentioned in this rule. Presently only the rating of the appliance matters. A 208V or 250V rated appliance installed on a branch circuit operating at 120V to ground is presently excluded based on the literal wording since the branch circuit operating voltage is not part of this requirement. I don't believe that the intent is to exclude this equipment.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 98-NFPA 70-2023 [Section No. 422.5(A)]	

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 11:28:33 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: The suggested language does not add clarity. The existing language ensures protection and is sufficient

Public Input No. 4477-NFPA 70-2023 [Section No. 210.8(D)]

(D) Specific Appliances.

GFCI protection shall be provided for the branch circuit or outlet supplying the following appliances rated 150 volts or less to ground and 60 amperes or less ~~,~~ single-phase, or 100 amperes or less 3-phase:

(1) Automotive vacuum machines

(2) Drinking water coolers and bottle fill stations

(3) High-pressure spray washing machines

(4) Tire inflation machines

(5) Vending machines

(6) Sump pumps

(7) Dishwashers

(8) Electric ranges

(9) Wall-mounted ovens

(10) Counter-mounted cooking units

(11) Clothes dryers

(12) Microwave ovens

Statement of Problem and Substantiation for Public Input

Appliances are now in use that are beyond the 60 A value currently stated. GFCI devices are commercially available at this amperage rating, and moving the three-phase limit to 100 A correlates to the existing 210.8(B) requirement.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4486-NFPA 70-2023 [Section No. 422.5(A)]	
Public Input No. 4486-NFPA 70-2023 [Section No. 422.5(A)]	

Submitter Information Verification

Submitter Full Name: Mark Pollock
Organization: Littelfuse
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 16:11:02 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7736-NFPA 70-2024

Statement: This first level subdivision is modified to align with the existing requirements found in 210.8(B) for three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less. Appliances in three-phase applications are in use that are beyond the 60 A value currently stated and GFCI devices are commercially available at this amperage rating.

The following items from public input 2092 were not accepted:

1) The voltage was not changed from 150 volts or less to ground as the existing language is adequate and clear.

2) The branch-circuit rating was not moved from 60 Amperes to 50 Amperes as substantiation was not provided to reduce the level of protection currently afforded by 210.8(D).

3) Adding dewatering pumps was not accepted as this is not a defined term and could cause confusion.

4) An exception for elevator pits is not accepted as the GFCI protection requirements can be found in Article 620 as part of 620.6.

5) Removing list items (8) through (12) was also not accepted as substantiation was not provided to reduce the current level of protection afforded by these requirements. Substantiation was provided as part of SR 7596 during the 2023 Code cycle when these items were added. The panel statement noted that the CPSC database demonstrated 104 electrocutions from 2011-2020, of which 81 percent were working on an appliance or other type of appliance or equipment.

Public Input No. 82-NFPA 70-2023 [Section No. 210.8(D)]

(D) Specific Appliances.

GFCI protection shall be provided for the branch circuit or outlet supplying the following appliances rated 150 volts or less to ground and 60 amperes or less, single- or 3-phase:

(1) Automotive vacuum machines

(2) Drinking water coolers and bottle fill stations

(3) High-pressure spray washing machines

(4) Tire inflation machines

(5) Vending machines

(6) Sump pumps

(7) Dishwashers

(8) ~~Electric ranges~~

(9) ~~Wall-mounted ovens~~

(10) ~~Counter-mounted cooking units~~

(11) ~~Clothes dryers~~

(12) ~~Microwave ovens~~

Statement of Problem and Substantiation for Public Input

Greetings CMP 2 -

Maybe I missed it during the 2023 NEC Development Cycle where sustantiation was given, lives lost, hazrards presented in all the appliances added to 210.8(D) . All I remember seeing were device manufacturers stating how their devices save lives, which I am not debating but nothing was presented to justify expanding the GFCI requirements for Electric ranges, Wall-mounted ovens, Counter-mounted cooking units, Clothes dryers, and Microwave ovens.

I thought this body was to accept technically substantiated information only. Did the bait of "GFCI's Work" get put on the end of that trot line and cast out to all that are interested in the benefits of requiring more expenisve devices on appliances that are typically fixed in place or large enough to be stationary and do not present the same issue as cord and plug appliances?

Yes, it is another submission that will be labeled unsubtantiated but heck.....I had the same shot as the manufactures did when they convinced you that ALL these appliances need GFCI protection now. Show me the bodies......present the factual data as none was presented on these additions to the 2023 National Electrical Code, only the passionate testimony of those who serve to gain from the expansion.

Submitter Information Verification

Submitter Full Name: Paul Abernathy
Organization: Fast Trax System | Electrical Code Academy, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jan 09 16:16:26 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: Substantiation was provided as part of Second Revision No. 7596 during the 2023 Code cycle when these items were added. The panel statement noted that the CPSC database demonstrated 104 electrocutions from 2011-2020, of which 81 percent were working on an appliance or other type of appliance or equipment.

Public Input No. 90-NFPA 70-2023 [Section No. 210.8(D)]

(D) Specific Appliances.

GFCI protection shall be provided for the branch circuit or outlet supplying the following appliances rated 150 volts or less to ground and 60 amperes or less, single- or 3-phase:

(1) Automotive vacuum machines

(2) Drinking water coolers and bottle fill stations

(3) High-pressure spray washing machines

(4) Tire inflation machines

(5) Vending machines

(6) Sump pumps

(7) Dishwashers

(8) Electric ranges

(9) Wall-mounted ovens

(10) Counter-mounted cooking units

(11) Clothes dryers

(12) Microwave ovens

Exception : GFCI protection shall not be required for appliances having ratings below the low-voltage contact limit

Additional Proposed Changes

File Name	Description	Approved
A1381A95-E874-4423-A980-FAC3B1CC6B4D.jpeg	12 volt sump pump	

Statement of Problem and Substantiation for Public Input

This exception is needed to allow low-voltage appliances to be installed without GFCI protection. Provisions similar to this exist throughout Article 680 allowing low-voltage swimming pool equipment to be installed without GFCI protection. I don’t think low-voltage appliances are any more of a shock hazard than a low-voltage pool pump motor or low-voltage underwater swimming pool light. The pool pump and swimming pool light can be installed without GFCI protection per Article 680. Presently a 12-volt sump pump needs GFCI protection. This proposed exception provides needed relief for low-voltage appliances.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 91-NFPA 70-2023 [Section No. 422.5(A)]	

Submitter Information Verification

Submitter Full Name: Russ Leblanc

Organization: Leblanc Consulting Services

Street Address:

City:

State:

Zip:

Submittal Date: Wed Jan 11 08:41:23 EST 2023

Committee: NEC-P02

Committee Statement

Resolution: It is not necessary to provide an exception for appliances that would operate below the low-voltage contact limit. If these appliances are cord -and -plug -connected, they would be required to have conversion equipment, hence the receptacle would still be at 120 Volts or other voltage where GFCI is required and should not be removed. Examples of hard -wired appliances that operate below the low-voltage contact limit would be helpful to understand the application better. Just because the appliance is low -voltage, doesn’t mean we should not provide protection for the outlet.


THE BASEMENT WATCHDOG®
Special +
Heavy Duty
Sump Pump
12 VDC
• Submersible motor
• Not fit for use in oil, corrosive or flammable liquids
Part No. 1011002
Distributed by Glentronics, Inc., Lincolnshire, IL 60069

Public Input No. 3889-NFPA 70-2023 [New Section after 210.8(F)]

(G) Metal Framing

GFCI protection shall be provided for branch circuits consisting of non-metallic sheathed cables routed through and/or parallel to metal framing members.

Exception: GFCI protection shall not be required to protect those portions of the branch circuit installed in rigid metal conduit, intermediate metal conduit, rigid non - metallic conduit, or electrical metallic tubing. ,

Statement of Problem and Substantiation for Public Input

Metal framing is much different than standard wood studs and provides more of an opportunity for non-metallic conductors to be damaged during installation. NM Cable is not allowed in areas subject to damage and with the metal framing itself having sharp edges and the screws used for the framing itself as well as the drywall i could argue that NM cable is subject to physical damage in metal framing applications. Damaged conductors that are routed through metal framing members can lead to death through electrocution because the whole frame and any metal touching it can become energized– this occurred in a new home where a man was electrocuted due to a damaged conductor. An appliance delivery person was electrocuted while installing a dryer, even though the electricity to the room where the dryer was to be installed was turned off. In the case of metal framing members, damage to a conductor could result in energizing the metal framing members and can cause a person to be electrocuted. When the delivery person in this instance installed the dryer appliance, his effort to push the dryer vent through a wall that was energized due to a damaged conductor, lead to his death.

See video at this URL: mfile.akamai.com/12909/wmv/vod.ibsys.com/2006/0221/7301329.200k.asx

This proposal provides the protection necessary to help mitigate instances like that which happened to the gentleman who was killed in this case.

Submitter Information Verification

Submitter Full Name: Raymond Horner
Organization: Atkore
Affiliation: Atkore
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 06 09:13:56 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Section 300.4(B), which covers NM cables passing through metal framing, requires listed bushings or grommets covering all metal edges, that are securely fastened in the openings. Additional substantiation in the form of statistics or other data to support expansion of GFCI protection in these applications would be helpful.

Public Input No. 1501-NFPA 70-2023 [Section No. 210.8(F)]

~~(F) Outdoor Outlets.~~

~~For dwellings, all outdoor outlets, other than those covered in 210.8(A) , Exception No. 1, including outlets installed in the following locations, and supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, shall be provided with GFCI protection:~~

(1) ~~Garages that have floors located at or below grade level~~

(2) ~~Accessory buildings~~

(3) ~~Boathouses~~

~~If equipment supplied by an outlet covered under the requirements of this section is replaced, the outlet shall be supplied with GFCI protection.~~

~~*Exception No. 1: GFCI protection shall not be required on lighting outlets other than those covered in 210.8(C) .*~~

~~*Exception No. 2: GFCI protection shall not be required for listed HVAC equipment. This exception shall expire September 1, 2026.*~~

Additional Proposed Changes

File Name	Description	Approved
296965463_6010771205605933_8564377372213825961_n.jpg	210.8(F) enhanced content of NFPA link	
320019777_2046653762198065_3545953819685187176_n.jpg	Local amendment	
359429486_644239564281884_3973899024483115720_n.jpg	Most likely code	

Statement of Problem and Substantiation for Public Input

The standards council's assertion of lacking technical merit from CMP-2 appears to be unsubstantiated as there is no indication of an appliance outlet location in the documentation. Moreover, there seems to be a glaring double standard concerning safety, given that hardwired utilization equipment has been compliant with the electrical code for several decades without any safety concerns. Thus, the reference provided holds no significance in terms of electrical safety. Furthermore for the first time in the NEC Class A protection was required at the outlet no substantiation was provided by CMP-2 for the location that is a hazard to personnel. The justification for this change was based on a tragic death of a child from an installation with no equipment grounding conductor, so if we were to use this logic hardwired utilization equipment could be installed without an equipment grounding conductor as long as class A protection was provided.

Submitter Information Verification

Submitter Full Name: William Snyder
Organization: RCC Solutions
Affiliation: High Voltage Live Podcast
Street Address:
City:
State:
Zip:

Submittal Date: Fri Jul 21 20:34:16 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Existing requirements were substantiated with unfortunate examples of death due to electrocution on outdoor equipment when 210.8(F) was added during the 2020 Code cycle. 210.8(F) complements the existing requirements for outdoor receptacles which have been required to be GFCI protected for many years. The addition of 210.8(F) recognized the fact that the electrical shock hazard does not disappear when the equipment is hard-wired instead of being cord-and-plug connected.

78% 8:28 AM

11:29 5GE

link.nfpa.org/publications/7

ENHANCED CONTENT

Outdoor receptacle outlet requirements for dwelling units are covered in **210.8(A)**(3). This requirement covers other outdoor outlets, such as an appliance outlet for the connection of air-conditioning equipment.

Ryan Jackson

OCT 7, 2021

***EL-20-04-21**[8]

210.8 (E) Equipment Requiring Servicing. *Delete without substitution. Showing line ~~thru~~ as removed language.*

> ~~210.8 (E) Equipment Requiring Servicing. GFCI protection shall be provided for the receptacles required by 210.63.~~

***EL-20-05-21**[9]

210.8(F) Outdoor Outlets. *Delete without substitution. Showing line ~~thru~~ as removed language.*

> ~~210.8(F) Outdoor Outlets. All outdoor outlets for dwellings, other than those covered in 210.8(A)(3), Exception to (3), that are supplied by single-phase branch circuits rated 150 volts to ground or less, 50 amperes or less, shall have ground-fault circuit interrupter protection for personnel.~~

210.8(F) GFCI Prot

Overview of a Life

What is the change?

The 2020 edition of the NEC® now requ
change would most likely require the s
[redacted]

Why is the code changing?

"On August 3, 2007, 12-year-old Vontr
landed on the AC condenser unit. Howe
ground fault which caused the unit's ou
electrified, so Vontrell was fatally elect
into contact with both the condenser a

The child was survived by his parent
2016 Annual JVR Magazine (jury

Often, the NEC® language is updated w
death is brought forward highlighting a
installation. This installation of this air
required to be GFCI protected. With th
require this air conditioner to be GFCI

Public Input No. 157-NFPA 70-2023 [Section No. 210.8(F)]

(F) Outdoor Outlets.

For dwellings, all outdoor outlets, other than those covered in 210.8(A), Exception No. 1, including outdoor outlets installed ~~in~~ at the following locations, and supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, shall be provided with GFCI protection:

(1) Garages that have floors located at or below grade level

(2) Accessory buildings

(3) Boathouses

If equipment supplied by an outlet covered under the requirements of this section is replaced, the outlet shall be supplied with GFCI protection.

Exception No. 1: GFCI protection shall not be required on lighting outlets other than those covered in 210.8(C).

Exception No. 2: GFCI protection shall not be required for listed HVAC equipment. This exception shall expire September 1, 2026.

Statement of Problem and Substantiation for Public Input

The existing language can be read as requiring outlets installed in garages, accessory buildings and boathouses to have GFCI protection. The substantiation and panel statement for PI 1964, in FR 8896 for the 2023 code indicates that this change was only intended to require protection for outdoor outlets. The proposed wording change will make it clear that only outdoor outlets require GFCI protection. The rule in 210.8(A) will continue to require GFCI protection for receptacle outlets installed in these locations.

Submitter Information Verification

Submitter Full Name: Don Ganiere

Organization: none

Affiliation: none

Street Address:

City:

State:

Zip:

Submittal Date: Sat Jan 14 12:26:59 EST 2023

Committee: NEC-P02

Committee Statement

Resolution: FR-7748-NFPA 70-2024

Statement: The language found in the parent text of 210.8(F) was modified to identify that the outlets are outdoor outlets which aligns with the title of 210.8(F) and that the outlets are installed at and not in the locations listed. In addition, (Reference Public Input No. 264), the language “shall be provided with GFCI protection” was modified to add clarity stating that these outlets “shall be GFCI protected”. The existing language could be read as requiring outlets installed in garages, accessory buildings and boathouses to have GFCI protection. This change will make it clear that only outdoor outlets require GFCI protection. Note that the rule in 210.8(A) will continue to require GFCI protection for receptacle outlets installed in these locations.

Public Input No. 1582-NFPA 70-2023 [Section No. 210.8(F)]

(F) Outdoor Outlets.

For dwellings, all outdoor outlets, other than those covered in 210.8(A), Exception No. 1, including outlets installed in the following locations, and supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, shall be provided with GFCI protection:

(1) Garages that have floors located at or below grade level

(2) Accessory buildings

(3) Boathouses

If equipment supplied by an outlet covered under the requirements of this section is replaced, the outlet shall be supplied with GFCI protection.

Exception No. 1: GFCI protection shall not be required on lighting outlets other than those covered in 210.8(C).

Exception No. 2: GFCI protection shall not be required for listed HVAC equipment. This exception shall expire September 1, 2026.

Additional Proposed Changes

File Name	Description	Approved
TIA_1653_70_20_19.pdf	NEC TIA 20-19 Log 1653	
TIA_1654_70_23_3.pdf	NEC TIA 23-3 Log 1654	

Statement of Problem and Substantiation for Public Input

NOTE: This public input originates from Tentative Interim Amendment No. 20-19 (Log 1653) and Tentative Amendment No. 23-3 (Log 1654) both issued by the Standards Council on August 12, 2022 and per the NFPA Regs., needs to be reconsidered by the Code-Making Panel for the next edition of the Document.

Substantiation: When the Standards Council issued TIA 1593, the Council acknowledged "the concerted and sustained effort by numerous stakeholders to find a mutually agreeable solution to the technical issues at hand." The Council directed that a Task Group of affected stakeholders be formed to evaluate and reach an informed, technically substantiated resolution to the issues raised. The Council further encouraged the Task Group to submit a TIA for processing to the current edition and in parallel to the work being done within the next edition of the NEC, if appropriate. This TIA is in response to the direction given to the Task Group. The Task Group consisted of representatives from home builder organizations, contractors, HVAC manufacturers, GFCI manufacturers, CMP2, electrical inspectors, CPSC, and testing laboratories.

Based upon the information submitted to and reviewed by the Task Group, the proposed TIA extends the date when the requirement for GFCI protection will be required and expands the application of the exemption for GFCI protection to all listed HVAC equipment. If GFCI protection is required while the incompatibility issue remains, there is a higher risk of people being adversely impacted by exposure to extreme temperatures due to nuisance tripping than the risk of people being exposed to a leakage current that could cause injury or harm. The issue of GFCI protection not being compatible with listed HVAC equipment was known at the time SR 7676-NFPA 70-2018 was approved by CMP-2. Three of the four negative ballots specifically mentioned the concern with incompatibility associated with requiring GFCI protection for listed HVAC equipment.

The potential issue of GFCI protection not being compatible with listed HVAC equipment was known at the time SR 7676-NFPA 70-2018 was approved by CMP-2. Three of the four negative ballots specifically mentioned the concern with incompatibility associated with requiring GFCI protection for listed HVAC equipment. UL 943 (Standard for Ground-Fault Circuit-Interrupters) requires that Class A ground-fault circuit-interrupters are capable of tripping at a minimum of 6 mA and could be as low as 4 mA. UL 60335-2 (Standard for Household and Similar Electrical Appliances – Safety – Part 2-40: Particular Requirements for Electrical Heat Pumps, Air Conditioners and Dehumidifiers) allows a maximum leakage current value of 10 mA for appliances accessible to the general public.

Data was submitted to the Task Group showing that listed HVAC equipment typically can have a leakage current higher than what would trip a Class A GFCI, but the touch current is well below levels that would injure or harm an individual. The number of potential deaths from electrocution involving HVAC equipment may be as high as four per year. However, the number of fatalities (no cooling during a heat wave period) due to nuisance trips associated with GFCI protection of HVAC equipment where no hazard exists may be as high as 750 per year.

Table 1: Loss of HVAC Operation – Potential Impact (From Reference 3 below)

With respect to the extension of the date, the Task Group understands that there may not be a resolution to the incompatibility associated with listed Class A GFCIs and the leakage current permitted for listed HVAC equipment. However, the Task Group has included the date so that the exemption is not continued for an undefined period of time and to encourage the affected parties to continue to work together to resolve the incompatibility issue. The Task Group acknowledges that the date may need to be re-evaluated in the future if the incompatibility issues are not resolved.

AHRI has developed a testing program to identify the cause of interoperability issues. The study is scheduled to be completed by November 2023. The causes need to be defined before solutions can be proposed and tested. Product design and testing must follow. Industry standard revisions and related standardized test procedures are needed. Production tooling and supply chain modifications require additional time after the earlier steps are completed.

With respect to the expansion to all listed HVAC equipment, industry standards for power conversion equipment allow leakage currents above the trip current of Class A GFCI's. Residential air-conditioning (AC) and heat pump (HP) power conversion equipment for compressors have demonstrated leakage currents above Class A GFCI trip currents in lab measurements. Residential AC and HP electronically commutated outdoor fan motors have demonstrated leakage currents above the trip current of Class A GFCI's in lab measurements. Data was submitted based upon actual nuisance trips and a survey of air-conditioning contractors indicating that nuisance trips also occur with single-stage units. (Also see Source 3 listed below)

Figure 1: Texas Air Conditioning Contractor Association (TACCA) Survey (From Reference 5 below)

There are multiple reports of interoperability issues ('nuisance tripping') from AC and HP units that do not have power conversion equipment for the unit compressor which is the only current TIA exception. The cause(s) of this nuisance tripping remain unknown at this time. Furthermore, the presence of electronically commutated motors (ECM) is not currently documented on AC and HP nameplates or consumer/installer documents readily available to the code official. Therefore, an exception limited to ECM motors and/or other power conversion is not practical for the code official, builder or electrical contractor.

Conditions that affect interoperability include the following issues which have yet to be fully examined.

1) Residential AC and HP starting conditions distort circuit power supply conditions to such a great extent that other separate circuits in the building, such as lighting, experience power distortion that is well known to be noticed by occupants (through lights dimming). The appliances identified as comparable to AC and HP do not display and create distortion of this magnitude. There is no study to date to document that interoperability issues do not result from this startup power distortion.

2) A Class A GFCI's trip level amperage is based on the effects on humans of 60 hertz current. The higher frequency currents that create interoperability issues may not affect humans at the same current level. Evidence of safe use in Japan with a different means of protection has been documented.

3) AC and HP units include refrigeration devices that cause the direct drive compressor to start under conditions of existing high-pressure differential. This condition does not exist or is much less common in the refrigeration equipment that was cited in the 2020 code deliberations as a similar load.

4) AC and HP units operate under a much wider range of temperature conditions than the refrigeration equipment cited as similar in the 2020 code deliberations. The conductivity of the fluids surrounding the motor windings may increase as a result. The net result has not yet been tested to confirm this is not an interoperability issue.

5) Higher federal minimum energy standards have increased the use of power conversion equipment for compressors and high efficiency ECM fan motors. Standards again increase January 1, 2023, further increasing the portion of equipment that will contain features that have demonstrated measured interoperability problems.

In addition to some of the information sources cited above, the Task Group was presented with a significant amount of technical information that was considered in developing this TIA. The following is a bibliography of that information:

1. 2020 NEC Adoption/210.8(F)
2. AHRI Experts GFCI TG April 4, 2022 Powerpoint Presentation
3. AHRI 2020 NEC GFCI Summary Data Only 02-08-21
4. Assessment of Incompatibility of HVAC Equipment and GFCI Breakers, AHRI Project 8029 PowerPoint Presentation
5. GFCI Survey by TACCA
6. Minnesota April through September 2021 AC/HP Mini Split – Non GFCI Forms

Emergency Nature: The standard contains an error or an omission that was overlooked during the regular revision process. The proposed TIA intends to correct a circumstance in which the revised NFPA Standard has resulted in an adverse impact on a product or method that was inadvertently overlooked in the total revision process or was without adequate technical (safety) justification of the action.

Almost every state that has adopted the 2020 Edition of the NEC have modified or deleted Section 210.8(F). NFPA is aware of at least six states that have deleted Section 210.8(F) in its entirety and two have delayed enforcement until January 1, 2023. In those eight states, GFCI protection has been deleted for outdoor outlets that do not serve listed HVAC equipment. As such, GFCI protection for equipment for which there is not a compatibility issue is lost (see Reference 1 above). It should also be noted that at the time the TIA was developed several other states were in the midst of adopting the 2020 Edition of the NEC with various amendments to Section 210.8(F) being proposed, some of which include deletion or delayed implementation.

The equipment incompatibility issues identified above will not be resolved by January 1, 2023. If GFCI protection is required while the incompatibility issue remains, there is a higher risk of people being adversely impacted by exposure to extreme temperatures due to nuisance tripping than the risk of people being exposed to a leakage current that could cause injury or harm. Data was submitted to the task group showing that listed HVAC equipment typically can have aleakage current higher than what would trip a Class A GFCI but the touch current is well below levels that would injure or harm an individual.

Submitter Information Verification

Submitter Full Name: CMP ON NEC-P02
Organization: NFPA
Street Address:

City:
State:
Zip:
Submittal Date: Wed Jul 26 11:25:12 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7748-NFPA 70-2024

Statement: The language found in the parent text of 210.8(F) was modified to identify that the outlets are outdoor outlets which aligns with the title of 210.8(F) and that the outlets are installed at and not in the locations listed. In addition, (Reference Public Input No. 264), the language “shall be provided with GFCI protection” was modified to add clarity stating that these outlets “shall be GFCI protected”. The existing language could be read as requiring outlets installed in garages, accessory buildings and boathouses to have GFCI protection. This change will make it clear that only outdoor outlets require GFCI protection. Note that the rule in 210.8(A) will continue to require GFCI protection for receptacle outlets installed in these locations.

Tentative Interim Amendment

NFPA® 70®

National Electrical Code®

2020 Edition

Reference: 210.8(F) and Exception No. 2(new)
TIA 20-19
(SC 22-8-16 / TIA Log #1653)

Pursuant to Section 5 of the NFPA *Regulations Governing the Development of NFPA Standards*, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 70®, *National Electrical Code®*, 2020 edition. The TIA was processed by the NEC Code-Making Panel 2, and the NEC Correlating Committee, and was issued by the Standards Council on August 12, 2022, with an effective date of September 1, 2022.

1. Revise paragraph 210.8(F) to read as follows:

210.8(F) Outdoor Outlets.
All outdoor outlets for dwellings, other than those covered in 210.8(A)(3), Exception to (3), that are supplied by single-phase branch circuits rated 150 volts to ground or less, 50 amperes or less, shall have ground-fault circuit-interrupter protection for personnel. ~~This requirement shall become effective on January 1, 2023, for mini-split-type heating/ventilating/air-conditioning (HVAC) equipment and other HVAC units employing power conversion equipment as a means to control compressor speed.~~

~~Informational Note: *Power conversion equipment* is the term used to describe the components used in HVAC equipment that is commonly referred to as a variable speed drive. The use of power conversion equipment to control compressor speed differs from multistage compressor speed control.~~

Exception <u>No. 1</u>: Ground-fault circuit-interrupter protection shall not be required on lighting outlets other than those covered in 210.8(C).
<u>Exception No. 2: Ground-fault circuit-interrupter protection shall not be required for listed HVAC equipment. This exception shall expire September 1, 2026.</u>

Issue Date: August 12, 2022

Effective Date: September 1, 2022

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/docinfo)

Tentative Interim Amendment

NFPA® 70®

National Electrical Code®

2023 Edition

Reference: 210.8(F) and Exception No. 2(new)
TIA 23-3
(SC 22-8-17 / TIA Log #1654)

Note: Text of the TIA was issued and approved for incorporation into the document prior to printing.

1. Revise paragraph 210.8(F) to read as follows:

210.8(F) Outdoor Outlets.

For dwellings, all outdoor outlets, other than those covered in 210.8(A), Exception No. 1, including outlets installed in the following locations, and supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, shall be provided with GFCI protection:

(1) Garages that have floors located at or below grade level
(2) Accessory buildings
(3) Boathouses

If equipment supplied by an outlet covered under the requirements of this section is replaced, the outlet shall be supplied with GFCI protection.

Exception No. 1: GFCI protection shall not be required on lighting outlets other than those covered in 210.8(C).
Exception No. 2: GFCI protection shall not be required for listed HVAC equipment. This exception shall expire September 1, 2026.

Issue Date: August 12, 2022

Effective Date: September 1, 2022

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/docinfo)

Public Input No. 3285-NFPA 70-2023 [Section No. 210.8(F)]

(F) Outdoor Outlets.

For dwellings, all outdoor outlets, other than those covered in 210.8(A), Exception No. 1, including outlets installed in the following locations, and supplied by single-phase branch circuits rated 150 volts or less to ground, ~~50~~ 60 amperes or less, shall be provided with GFCI protection:

(1) Garages that have floors located at or below grade level

(2) Accessory buildings

(3) Boathouses

If equipment supplied by an outlet covered under the requirements of this section is replaced, the outlet shall be supplied with GFCI protection.

Exception No. 1: GFCI protection shall not be required on lighting outlets other than those covered in 210.8(C).

Exception No. 2: GFCI protection shall not be required for listed HVAC equipment. This exception shall expire September 1, 2026.

Statement of Problem and Substantiation for Public Input

It would seem outlets of the 60-ampere rating at dwellings would also require GFCI protection. There are appliances (Pool Heaters and A/C Compressors) that allow such overcurrent and ground fault protection ampere rating that the 50-amp limitation would otherwise exempt such protection.

Submitter Information Verification

Submitter Full Name: David Engelhart

Organization: Collier County Gmd

Street Address:

City:

State:

Zip:

Submittal Date: Thu Aug 31 14:28:40 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: FR-7909-NFPA 70-2024

Statement: The branch circuit rating was increased from 50A to 60A as solutions are readily available and the hazard is the same.

Public Input No. 3619-NFPA 70-2023 [Section No. 210.8(F)]

(F) Outdoor Outlets.

For dwellings, all outdoor outlets, other than those covered in 210.8(A), Exception No. 1, including outlets installed in the following locations, and supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, shall be provided with GFCI protection:

(1) Garages that have floors located at or below grade level

(2) Accessory buildings

(3) Boathouses

If equipment supplied by an outlet covered under the requirements of this section is replaced, the outlet shall be supplied with GFCI protection.

Exception No. 1: GFCI protection shall not be required on lighting outlets other than those covered in 210.8(C).

Exception No. 2: GFCI protection shall not be required for listed HVAC equipment. This exception shall expire ~~September~~ January 1, ~~2026~~ 2028 .

Statement of Problem and Substantiation for Public Input

The current exception was the result of TIA 23-3, developed by a Task Group of interested parties appointed at the direction of the Standards Council.

UL 943 (Standard for Ground-Fault Circuit-Interrupters) requires that Class A ground-fault circuit-interrupters shall trip at a minimum of 6 mA and may trip as low as 4 mA. The present UL standard only requires such trip thresholds for 60-Hertz as measured by differential current between line and neutral. To fix the incompatibility proven by independent testing, UL standards must be updated. For example, the GFCI standard, UL 943 must be updated to ensure that devices only trip when presented with a dangerous differential current. A UL 943 proposal to accomplish this is being considered in a UL standards Task Group. This proposal will take years to develop and fully ballot, with a reasonable effective date in 2028.

The substantiation for TIA 23-3 included the following statement indicating that the Task Group was well aware that the September 2026 may not be adequate and that a future extension may be necessary. The date proposed is consistent with the date in the AHMA TIA's that are currently being processed.

"The Task Group acknowledges that the date may need to be re-evaluated in the future if the incompatibility issues are not resolved."

Submitter Information Verification

Submitter Full Name: William Koffel

Organization: Koffel Associates, Inc.

Affiliation: Leading Builders of America

Street Address:

City:

State:

Zip:

Submittal Date: Tue Sep 05 09:01:45 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: CMP-2 reaffirms the expiration date of September 1, 2026, to help drive urgency in resolving the problem of incompatibility.

Public Input No. 4026-NFPA 70-2023 [Section No. 210.8(F)]

(F) Outdoor Outlets.

For dwellings, all outdoor outlets, other than those covered in 210.8(A), Exception No. 1, including outlets installed in the following locations, and supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, shall be provided with GFCI protection:

(1) Garages that have floors located at or below grade level

(2) Accessory buildings

(3) Boathouses

If equipment supplied by an outlet covered under the requirements of this section is replaced, the outlet shall be supplied with GFCI protection.

Exception No. 1: GFCI protection shall not be required on lighting outlets other than those covered in 210.8(C).

Exception No. 2: GFCI protection shall not be required for listed HVAC equipment ~~. This exception shall expire September 1, 2026.~~ when installed in accordance with the provisions in 440.9.2 and marked in accordance with 440.4(D)(1), (2), or (3) .

Exception No. 3: GFCI protection shall not be required for listed HVAC equipment when marked in accordance with one of the methods in 440.4(D)(4) through 440.4(D)(7).

Statement of Problem and Substantiation for Public Input

Listed HVAC equipment equipped and installed using new alternative protection grounding options shown in new Section 440.9.2 and marked in accordance with new Section 440.4(D)(1), (2) or (3) do not require GFCI protection and are exempt from Section 210.8(F) (see revised Exception No. 2). When equipment is certified to UL 60335-2-40 such that (1) the touch current of 3.5 mA is not exceeded or (2) the system protective earth (ground) complies with requirements for Class 2 Power-Limited Circuits in accordance with the NEC and marked in accordance with one of the methods in new Section 440.4(D)(4), (5), (6) or (7), GFCI protection is not required and are exempt from Section 210.8(F) (see new Exception No. 3).
If the circuit itself is Class 2, then any touch current is not high enough to create an issue. The safety isolating transformer(s) employed to comply with Class 2 requirements are evaluated to IEC 61558–1 and IEC 61558–2–6.
The UL 60335-2-40 standard has many new requirements that were not in the UL 1995 standard when evaluating HVAC equipment. The leakage current test in UL 1995 only applied to cord-connected equipment, whereas in UL 60335–2–40, all equipment installed in locations accessible to the general public are subjected to the touch current test.
An earthing continuity test is included as part of the product certification to ensure that the resistance between the earthing terminal or earthing contact and earthed metal parts is sufficiently low (0.1 Ω).
Further, insulating materials and internal wiring that may be exposed to ultraviolet radiation are evaluated for acceptable resistance to ultraviolet light per UL 746C and IEC 60335–1, as applicable.
In addition, there are requirements for end-of-line testing to ensure all products function as certified and there are follow-up services conducted several times per year. The earthing continuity test and the dielectric strength test for the insulation are such routine tests to be performed on each piece of equipment. The dielectric strength test subjects the insulation to a voltage equal to at least two times rated voltage plus 1000 V.
The certification and routine tests mentioned in the preceding paragraphs ensure that each listed piece of HVAC equipment is held to a consistent standard in terms of electrical safety. Exempting listed HVAC equipment from the scope of Section 210.8(F) by relying on compliance options in the listing standard (UL 60335–2–40) provides flexibility to manufacturers and installers, reduces test burden on manufacturers, and prevents duplication of requirements intended to protect against the same hazard. This approach also helps homeowners and installers avoid incompatibility issues between HVAC equipment and GFCI devices.

Note: This public input is related to AHRI's 4 other public inputs in Article 100 (Public Input 3901), Section 440.4 (Public Input 4029), Section 440.9 (Public Input 4030), and Table A.1(a) (Public Input 4031), which provide important context. The public input in Section 440.4 provides marking requirements for listed HVAC equipment when the listed alternate protective grounding options are utilized by an HVAC manufacturer on equipment. The public input in Section 440.9 adds listed alternate protective grounding options that can be utilized by an HVAC manufacturer on equipment in lieu of adding GFCI protection in the field. The public input in Table A.1 (a) adds UL 60335-2-40 as a referenced standard because Section 210.8(F) references "listed HVAC equipment," and this is the applicable reference for listed HVAC equipment. The public input in Article 100 adds definitions for "touch current" and "protective grounding current" that provide important context to the reader.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3901-NFPA 70-2023 [New Article after 100]	
Public Input No. 4029-NFPA 70-2023 [Section No. 440.4(C)]	
Public Input No. 4030-NFPA 70-2023 [Section No. 440.9]	
Public Input No. 4031-NFPA 70-2023 [Definition:]	
Public Input No. 3901-NFPA 70-2023 [New Article after 100]	
Public Input No. 4029-NFPA 70-2023 [Section No. 440.4(C)]	
Public Input No. 4030-NFPA 70-2023 [Section No. 440.9]	

Public Input No. 4031-NFPA 70-2023 [Definition:]

Submitter Information Verification

Submitter Full Name: Thomas Deary
Organization: AHRI
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 06 14:24:59 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: CMP-2 reaffirms that GFCI protection is necessary for HVAC equipment. The suggested wiring method does not provide adequate personnel protection during maintenance.

Public Input No. 4203-NFPA 70-2023 [Section No. 210.8(F)]

(F) Outdoor Outlets.

For dwellings, all outdoor outlets, other than those covered in 210.8(A), Exception No. 1, including outlets installed in the following locations, and supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, shall be provided with GFCI protection:

(1) Garages that have floors located at or below grade level

(2) Accessory buildings

(3) Boathouses

If equipment supplied by an outlet covered under the requirements of this section is replaced, the outlet shall be supplied with GFCI protection.

Exception No. 1: GFCI protection shall not be required on lighting outlets other than those covered in 210.8(C).

Exception No. 2: ~~-~~ GFCI protection shall not be required for listed HVAC equipment ~~. This exception shall expire September 1, 2026.~~ prior to January 1, 2029. SP GFCI protection shall be permitted for HVAC equipment effective January 1, 2029.

Statement of Problem and Substantiation for Public Input

This exception increases the pickup value of the GFCI protection yet provides shock protection for personnel. The trip threshold for an SPGFCI is 20mA and is adequate to avoid unwanted tripping due to compatibility.

Submitter Information Verification

Submitter Full Name: Thomas Domitrovich
Organization: Eaton Corporation
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 06 21:49:39 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7913-NFPA 70-2024

Statement: The date found in Exception No. 2 was not modified but the parent text will now permit either the GFCI or a SPGFCI as of September 1, 2026, to provide options when compatibility issues exist with HVAC equipment that does not include a standard thermal magnetic circuit breaker.

Public Input No. 4392-NFPA 70-2023 [Section No. 210.8(F)]

(F) Outdoor Outlets.

For dwellings, all outdoor outlets, other than those covered in 210.8(A), Exception No. 1, including outlets installed in the following locations, and supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, shall be provided with GFCI protection:

(1) Garages that have floors located at or below grade level

(2) Accessory buildings

(3) Boathouses

If equipment supplied by an outlet covered under the requirements of this section is replaced, the outlet shall be supplied with GFCI protection.

Exception No. 1: GFCI protection shall not be required on lighting outlets other than those covered in 210.8(C).

Exception No. 2: GFCI protection shall not be required for listed HVAC equipment. This exception shall expire September 1, ~~2026~~ 2029 .

Statement of Problem and Substantiation for Public Input

ACCA's reasons for extending the expiration date are similar to the reasons for supporting Exception No. 2 in the 2020 and 2023 NEC. This involves the health and safety of occupants due to nuisance tripping of outdoor HVAC equipment. At this time, progress has been slow to determine a viable resolution or technical solution to this problem before September 1, 2026. The AHRI research on the causes of the tripping has not been made public yet, and additional research will be needed over the next several years to validate any technical solutions. In addition, ACCA is aware of a new optional requirement in UL Standard 60335-2-40 for an alternate protective grounding means that can be utilized by an HVAC equipment manufacturer in lieu of adding GFCI protection in the field. It is not known when this optional UL coverage will be effective or how soon such a feature will be certified and available in the marketplace. In addition, the impact of such a new feature has not been evaluated for replacing existing installations in the field that currently utilize a disconnect box. For these reasons we are asking that the expiration date be extended by another three years. In addition, ACCA is aware that there is a new class of GFCI device being developed, known as a Class AHF device. Such a device would be capable of being used on various equipment and devices that create high frequency leakage current. We are hopeful that proposed revisions will be made to UL Standard 943 to cover this new class of GFCI. This will also require time for manufacturers of GFCI devices to certify these devices and make them available in the marketplace. It is also anticipated that proposed revisions will need to be made to the NEC to address the above potential solutions.

Submitter Information Verification

Submitter Full Name: David Bixby

Organization: ACCA

Affiliation: ACCA

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 13:54:45 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: CMP-2 reaffirms the expiration date of September 1, 2026, to help drive urgency in resolving the problem of incompatibility.

Public Input No. 4471-NFPA 70-2023 [Section No. 210.8(F)]

(F) Outdoor Outlets.

For dwellings, all outdoor outlets, other than those covered in 210.8(A), Exception No. 1, including outlets installed in the following locations, and supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, shall be provided with GFCI protection:

(1) Garages that have floors located at or below grade level

(2) Accessory buildings

(3) Boathouses

If equipment supplied by an outlet covered under the requirements of this section is replaced, the outlet shall be supplied with GFCI protection.

Exception No. 1: GFCI protection shall not be required on lighting outlets other than those covered in 210.8(C).

Exception No. 2: GFCI protection shall not be required for listed HVAC equipment. This exception shall expire ~~September~~ January 1, ~~2026.~~ 2029,

Exception No 3. GFCI protection shall not be required for listed well pumps.

Exception No 4. GFCI protection shall not be required for septic pumps, or lift pumps.

Exception No 5. GFCI protection shall not be required for listed EV charges.

Statement of Problem and Substantiation for Public Input

Well and septic pump will trip the GFCI.
A septic pump will back up into the dwelling if the pump fails, because the controllers and alarm circuit is on the GFCI device.
Home owners will not know if it tripped until it is to late, and major property damage as a result.
EV charges already have GFCI protection build into them, and some manufactures do not allow EV chargers to be on a GFCI device

Submitter Information Verification

Submitter Full Name: John Plourde
Organization: Portsmouth Nh City Of
Affiliation: Performance Electrical Training LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 16:05:34 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: CMP-2 reaffirms the expiration date of September 1, 2026, to help drive urgency in resolving the problem of incompatibility. The suggested three new exceptions were not accepted as insufficient substantiation was provided to reduce the current level of protection. Charging circuit interrupting device (CCID) protection for EV chargers, as required by the product standard, provides protection between the charger and the vehicle but not upstream of the charger between the panelboard and the outlet.

Public Input No. 1346-NFPA 70-2023 [Section No. 210.8 [Excluding any Sub-Sections]]

A listed Class A GFCI shall provide protection in accordance with 210.8(A) through (F). The GFCI shall be installed in a readily accessible location.

Informational Note: See 215.9 for GFCI protection on feeders.

For the purposes of this section, the distance from receptacles shall be measured as the shortest path the power supply cord connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier. Add a new Exception No. 5 to section 210.8(A) to read as follows: 210.8(A) Dwelling Units. … Exception No. 5: GFCI protection shall not be required for a receptacle serving a refrigerator or HVAC appliance if all of the following conditions are met: (1) The appliance is located within a dedicated space. (2) The appliance is on an individual branch circuit. This exception shall expire January 1, 2028.

Exception No. 6 If any of the specific equipment has integral protection for personnel provided by the manufacturer and compliant with the UL standard.

Additional Proposed Changes

File Name	Description	Approved
315522135_562375592318221_2186616584159142738_n.jpg	Tesla Manufacturer instructions	
358395649_3488271048114890_8514449395977391969_n.jpg	Massachusetts local amendment for compatibility exception	

Statement of Problem and Substantiation for Public Input

There has been a growing number of incompatibility issues with specific equipment and it would seem that the UL standard for testing and safety would meet the minimum requirements of the NEC. I feel this must be addressed due to the fact if a piece of equipment does not function with a class A device, the class A device is removed and standard OCPD is used. A scenario where the equipment is not listed in 210.8(D) and hardwired the hazard to personnel is removed by removing the receptacle. The data has been submitted with very little injuries and I didn't see any deaths due to cord and plug connected refrigerators and HVAC units.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3158-NFPA 70-2023 [Section No. 210.8(B)]	
Public Input No. 3158-NFPA 70-2023 [Section No. 210.8(B)]	

Submitter Information Verification

Submitter Full Name: William Snyder
Organization: RCC Solutions
Affiliation: High voltage live show
Street Address:
City:
State:
Zip:

Submittal Date: Sun Jul 09 12:57:19 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: In proposed Exception 5, the restriction of being on an individual branch circuit does not remove the hazard. Simply removing the receptacle does not remove the electrical hazard, the hazard is not the receptacle. Massachusetts data shows that a country wide issue with refrigerators is not substantiated. The suggested language could also lead to receptacles that provide power to the refrigerator left without GFCI protection yet serve other appliances. The receptacle does not have to be located in the space behind the refrigerator. This suggested language for proposed Exception 6 could result in general receptacles in the areas identified in 210.8 to be left without GFCI protection. Appliance standards do not require GFCI protection to be placed integral with the appliance and older appliances may still be plugged in to receptacles. UL standard 60335-2-24 requires a means of disconnect.

Public Input No. 161-NFPA 70-2023 [Section No. 210.8 [Excluding any Sub-Sections]]

A listed Class A GFCI shall provide protection in accordance with 210.8(A) through (F). The GFCI shall be installed in a readily accessible location.

Informational Note: See 215.9 for GFCI protection on feeders.

For the purposes of this section, the distance from receptacles shall be measured as the shortest path the power supply cord connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier. Fixed wiring installed for the purpose of serving a receptacle for a recreational vehicle in locations other than recreational vehicle parks shall be considered a branch circuit.

Statement of Problem and Substantiation for Public Input

210.8A (3), 210.8B (6) and 210.8F all require GFCI protection for a 125v 30 amp and a 250/125v 50 amp receptacle. A branch circuit is defined as the circuit conductors between the final overcurrent protecting device the circuit and the outlet. RVs with a 30 or 50 amp supply will have another level of over current protection. By definition this fixed wiring prior to the RV is now a feeder, making 210.8 inapplicable. Art 551 scope only includes RV and RV parks, not electrical installations in dwellings or other structures. 551.71F informational note leads on that the power supply cord is a feeder, which by Art 100 definition it is. I believe it is the intent of CMP-2 that exterior receptacles in those other than installed in RV parks be Class A GFCI protected, but with the current code structure a receptacle installed for the purpose of supplying a RV would not be subject to 210.8.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 162-NFPA 70-2023 [Section No. 551.71(F)(2)]	

Submitter Information Verification

Submitter Full Name:	Matt Bednarik
Organization:	State of Iowa
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sat Jan 14 23:29:57 EST 2023
Committee:	NEC-P02

Committee Statement

Resolution: The suggested language is not necessary, as a branch circuit is defined in Article 100 as the circuit conductors between the final overcurrent device protecting the circuit and the outlet(s). The fact that there is an outlet that serves the cord supplying an RV does not make the circuit a feeder, as the outlet to which the cord is attached is supplied by the final overcurrent device in the circuit.

Public Input No. 4315-NFPA 70-2023 [Section No. 210.8 [Excluding any Sub-Sections]]

A listed Class A-HF GFCI shall provide protection in accordance with 210.8(A) through (F). The GFCI shall be installed in a readily accessible location.

Informational Note: See 215.9 for GFCI protection on feeders.

For the purposes of this section, the distance from receptacles shall be measured as the shortest path the power supply cord connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier.

Statement of Problem and Substantiation for Public Input

A. Class A GFCIs trip on safe appliances

There is a technological incompatibility between common loads in the home and GFCIs. The incompatibility is often realized in the form of "nuisance tripping", where a GFCI trips and no electrical hazard is present. This incompatibility is especially pertinent in the context of home appliances, which are subject to continuously updated, mandatory, Department of Energy efficiency requirements. In order for appliances to meet efficiency standards, home appliance manufacturers incorporate components that operate at frequencies higher than the mains frequency of 60-Hertz. These technologies include switch-mode power supplies, electronically commutated motors, and LED drivers.

It should be noted that technologies used to make home appliances more efficient are similar to technologies used to make central air conditioners more efficient.

Presently, there are major inconsistencies in GFCI performance above 60-Hertz. To study effects of this variation, UL has conducted an independent study testing 3 different types of appliances, from 3 different manufacturers, connecting each of these appliances to 10 different GFCIs. All three appliances contain high frequency components - such components are found in virtually all modern home appliances. A link to the study is here:

https://collateral-library-production.s3.amazonaws.com/uploads/asset_file/attachment/54854/Study_of_High_Frequency_Spectrum_for_120_V_Household_Appliances.pdf

There are a few notable items from the UL study:
1) GFCI trip thresholds are all over the place. At certain frequencies, GFCI trip thresholds differ by roughly 150%.
2) The appliances are safe. When compared to present leakage current requirements and possible future requirements, all appliances pass by a wide margin.
3) The three appliance models tested are representative of many more models that are essentially identical as defined by Department of Energy.
4) GFCIs trip on all the appliances tested.

B. Conclusion

There has been significant expansion of Class A GFCI requirements in recent NEC code cycles.

These new locations contain appliances which are significantly more complex than appliances in past GFCI locations such as bathrooms and kitchen countertops. While a Class A GFCI may be suitable for protection on circuits powering hair dryers and blenders, there are Class A GFCIs that are not suitable for protection on more complex appliances which are subject to efficiency requirements. GFCIs must be modernized if they are required to be connected to more complex loads. One example of such modernization is a Class A-HF GFCI.

While it is AHAM's preference that all permanently connected Class A GFCIs be modernized, home appliance manufacturers understand that such requirements may not get the necessary votes in the UL 943 standard. AHAM looks forward to CMP2 feedback on this alternative approach to nuisance tripping relief.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4308-NFPA 70-2023 [New Definition after Definition: Ground-Fault Circuit Inter...]	New definition is used in 210.8 PI
Public Input No. 4308-NFPA 70-2023 [New Definition after Definition: Ground-Fault Circuit Inter...]	

Submitter Information Verification

Submitter Full Name: Greg Woyczynski
Organization: Association of Home Appliance Manufacturers
Street Address:

City:
State:
Zip:
Submittal Date: Thu Sep 07 11:07:04 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The suggested language would no longer permit a Class A GFCI device to meet the requirements of 210.8. Compatibility with appliances would be improved but not assured using the Class A-HF GFCI. Language from UL 943 does not currently define anything other than a Class A device.

Public Input No. 475-NFPA 70-2023 [Section No. 210.8 [Excluding any Sub-Sections]]

A listed Class A GFCI shall provide protection in accordance with 210.8(A) through (F). The GFCI shall ~~be installed in a readily accessible location.~~ be readily accessible and within sight of the protected outlet.

Informational Note: See 215.9 for GFCI protection on feeders~~.~~

For the purposes of this section, the distance from receptacles shall be measured as the shortest path the power supply cord connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier.

Statement of Problem and Substantiation for Public Input

This proposal is intended to reduce the hazard risks associated with maintenance and operation of GFCIs by reducing the risk of slips and falls associated with traversing stairs, reducing opportunities for leaving children unattended and unsupervised near bodies of water and heat sources, and eliminating remote, both unattended and unintended, operation of household appliances.

From 2017 to 2021, there was a 25% increase in death and injuries from falls in homes, with stairs being the most dangerous location and responsible for 23% of the fatalities, according to the National Safety Council. For the US in 2021, there were 29,100 deaths and 3 million injuries treated in hospital emergency facilities that were attributed to falls in the homes. Over 25,000 of the deaths were adults aged 65 and older. Overall, falls among adults aged 65 and older cost over $50 billion annually.

AFCIs and GFCIs, as part of recommended routine safety checks and maintenance, should be tested monthly, which requires going back and forth between the load center and the areas being protected for confirmation that the electronics and switching contacts are functioning properly to turn off power when called upon. Additional back and forth travels are expected to resolve nuisance trips, as we continue to receive reports of nuisance trips with appliance loads such as refrigerators, vacuum cleaners, microwave ovens, dishwashers, almost exclusively plug-in loads on receptacle branch circuits. According to the 2023 follow-up to the 2020 survey of contactors that responded to the East Carolina University survey, electrical contractors are still dealing with a least one nuisance tripping issue in 33% of the jobs involving AFCIs, with 18% being two or more issues requiring two or more call backs.

ESFI, in 2022, published a survey of 100 Massachusetts electrical contractors that showed a similar trend, with approximately 30% of the service calls involving either AFCI, GFCI, or Dual-Function AFCI/GFCI breakers, totaling over 38,000 calls a year. The survey also noted that approximately 4% of all circuit breaker related calls involved defective breakers.

Considering the fact that the majority of dwelling units are two levels or more with load centers typically located in the basement, garages or outdoors, it is not hard to conclude that more back and forth between the load center and the areas being protected means increased likelihood of slips and falls on the stairs, often times fatal events for the elderly population, a demographic we all hope to eventually become a part of.

Bathrooms, kitchens, and outdoors are locations where GFCI protection is essential. Leaving young children unattended or unsupervised in these locations can result in injuries and even fatal consequences. Parents shall not be forced to leave their children unattended in the middle of a bath (drowning), during cooking(burn), or playing in the backyard or pool (drowning or physical injury), to reset a tripped GFCI circuit breaker or receptacle located remotely in another room, the garage, basement, or outdoors. According to the CDC, about 2,000 children ages 14 and under die each year from home injuries caused by fire and burns, suffocation, drowning, falls, choking, and more.

According to NFPA research, cooking was the leading cause of reported home fires and home fire injuries in 2015-2019 and the second leading cause of home fire deaths. Cooking caused 49% of reported home fires, 20% of reported home fire deaths, and 42% of home fire injuries. Unattended equipment is a factor in one-third of reported home cooking fires and over half of the associated deaths. Ranges or cooktops account for three-fifths of home cooking fire incidents. Kitchen appliances accounted for the majority of reported unwanted tripping events. With the kitchen being one of only two locations requiring both AFCI and GFCI protection, it is not surprising to learn, from the recent survey, that almost 2 out of 3 (63%) contactors that responded to the East Carolina University survey reported personal or customer experience of resetting a AFCI or GFCI breaker that resulted in a plugged-in appliance, such as a blender, food processor, stove, toaster oven, garbage disposal, immediately starting back up again.

The purpose of the NEC is practical safeguarding of persons and property from hazards arising from the use of electricity. CMP 2 had adhered to this purpose as demonstrated by the passing of SR 8090 for NEC 2023 that removed the countertop receptacle mandate in attempt to reduce physical injuries caused by or associated with kitchen appliance cords. The committee based the decision on CPSC data set of 45 anecdotal reports of burn/other injuries and estimated 9,700 burn/other injuries treated in US hospital emergency departments over the 30-year span from Jan 1991 through 2020.

CMP 2 is urged again to adhere to the NEC's practical safeguard principle and support this proposal in a joined effort to reduce OVERALL deaths and injuries in the home, across all ages from newborns to elderly. Human-life saving devices shall never be the cause of human deaths and injuries.

Submitter Information Verification

Submitter Full Name: Frank Tse
Organization: Hubbell Incorporated
Street Address:
City:

State:
Zip:
Submittal Date: Wed Mar 15 16:08:04 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The suggested language is too restrictive and not substantiated. There are several methods available to achieve GFCI protection and the option chosen is up to the designer, installer, or owner.

Public Input No. 2389-NFPA 70-2023 [Section No. 210.11(C)(1)]

(1) Small-Appliance Branch Circuits.

In addition to the number of branch circuits required by other parts of this section, two or more 20-ampere small-appliance branch circuits shall be provided for all receptacle outlets specified by 210.52(B). <u>Such circuits shall have no other outlets.</u>

Statement of Problem and Substantiation for Public Input

To be consistent with 210.11(C)(2), (3), and (4) adding the language "Such circuits shall have no other outlet" to second level subdivision 210.11(C)(1). The proposed revision will bring clarity to Code users.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 16 15:54:33 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7538-NFPA 70-2024

Statement: Although 210.52(B)(2) states that small-appliance branch circuits in dwelling units shall have no other outlets, the added sentence is consistent with 210.11(C)(2), (3), and (4).

Public Input No. 985-NFPA 70-2023 [Section No. 210.11(C)(2)]

(2) Laundry Area Branch Circuits.

In addition to the number of branch circuits required by other parts of this section, at least one additional 20-ampere branch circuit shall be provided to supply the laundry area receptacle outlet(s) required by 210.52(F). This circuit shall have no other outlets.

Statement of Problem and Substantiation for Public Input

The requirements covered in 210.52(F) cover "Laundry Areas".

Adding "Area" to 210.11(C)(2) will keep consistency.

This proposed change should also help with confusion over whether this circuit is just for the washing machine or dryer (120-volt).

Thanks

Submitter Information Verification

Submitter Full Name: Daniel Naughton
Organization: IBEW Local 103, Boston Ma
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 08 11:26:03 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7543-NFPA 70-2024
Statement: The word "area" is added to be consistent with the defined term "laundry area".

This revision word "nominal" is made included to add clarity regarding the voltage of small-appliance branch circuits relative to "nominal voltage" cited in 110.4.

The phrase "120-volt" is added to add clarity clarify that the required 20-ampere branch circuit for the laundry area and is for 120-volt nominal equipment such as flat irons, washing machines, and for heat-pump clothes dryers or gas clothes dryer ignitions, and to clarify that this requirement applies to receptacle outlets in a laundry area as define in Article 100.

Public Input No. 23-NFPA 70-2023 [Sections 210.11(C)(3), 210.11(C)(4)]

Sections 210.11(C)(3), 210.11(C)(4)

(3) Bathroom Branch Circuits.

In addition to the number of branch circuits required by other parts of this section, one or more 120-volt nominal ,- ~~20~~ 20 - ampere branch circuit shall be provided to supply bathroom(s) receptacle outlet(s) required by 210.52(D) and any countertop and similar work surface receptacle outlets. Such circuits shall have no other outlets.

Exception: Where the 20-ampere circuit supplies a single bathroom, outlets for other equipment within the same bathroom shall be permitted to be supplied in accordance with 210.23(B)(1) and (B)(2).

(4) Garage Branch Circuits.

In addition to the number of branch circuits required by other parts of this section, at least one 120-volt, ~~20~~ nominal 20 - ampere branch circuit shall be installed to supply receptacle outlets, including those required by 210.52(G)(1) for attached garages and in detached garages with electric power. This circuit shall have no other outlets.

Additional branch circuits rated 15 amperes or greater shall be permitted to serve receptacle outlets other than those required by 210.52(G)(1).

Exception No. 1: This circuit shall be permitted to supply outdoor receptacle outlets.

Exception No. 2: Where the 20-ampere circuit supplies a single vehicle bay garage, outlets for other equipment within the same garage shall be permitted to be supplied in accordance with 210.23(B)(1) and (B)(2).

Statement of Problem and Substantiation for Public Input

These revisions are needed to clarify that the “120 volt” means “nominal voltage” rather the “voltage of the circuit”. Otherwise a circuit operating at 119 volts would be a violation! I certainly don’t think that this is the intent of the present wording. Section 110.4 tells us the voltage considered is in fact the voltage at which the circuit operates! Clarification is needed here as to whether the 120 volts means “nominal voltage” or “voltage of the circuit”. Article 100 provides definitions of “voltage, nominal” and “voltage (of a circuit)”. My proposed revisions help clarify which term to apply.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 16-NFPA 70-2023 [Sections 210.12(B), 210.12(C), 210.12(D)]	nominal voltage vs. voltage of a circuit
Public Input No. 92-NFPA 70-2023 [Section No. 210.8(C)]	
Public Input No. 96-NFPA 70-2023 [Section No. 525.23(A)]	

Submitter Information Verification

Submitter Full Name:	Russ Leblanc
Organization:	Leblanc Consulting Services
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Wed Jan 04 11:08:26 EST 2023
Committee:	NEC-P02

Committee Statement

Resolution: FR-7558-NFPA 70-2024

Statement: This revision is made to add clarity that the voltage of bathroom branch circuits is relative to “nominal voltage” cited in 110.4.

This revision is made to add clarity by replacing “outlets for other equipment” by “other outlets” as the restrictions on other equipment within the same garage are sufficiently addressed in 210.23(B). Outlets for luminaires are also covered in 210.23(B).

Public Input No. 3406-NFPA 70-2023 [New Section after 210.11(C)(4)]

210.11(C)(5) Bedroom Branch Circuits

To serve each bedroom and its adjoining clothes closets, at least one 120-volt, 15- or 20-ampere required branch circuit shall supply wall, floor, ceiling, countertop, and work surface outlets. Such required branch circuits shall not supply outlets in any other rooms.

Additional Proposed Changes

File Name	Description	Approved
ESFI-2022-AFCI-and-GFCI-Performance-Survey.pdf	ESFI 2022 AFCI GFCI Performance Survey	

Statement of Problem and Substantiation for Public Input

This public input recognizes the fact that the load demand on bedroom receptacle outlets have become even more critical to support remote / home office applications, home fitness equipment, and the trend to more in-home medical recovery equipment.

ESFI conducted a survey of electrical contractors in the Commonwealth of Massachusetts during 2022 asking about any various circuit breaker technology tripping issues. A large majority of tripping issues found were related to overloads/short circuits. This corresponds to the Customer Service call data that circuit breaker manufacturers are seeing. This Data reviewed from the last three years indicates that over 40% of customer phone calls related to residential circuit protection are a result of an overloaded circuit. The overload calls were almost 2 ½ times greater than the nearest other reason. This proposal seeks to address our documented concerns of homeowners where overloads have left them without power. These situations are simply due to poor design / installation based on the loads an individual homeowner may utilize establishing perceived 'nuisance' tripping events when the circuit was appropriately protected from an overload hazard.

The load demand on bedroom receptacle outlets have become even more critical as we learned during the COVID-19 pandemic to support remote / home office applications, home fitness equipment, and the trend to more in-home medical recovery and the use of Durable Medical Equipment (DME). Many homes are wired with 15A circuits in the bedroom that also supply the lighting in the room as well as multiple bedrooms. If the home requires a hospital type bed that could take 6-10A itself thereby not providing additional load capacity. While these are the largest loads there are smaller DME loads that could add up. A CPAP is 2A, Oxygenator is 3A, and infusion pump is 1A. Another example is if a treadmill is installed it is required to be on a dedicated 20A receptacle. The load data and requirements came from the various manufacturer's documentation. These loads are in addition to the normal bedroom loads such as TV's, personal computer, ceiling fan, table lamps, radio, etc.

Example:

Actual load measured for one-bedroom circuit with computer, monitors, ceiling fan, and table lamp along with other electronics loads. The reading is 4.41A. (Didn't turn on gaming console or radio) Three bedrooms on the same circuit which is currently permitted by the NEC would push the load on that 15A breaker over 80% for more than three hours. Simple math begins to demonstrate the driver of why the largest number of customer calls today are a result of an overloaded circuit.

https://www.esfi.org/esfi-afci-and-gfci-performance-survey/

Submitter Information Verification

Submitter Full Name: Megan Hayes
Organization: NEMA
Street Address:
City:
State:
Zip:
Submittal Date: Sat Sep 02 15:54:47 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Insufficient substantiation was provided that the overloaded circuits and tripping issues were directly attributable to bedroom circuits being overloaded. Additional substantiation could be provided specifically related to overload data in the bedroom.

ESFi
Electrical Safety Foundation International

ESFI ARC-FAULT CIRCUIT INTERRUPTER (AFCI) AND GROUND FAULT CIRCUIT INTERRUPTER (GFCI) PERFORMANCE SURVEY

In May 2022, the Electrical Safety Foundation International surveyed homeowners, and electrical contractors to assess the performance of AFCI and GFCI devices in homes in Massachusetts.The Commonwealth of Massachusetts quickly adopted the 2020 National Electrical Code ® with AFCI requirements for the entire home.

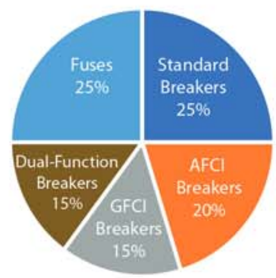
Electrical Contractors

ESFI surveyed 100 electrical contractors in Massachusetts to determine the amount and type of service calls they responded to on an average week from the start of 2020 to the present.

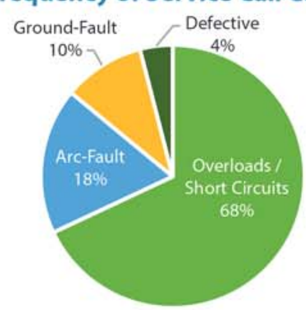
Key Findings:

- The surveyed electrical contractors personally responded to an average of 27 service calls a week
- An average of 15.9 (59%) of service calls a week involved tripped breakers or fuses
  - Standard circuit breaker – 3.7 calls on average
  - Fuses – 3.7 calls on average
  - AFCI breaker – 3 calls on average
  - GFCI breaker – 2.2 calls on average
  - AFCI / GFCI dual function circuit breakers – 2.2 calls on average
- Electrical contractors were asked to estimate the frequency of breaker trip related calls. ESFI found that the following was the cause of "most" or "all" service calls for all breaker types:
  - Overloads / Short Circuits: 68%
  - Arc-fault: 18%
  - Ground fault: 10%
  - Defective: 4%
- When asked what the most common mistake the electrical contractors encountered regarding the usage of circuit interruption devices:
  - 37% reported wiring issues
  - 32% reported lack or inadequate GFCI protection
  - 27% reported electrical overloads
  - 3% reported other causes
  - No comments were made regarding AFCI devices or protection

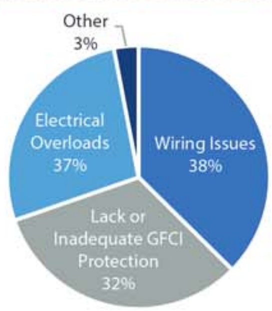
Percentage of Service Calls



Frequency of Service Call Causes



Common Protection Mistakes



Homeowner Survey: ESFI attempted to survey homeowners in Massachusetts who live in homes built in 2020 or later but did not receive significant results due to a small sample size. The initial results found that AFCI devices work to properly detect faults in appliances and wiring, but additional research is required. Additional data may be available at a later date once a larger population with new homes is identified.

Public Input No. 437-NFPA 70-2023 [New Section after 210.11(C)(4)]

TITLE OF NEW CONTENT

Type your content here ...In addition to the number of branch circuits required by other parts of this section, at least one branch circuit within 6ft of water heater location, and will be rated at 120 volt, 20 amp.

Statement of Problem and Substantiation for Public Input

With the need to switch to electric ignition with tanked or tankless water heaters. we would need to have the electrical supply needed for electrical ignition. Enormous amounts of gas is waisted with the use of a pilot light. This would at least give homeowners the option to switch to an electric ignition tanked water heater, if they aren't interested in a tankless water heater.

Submitter Information Verification

Submitter Full Name: Mark Frank
Organization: [Not Specified]
Street Address:
City:
State:
Zip:

Submittal Date: Mon Mar 06 22:41:24 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: No evidence was provided in the substantiation to show a problem that warrants the addition of the proposed language. 120 V rated water heaters are only one option. There are water heaters requiring 240 V and others requiring no power at all.

Public Input No. 1867-NFPA 70-2023 [Section No. 210.11(C)(4)]

(4) Garage Branch Circuits.

In addition to the number of branch circuits required by other parts of this section, at least one 120-volt, 20-ampere branch circuit shall be installed to supply receptacle outlets, including those required by 210.52(G)(1) for attached garages and in detached garages with electric power. This circuit shall have no other outlets.

Additional branch circuits rated 15 amperes or greater shall be permitted to serve receptacle outlets other than those required by 210.52(G)(1).

Exception No. 1: This circuit shall be permitted to supply outdoor receptacle outlets.

Exception No. 2: Where the 20-ampere circuit supplies a single vehicle bay garage, outlets for other equipment within the same garage shall be permitted to be supplied in accordance with 210.23(B)(1) and (B)(2).

210.11 (C) (4) Provide clarity regarding the number of required branch circuits in a multifamily dwelling unit with detached vehicle garage building(s) with multiple individual/separate garage bays.

Statement of Problem and Substantiation for Public Input

210.11 (C) (4) Provide clarity regarding the number of required branch circuits in a multifamily dwelling unit with detached vehicle garage building(s) with multiple individual/separate garage bays. In some cases, a condo community for example, will have detached garage building(s) with individual/separate garage bays. Current NEC language allows an installer to install one branch circuit for the entire garage building which is dedicated to serving receptacle outlets in multiple individual/separate garage bays.

- Consider requiring one branch circuit per individual garage bay.
- Consider required receptacle outlets to be calculated at a load of 180 volt-amperes per receptacle outlet as outlined in NEC 220-14 (I).

Submitter Information Verification

Submitter Full Name: Gary Hein

Organization: [Not Specified]

Street Address:

City:

State:

Zip:

Submittal Date: Sun Aug 06 17:08:05 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: No proposed changes were provided, which is in violation of Section 4.3.4.1(c) of the Regulations Governing the Development of NFPA Standards. The submitter did not provide a basis for why this change is necessary. The installer should be able to design the electrical system to fit how the building is managed.

Public Input No. 1868-NFPA 70-2023 [Section No. 210.11(C)(4)]

(4) Garage Branch Circuits.

In addition to the number of branch circuits required by other parts of this section, at least one 120-volt, 20-ampere branch circuit shall be installed to supply receptacle outlets, including those required by 210.52(G)(1) for attached garages and in detached garages with electric power. This circuit shall have no other outlets.

Additional branch circuits rated 15 amperes or greater shall be permitted to serve receptacle outlets other than those required by 210.52(G)(1).

Exception No. 1: This circuit shall be permitted to supply outdoor receptacle outlets.

Exception No. 2: Where the 20-ampere circuit supplies a single vehicle bay garage, outlets for other equipment within the same garage shall be permitted to be supplied in accordance with 210.23(B)(1) and (B)(2).

210.11 (C) (4) Provide clarity regarding the number of required branch circuits in a multifamily dwelling unit with a shared garage with multiple vehicle parking spots .

Statement of Problem and Substantiation for Public Input

210.11 (C) (4) Provide clarity regarding the number of required branch circuits in a multifamily dwelling unit with a shared garage with multiple vehicle parking spots. In some cases, a condo community for example, will have a below grade parking garage detached garage. Current NEC language allows an installer to install one branch circuit for the entire garage building which is dedicated to serving receptacle outlets in multiple garage bays.

- Consider: To help ensure a safe electrical installation consider required receptacle outlets to be calculated at a load of 180 volt-amperes per receptacle outlet as outlined in NEC 220-14 (I)

Submitter Information Verification

Submitter Full Name: Gary Hein
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 06 17:12:35 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: No proposed changes were provided, which is in violation of Section 4.3.4.1(c) of the Regulations Governing the Development of NFPA Standards. The submitter did not provide a basis for why this change is necessary. The installer should be able to design the electrical system to fit how the building is managed.

Public Input No. 2550-NFPA 70-2023 [Section No. 210.11(C)(4)]

(4) Garage Branch Circuits.

In addition to the number of branch circuits required by other parts of this section, at least one 120-volt, 20-ampere branch circuit shall be installed to supply receptacle ~~outlets, including those required~~ outlets required by 210.52(G)(1) for attached garages and in detached garages with electric power. This circuit shall have no other outlets.

Additional branch circuits rated 15 amperes or greater shall be permitted to serve receptacle outlets other than those required by 210.52(G)(1).

Exception No. 1: This circuit shall be permitted to supply outdoor receptacle outlets.

Exception No. 2: Where the 20-ampere circuit supplies a single vehicle bay garage, outlets for other equipment within the same garage shall be permitted to be supplied in accordance with 210.23(B)(1) and (B)(2).

Additional Proposed Changes

File Name	Description	Approved
.1692584638870		

Statement of Problem and Substantiation for Public Input

The 2020 NEC Code 210.11(D) did not include the words including those required. The 2020 code maybe did not include wording that allowed additional circuits but expressed the desire for a dedicated circuit for the the outlets required in each garage space. No other outlets on that circuit. The 2023 has added the wording "including those required". These words muddle the meaning of the dedicated circuit. What does "including those required" really mean? What other receptacles or circuits are required? Other receptacles or circuits maybe required by a need, i.e. Garage Door openers, but I do not know of other circuits required in the space because it is a garage.

Submitter Information Verification

Submitter Full Name: Roger Chick
Organization: Electrical Training
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 20 20:16:37 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The 210.52(G)(1) mandate for the receptacle outlets is a subset of the mandates and allowances for the 210.11(C)(4) branch circuit. 210.52(G)(1) addresses receptacle outlets serving solely each vehicle bay up to 5½ feet above the floor. By contrast, the 2023 210.11(C)(4) words ", including those" expanded the allowance for that 120-volt branch circuit to supply receptacle outlets located within or at the garage but serving purposes not specifically related to that vehicle bay (e.g., power tools, work benches, ancillary appliances and equipment) or above the 5½-foot height (e.g., garage-door openers) to be not prohibited by the "no other outlets" words. Exception No 2, added to this section last cycle, permissively allows other outlets besides the one receptacle outlet mandated by 210.52(G)(1).

Public Input No. 2575-NFPA 70-2023 [Section No. 210.11(C)(4)]

(4) Garage Branch Circuits.

In addition to the number of branch circuits required by other parts of this section, at least one 120-volt, 20-ampere branch circuit shall be installed to supply receptacle outlets, including those required by 210.52(G)(1) for attached garages and in detached garages with electric power. This circuit shall have no other outlets.

Additional branch circuits rated 15 amperes or greater shall be permitted to serve receptacle outlets other than those required by 210.52(G)(1).

Exception No. 1: This circuit shall be permitted to supply outdoor receptacle outlets.

Exception No. 2: Where the 20-ampere circuit supplies a single vehicle bay garage, outlets for other equipment within the same garage shall be permitted to be supplied in accordance with 210.23(B)~~(1) and (B)(2)~~ .

Statement of Problem and Substantiation for Public Input

The exception references (B)(1) and (B)(2) only and not the parent text of (B). The exception referencing just these two first level subdivisions doesn't make sense. The proposed correction would then permit this branch circuit to include the items that are a part of the parent text of (B). If this is not the intent of the CMP then the exception should be removed.

Submitter Information Verification

Submitter Full Name: Thomas Domitrovich

Organization: Eaton Corporation

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 22 15:03:40 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: FR-7558-NFPA 70-2024

Statement: This revision is made to add clarity that the voltage of bathroom branch circuits is relative to “nominal voltage” cited in 110.4.

This revision is made to add clarity by replacing “outlets for other equipment” by “other outlets” as the restrictions on other equipment within the same garage are sufficiently addressed in 210.23(B). Outlets for luminaires are also covered in 210.23(B).

Public Input No. 2858-NFPA 70-2023 [Section No. 210.11(C)(4)]

(4) Garage Branch Circuits.

In addition to the number of branch circuits required by other parts of this section, at least one 120-volt, 20-ampere branch circuit shall be installed to supply receptacle outlets, including those required by 210.52(G)(1) for attached garages and in detached garages with electric power. This circuit shall have no other outlets.

Additional branch circuits rated 15 amperes or greater shall be permitted to serve receptacle outlets other than those required by 210.52(G)(1).

Exception No. 1: This circuit shall be permitted to supply outdoor receptacle outlets. <u>When a branch circuit supplies a detatched garage, the outdoor receptacle must be supplied from the garage.</u>

Exception No. 2: Where the 20-ampere circuit supplies a single vehicle bay garage, outlets for other equipment within the same garage shall be permitted to be supplied in accordance with 210.23(B)(1) and (B)(2).

Statement of Problem and Substantiation for Public Input

For enforcement reasons, the exception would allow for multiple exterior receptacles on a dwelling unit to be supplied with the garage 20-amp branch circuit and then routed to a detached garage. The revised language would require the branch circuit to be extended to the detached garage first, and then supply the outdoor receptacles.

Submitter Information Verification

Submitter Full Name:	Dean Hunter
Organization:	Minnesota Department of Labor
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Fri Aug 25 15:41:05 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: Public Input 2858 results in correlation issues. Article 210 addresses the wiring of a branch circuit within or at the detached garage. Where branch circuits run between buildings (i.e., between the dwelling and a detached garage), however, those requirements fall within the scope of Article 225. From a dwelling to a detached garage, the Submitter’s objective is already mandated by 225.30 and by existing 210.11(C)(4) Exception 1 for receptacle outlets of the load side of one outdoor branch circuit, multiwire or not, or of multiple branch circuits from one outdoor feeder. Further, the proposed language effectively the 20 A garage branch circuit to supplying only outdoor receptacles in the same garage.

Public Input No. 483-NFPA 70-2023 [Section No. 210.11(C)(4)]

(4) Garage Branch Circuits.

In addition to the number of branch circuits required by other parts of this section, at least one 120-volt, 20-ampere branch circuit shall be installed to supply receptacle outlets, including those required by 210.52(G)(1) for attached garages and in detached garages with electric power. This circuit shall have no other outlets.

Additional branch circuits rated 15 amperes or greater shall be permitted to serve receptacle outlets other than those required by 210.52(G)(1).

Exception No. 1: This circuit shall be permitted to supply outdoor receptacle outlets.

Exception No. 2: Where the 20-ampere circuit supplies a single vehicle bay garage, outlets for other equipment or luminaires within the same garage shall be permitted to be supplied in accordance with 210.23(B)(1) and (B)(2).

Statement of Problem and Substantiation for Public Input

Allowing luminaires on the 20 amp branch circuit to single bay garages, especially detached garages, eliminates the need for a 2nd circuit to supply the normally limited load of a luminaire.
In practice, most single bay detached garages have been supplied by only one circuit for years with no adverse effects.

Submitter Information Verification

Submitter Full Name: a Bryan
Organization: State Of Tennessee Inspector (retired)
Street Address:
City:
State:
Zip:

Submittal Date: Fri Mar 17 14:34:18 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7558-NFPA 70-2024

Statement: This revision is made to add clarity that the voltage of bathroom branch circuits is relative to “nominal voltage” cited in 110.4.

This revision is made to add clarity by replacing “outlets for other equipment” by “other outlets” as the restrictions on other equipment within the same garage are sufficiently addressed in 210.23(B). Outlets for luminaires are also covered in 210.23(B).

Public Input No. 1230-NFPA 70-2023 [Section No. 210.12]

210.12 Arc-Fault Circuit-Interrupter Protection.

Arc-fault circuit-interrupter (AFCI) protection shall be installed in accordance with 210.12(B) through (E) by any of the means described in 210.12(A)~~(1) through (A)(6)~~ . The AFCI shall be listed and installed in a readily accessible location.

(A) Means of Protection.

AFCI protection shall be provided by any of the following means:

(1) A listed combination-type AFCI installed~~ to provide protection ~~ at the origin of the ~~entire~~ branch circuit to protect the entire branch circuit .

(2) A listed branch/feeder-type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet box, which shall be marked to indicate that it is the first outlet of the branch circuit.

(3) A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet box if all of the following conditions are met:

  (4) The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.

  (5) The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.

  (6) The first outlet box shall be marked to indicate that it is the first outlet of the branch circuit.

(7) A listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet in combination with a listed branch-circuit overcurrent protective device if all of the following conditions are met:

  (8) The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.

  (9) The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.

  (10) The first outlet box shall be marked to indicate that it is the first outlet of the branch circuit.

  (11) The combination of the branch-circuit overcurrent device and outlet branch-circuit AFCI shall be identified as meeting the requirements for a system combination-type AFCI and listed as such.

(12) If metal raceway, metal wireways, metal auxiliary gutters, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, metal conduit bodies, and metal enclosures are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, ~~it shall be permitted to install~~ a listed outlet branch-circuit-type ~~AFCI~~ AFCI installed at the first outlet to ~~provide protection for the~~ protect this remaining portion of the branch circuit.

(13) Where a listed metal or nonmetallic conduit or tubing or Type MC cable is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, ~~it shall be permitted to install~~ a listed outlet branch-circuit-type ~~AFCI~~ AFCI installed at the first outlet to ~~provide protection for the~~ protect this remaining portion of the branch circuit.

Informational Note: See UL 1699-2011, *Standard for Arc-Fault Circuit-Interrupters*, for information on combination-type and branch/feeder-type AFCI devices. See UL Subject 1699A, *Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters*, for information on outlet branch-circuit type AFCI devices. See UL Subject 1699C, *Outline of Investigation for System Combination Arc-Fault Circuit Interrupters*, for information on system combination AFCIs.

(B) Dwelling Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Kitchens

(2) Family rooms

(3) Dining rooms

(4) Living rooms

(5) Parlors

(6) Libraries

(7) Dens

(8) Bedrooms

(9) Sunrooms

(10) Recreation rooms

(11) Closets

(12) Hallways

(13) Laundry areas

(14) Similar areas

Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

Informational Note No. 1: See *NFPA 72*-2022, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

(C) Dormitory Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Bedrooms

(2) Living rooms

(3) Hallways

(4) Closets

(5) Bathrooms

(6) Similar rooms

(D) Other Occupancies.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Guest rooms and guest suites of hotels and motels

(2) Areas used exclusively as patient sleeping rooms in nursing homes and limited-care facilities

(3) Areas designed for use exclusively as sleeping quarters in fire stations, police stations, ambulance stations, rescue stations, ranger stations, and similar locations

(E) Branch Circuit Wiring Extensions, Modifications, or Replacements.

If branch-circuit wiring for any of the areas specified in 210.12(B), (C), or (D) is modified, replaced, or extended, the branch circuit shall be protected by one of the following:

(1) By any of the means described in 210.12(A)(1) through (A)(6)

(2) A listed outlet branch-circuit-type AFCI located at the first receptacle outlet of the existing branch circuit

Exception: AFCI protection shall not be required where the extension of the existing branch-circuit conductors is not more than 1.8 m (6 ft) and does not include any additional outlets or devices, other than splicing devices. This measurement shall not include the conductors inside an enclosure, cabinet, or junction box.

Statement of Problem and Substantiation for Public Input

OBJECTIVE: Usability of the Code.

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Presently, 210.12 charging text and 210.12(A) MANDATE that the AFCI protective means be one of the six ALTERNATIVES delineated as list items (1) through (6) of 210.12(A). Four of those possible six means, list items (1) though (4), are properly MANDATORY ALTERNATIVES (e.g., "... shall be provided by ... installed at ..."), but two of those possible six means, list items (5) and (6), are incorrectly shown as PERMISSIVE ALTERNATIVES (e.g., "... it shall be PERMITTED to install ... at ..."). As PERMISSIVE ALTERNATIVES, these two list items (5) and (6) are effectively stated as OPTIONS of USING or NOT USING each of the last two alternatives. In accordance with those list items (5) and (6) being PERMISSIVE ALTERNATIVES rather than MANDATORY ALTERNATIVES, 210.12(A) is indicating that PERMISSIVELY that any AFCI device itself can be outright omitted. NEC® Correlation Committee [NEC-AAC] take note.

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Consequently, list items (5) and (6) should each be reworded as choices of MANDATORY ALTERNATIVES, consistent with the choices of the other four MANDATORY ALTERNATIVE list items of 210.12(A).

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BACKGROUND:

The present mix of MANDATORY ALTERNATIVES and PERMISSIVE ALTERNATIVES of the list items of 210.12(A) violates 2023 NEC® Style Manual 2.1.8.2 for format: "All list items shall have parallel construction." Further, the first four list items are structured as PHRASES, whereas the last two list items are syntactically COMPLETE SENTENCES. As revised in this Public Input, all list items will be structured as PHRASES to comply with 2.1.8.2. NEC® Correlation Committee [NEC-AAC] take note.

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Editorially, because 210.12(A) states that "AFCI protection shall be provided by any of the following means" and is followed by 6 list items as ALTERNATIVES, there is no need in the "parent" text to enumerate redundantly those very same six list items , i.e., not as "... described in 210.12(A)(1) through (A)(6)" but as "... described in 210.12(A)".

.

NOTA BENE: NO REVISIONS WHATSOEVER were made by this Public Input to »list subitems 3a, 3b or 3c« (misidentified as »indented list items 4, 5, and 6«, respectively, or to »list subitems 4a, 4b. 4c or 4d« (misidentified as »indented list items 8, 9, 10 and 11«, respectively, by TerraView). Any underlining or renumbering indicated on any of those list subitems, and any spurious renumbering of subsequent list items were made without my authorization by NFPA's brain-dead excuse of an application program TerraView that NFPA seems to be incapable of remedying.

Submitter Information Verification

Submitter Full Name:	Brian Rock
Organization:	Hubbell Incorporated
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Wed Jun 28 11:50:40 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: FR-8032-NFPA 70-2024

Statement: Editorial changes are made in 2nd level subdivision list items 210.12(A)(5) and (6) to change the language from permissible to mandatory to comply with the parallel construction requirement of Section 2.1.8.2 of the NEC Style Manual.

List item (1) is revised to add the words “at the origin” to ensure that all list items have parallel construction.

Public Input No. 3786-NFPA 70-2023 [Section No. 210.12]

210.12 Arc-Fault Circuit-Interrupter Protection.

Arc-fault circuit-interrupter (AFCI) protection shall be installed in accordance with 210.12(B) through (E) by any of the means described in 210.12(A)(1) through (A)(~~6~~ 7). The AFCI shall be listed and installed in a readily accessible location.

(A) Means of Protection.

AFCI protection shall be provided by any of the following means:

(1) A listed combination-type AFCI installed to provide protection of the entire branch circuit.

(2) A listed branch/feeder-type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet box, which shall be marked to indicate that it is the first outlet of the branch circuit.

(3) A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet box if all of the following conditions are met:

(4) The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.

(5) The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.

(6) The first outlet box shall be marked to indicate that it is the first outlet of the branch circuit.

(7) A listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet in combination with a listed branch-circuit overcurrent protective device if all of the following conditions are met:

(8) The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.

(9) The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.

(10) The first outlet box shall be marked to indicate that it is the first outlet of the branch circuit.

(11) The combination of the branch-circuit overcurrent device and outlet branch-circuit AFCI shall be identified as meeting the requirements for a system combination-type AFCI and listed as such.

(12) If metal raceway, metal wireways, metal auxiliary gutters, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, metal conduit bodies, and metal enclosures are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

(13) Where a listed metal or nonmetallic conduit or tubing or Type MC cable is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

(14) A listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet in combination with a listed branch-circuit overcurrent protective device installed at the service equipment if all of the following conditions are met:

(15)

a. The branch-circuit wiring shall be unspliced and untapped from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.

b. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.

c. The first outlet box is installed on the same floor or level as the room being protected and shall be marked to indicate that it is the first outlet of the branch circuit.

d. The service equipment or enclosure housing the branch circuit overcurrent protective device is located on a different floor or level from the room being protected that reaching the branch circuit overcurrent protective device from the room being protected requires traversing stairs or steps.

Informational Note: See UL 1699-2011, *Standard for Arc-Fault Circuit-Interrupters*, for information on combination-type and branch/feeder-type AFCI devices. See UL Subject 1699A, *Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters*, for information on outlet branch-circuit type AFCI devices. See UL Subject 1699C, *Outline of Investigation for System Combination Arc-Fault Circuit Interrupters*, for information on system combination AFCIs.

(B) Dwelling Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Kitchens

(2) Family rooms

(3) Dining rooms

(4) Living rooms

(5) Parlors

(6) Libraries

(7) Dens

(8) Bedrooms

(9) Sunrooms

(10) Recreation rooms

(11) Closets

(12) Hallways

(13) Laundry areas

(14) Similar areas

Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

Informational Note No. 1: See *NFPA 72*-2022, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

(C) Dormitory Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Bedrooms

(2) Living rooms

(3) Hallways

(4) Closets

(5) Bathrooms

(6) Similar rooms

(D) Other Occupancies.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Guest rooms and guest suites of hotels and motels

(2) Areas used exclusively as patient sleeping rooms in nursing homes and limited-care facilities

(3) Areas designed for use exclusively as sleeping quarters in fire stations, police stations, ambulance stations, rescue stations, ranger stations, and similar locations

(E) Branch Circuit Wiring Extensions, Modifications, or Replacements.

If branch-circuit wiring for any of the areas specified in 210.12(B), (C), or (D) is modified, replaced, or extended, the branch circuit shall be protected by one of the following:

(1) By any of the means described in 210.12(A)(1) through (A)(6)

(2) A listed outlet branch-circuit-type AFCI located at the first receptacle outlet of the existing branch circuit

Exception: AFCI protection shall not be required where the extension of the existing branch-circuit conductors is not more than 1.8 m (6 ft) and does not include any additional outlets or devices, other than splicing devices. This measurement shall not include the conductors inside an enclosure, cabinet, or junction box.

Additional Proposed Changes

File Name	Description	Approved
PI_3786_210.12_A_.docx	Public Input in Word showing correct formatting	

Statement of Problem and Substantiation for Public Input

This proposal is intended to reduce the hazard risks associated with maintenance and operation of AFCIs by reducing the risk of slips and falls associated with traversing stairs, reducing opportunities for leaving children unattended, and eliminating both remote and unattended/unintended operation of household appliances.

From 2017 to 2021, there was a 25% increase in death and injuries from falls in homes, with stairs being the most dangerous location and responsible for 23% of the fatalities, according to the National Safety Council. For the US in 2021, there were 29,100 deaths and 3 million injuries treated in hospital emergency facilities that were attributed to falls in the homes. Over 25,000 of the deaths were adults aged 65 and older. Overall, falls among adults aged 65 and older cost over $50 billion annually. Death and injuries due to electrical fires, and specifically branch circuit wiring, were numbered at 20 and 50 annually, according to NFPA's most recent Electrical Fires report.

AFCIs and GFCIs, as part of recommended routine safety checks and maintenance, should be tested monthly, which requires going back and forth between the load center and the areas being protected in order to accurately confirm the electronics and switching contacts are functioning properly to turn off power when called upon. Additional travels, by both homeowners and electricians, are expected due to nuisance trips with loads such as treadmill, game consoles, kitchen appliances, almost exclusively plug-in loads on receptacle branch circuits, as we continue to receive reports of nuisance trips. According to a follow-up survey of contactors that responded to the East Carolina University survey, previously conducted in 2020, they are still facing at least one nuisance tripping issue in 33% of the jobs involving AFCIs, with 18% being two or more issues requiring two or more call backs.

ESFI, in 2022, published a survey of 100 Massachusetts electrical contractors that showed a similar trend, with approximately 30% of the service calls involving either AFCI, GFCI, or Dual-Function AFCI/GFCI breakers, totaling over 38,000 calls a year. The survey also noted that approximately 4% of all circuit breaker related calls involved defective devices.

For multi-level dwelling units with load centers located in the basement, garages, or outdoors, it is not hard to conclude that more back and forth between the load center and the areas being protected means increased likelihood of slips and falls on the stairs, often times fatal events for the elderly population, a demographic we all hope to eventually become a part of.

Kitchens, bedrooms, family rooms, living rooms, dens, recreation rooms are locations requiring AFCI protection. These are the most common rooms that young children play in. According to the CDC, about 2,000 children ages 14 and under die each year because of a home injury caused by fire and burns, suffocation, drowning, falls, choking and more. Parents shall not be forced to leave their children unattended or unsupervised in the middle of cooking or during play/game time to reset a nuisance tripped AFCI breaker a floor or two down in the basement, garage or even outdoors.

With kitchen appliances accounting for the majority of reported AFCI unwanted tripping events and the fact that the kitchen is the only location requiring both AFCI and GFCI protection, it is not surprising to learn, from the recent survey, that nearly 2 out of 3 (63%) of the electrical contractors that responded to the East Carolina University survey reported personal or customer experience of resetting an AFCI or GFCI breaker that resulted in a plugged-in appliance, such as a blender, food processor, stove, toaster oven, garbage disposal, immediately starting back up again. According to NFPA research, unattended equipment is a factor in one-third of reported home cooking fires and over half of the associated deaths.

This proposed alternate method of providing AFCI protection is limited to receptacle branch circuits where most of the nuisance tripping loads/utilization equipment are connected to, based on available data. It is further restricted to receptacle branch circuits serving areas located on different levels as the load center. This represents a practical and sensible way to minimize trips up and down stairs, such as going from a second-floor bedroom to the basement load center, as well as leaving young children unattended or unsupervised for extended time, without mandating subpanels on each floor.

The purpose of the NEC is the practical safeguarding of persons and property from hazards arising from the use of electricity. CMP 2 had adhered to this purpose as demonstrated by the passing of SR 8090 for NEC 2023 that removed the countertop receptacle mandate in attempt to reduce physical injuries caused by or associated with kitchen appliance cords. The committee based the decision on CPSC data set of 45 anecdotal reports of burn/other injuries and estimated 9,700 burn/other injuries treated in US hospital emergency departments over the 30-year span from Jan 1991 through 2020.

CMP 2 is urged again to adhere to the NEC's practical safeguard principle and support this proposal in a joined effort to reduce OVERALL deaths and injuries in the home, across all ages from newborns to elderly. Human-life saving devices shall never be the cause of human deaths and injuries.

Submitter Information Verification

Submitter Full Name:	Frank Tse
Organization:	Hubbell Incorporated
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Tue Sep 05 16:18:49 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The NEC is not a design guide, and it is up to the designer to address the location of panelboards (load centers) in relation to AFCI protected areas. Accessibility concerns are better addressed in accessibility standards and not the NEC.

Public Input No. 3786-NFPA 70-2023 [Section No. 210.12(A)]

(A) Means of Protection.

AFCI protection shall be provided by any of the following means:

(1) A listed combination-type AFCI installed to provide protection of the entire branch circuit.

(2) A listed branch/feeder-type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet box, which shall be marked to indicate that it is the first outlet of the branch circuit.

(3) A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet box if all of the following conditions are met:

a. The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.

b. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.

c. The first outlet box shall be marked to indicate that it is the first outlet of the branch circuit.

(4) A listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet in combination with a listed branch-circuit overcurrent protective device if all of the following conditions are met:

a. The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.

b. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.

c. The first outlet box shall be marked to indicate that it is the first outlet of the branch circuit.

d. The combination of the branch-circuit overcurrent device and outlet branch-circuit AFCI shall be identified as meeting the requirements for a system combination-type AFCI and listed as such.

(5) If metal raceway, metal wireways, metal auxiliary gutters, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, metal conduit bodies, and metal enclosures are installed for the portion of the branch circuit between

the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

(6) Where a listed metal or nonmetallic conduit or tubing or Type MC cable is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

(7) A listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet in combination with a listed branch-circuit overcurrent protective device installed at the service equipment if all of the following conditions are met:

a. The branch-circuit wiring shall be unspliced and untapped from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.

b. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.

c. The first outlet box is installed on the same floor or level as the room being protected and shall be marked to indicate that it is the first outlet of the branch circuit.

d. The service equipment or enclosure housing the branch circuit overcurrent protective device is located on a different floor or level from the room being protected that reaching the branch circuit overcurrent protective device from the room being protected requires traversing stairs or steps.

Informational Note: See UL 1699-2011, *Standard for Arc-Fault Circuit-Interrupters*, for information on combination-type and branch/feeder-type AFCI devices. See UL Subject 1699A, *Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters*, for information on outlet branch-circuit type AFCI devices. See UL Subject 1699C, *Outline of Investigation for System Combination Arc-Fault Circuit Interrupters*, for information on system combination AFCIs.

Public Input No. 4163-NFPA 70-2023 [Section No. 210.12]

210.12 Arc-Fault Circuit-Interrupter Protection.

Arc-fault circuit-interrupter (AFCI) protection shall be installed in accordance with 210.12(B) through (E) by any of the means described in 210.12(A)(1) through (A)(6). The AFCI shall be listed and installed in a readily accessible location.

(A) Means of Protection.

AFCI protection shall be provided by any of the following means:

(1) A listed combination-type AFCI installed to provide protection of the entire branch circuit.

(2) A listed branch/feeder-type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet box, which shall be marked to indicate that it is the first outlet of the branch circuit.

(3) A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet box if all of the following conditions are met:

(4) <u>The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.</u>

(5) <u>The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.</u>

(6) <u>The first outlet box shall be marked to indicate that it is the first outlet of the branch circuit.</u>

(7) A listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet in combination with a listed branch-circuit overcurrent protective device if all of the following conditions are met:

(8) <u>The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.</u>

(9) <u>The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.</u>

(10) <u>The first outlet box shall be marked to indicate that it is the first outlet of the branch circuit.</u>

(11) <u>The combination of the branch-circuit overcurrent device and outlet branch-circuit AFCI shall be identified as meeting the requirements for a system combination-type AFCI and listed as such.</u>

(12) If metal raceway, metal wireways, metal auxiliary gutters, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, metal conduit bodies, and metal enclosures are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

(13) Where a listed metal or nonmetallic conduit or tubing or Type MC cable is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

Informational Note: See UL 1699-2011, *Standard for Arc-Fault Circuit-Interrupters*, for information on combination-type and branch/feeder-type AFCI devices. See UL Subject 1699A, *Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters*, for information on outlet branch-circuit type AFCI devices. See UL Subject 1699C, *Outline of Investigation for System Combination Arc-Fault Circuit Interrupters*, for information on system combination AFCIs.

(B) Dwelling Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in ~~the following locations~~ dwelling units shall be protected by any of the means described in 210.12(A)(1) through (A)(6)~~:~~

(1) ~~Kitchens~~

(2) ~~Family rooms~~

(3) ~~Dining rooms~~

(4) ~~Living rooms~~

(5) ~~Parlors~~

(6) ~~Libraries~~

(7) ~~Dens~~

(8) ~~Bedrooms~~

(9) ~~Sunrooms~~

(10) ~~Recreation rooms~~

(11) ~~Closets~~

(12) ~~Hallways~~

(13) ~~Laundry areas~~

(14) ~~Similar areas~~

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Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

~~*Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.*~~

Informational Note No. 1: See *NFPA 72*-2022, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

(C) Dormitory Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Bedrooms

(2) Living rooms

(3) Hallways

(4) Closets

(5) Bathrooms

(6) Similar rooms

(D) Other Occupancies.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Guest rooms and guest suites of hotels and motels

(2) Areas used exclusively as patient sleeping rooms in nursing homes and limited-care facilities

(3) Areas designed for use exclusively as sleeping quarters in fire stations, police stations, ambulance stations, rescue stations, ranger stations, and similar locations

(E) Branch Circuit Wiring Extensions, Modifications, or Replacements.

If branch-circuit wiring for any of the areas specified in 210.12(B), (C), or (D) is modified, replaced, or extended, the branch circuit shall be protected by one of the following:

(1) By any of the means described in 210.12(A)(1) through (A)(6)

(2) A listed outlet branch-circuit-type AFCI located at the first receptacle outlet of the existing branch circuit

Exception: AFCI protection shall not be required where the extension of the existing branch-circuit conductors is not more than 1.8 m (6 ft) and does not include any additional outlets or devices, other than splicing devices. This measurement shall not include the conductors inside an enclosure, cabinet, or junction box.

Statement of Problem and Substantiation for Public Input

AFCIs have been required in the Code for more than 24 years.
NEC 1999 required AFCIs for bedroom receptacle outlets, giving installers an opportunity to gain experience with what was at that time a new product, and manufacturers to address any unforeseen problems with their designs.
NEC 2002 expanded AFCIs to include all bedroom outlets.
NEC 2008 expanded once again to include bedrooms, family rooms, living rooms, parlors, libraries, dens, sun rooms, recreation rooms or similar rooms.
NEC 2014 expanded to kitchens, laundry areas and devices located in the specified areas as well as dormitory units expanding the areas for these dormitory units to bathrooms.
NEC 2017 expanded to guest rooms and guest suites of hotels and motels
NEC 2020 expanded to patient sleeping rooms in nursing homes and limited-care facilities
NEC 2023 continued the expansion beyond dwelling units to include areas designed for use exclusively as sleeping quarters in fire stations, police stations, ambulance stations, rescue stations, ranger stations, and similar locations

By the time the 2026 edition is published, the NEC will have included AFCI requirements for over 27 years.

AFCIs are making a difference. Electrical fires are trending down in a market where new home construction has been growing and existing housing stock is getting older. The NFPA reports that Home Fires Involving Electrical Failure or Malfunction by Year from 1980–2019 are on a downward trend. AFCIs and other important aspects of NEC requirements play a key role in reducing the likelihood of electrical fires in these structures. There are zero reported electrical fires on AFCI protected circuits.

In a current residence, between AFCI and GFCI most of the circuits are already protected by AFCIs or GFCIs. Accepting this public input would complete the journey for protection and ensure that these applications of 15A and 20A circuits are not the source of electrical fires found in statistics.

The NFPA reports that fire departments responded to an estimated average of 46,700 home fires involving electrical failure or malfunction each year in 2015–2019. These fires caused an estimated average of 390 civilian deaths and 1,330 civilian injuries each year in 2015–2019, as well as an estimated $1.5 billion in direct property damage a year. Electrical failures or malfunctions were the second leading cause of electrical home fires in 2015–2019 accounting for 13% of home structure fires. Three in ten fires (30%) involving electrical failure or malfunction occurred in the cold weather months from November through February. And finally, arcing served as the heat source in over three in five fires (63%) of home fires involving an electrical failure or malfunction in 2015–2019.

Accepting this public input will make a difference in electrical safety.

another item that this public input addresses is the removal of the exception as the date of the NEC is later than the expiration date of the exception.

Submitter Information Verification

Submitter Full Name:	Thomas Domitrovich
Organization:	Eaton Corporation
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Wed Sep 06 19:10:15 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: CMP-2 has continued to expand the use of AFCIs but not to all areas requested by the submitter. Substantiation to include garages is needed. Exception No. 2 is retained to address incompatibility concerns. Welding equipment could be used in areas, other than garages, that require AFCI protection.

Public Input No. 4276-NFPA 70-2023 [Section No. 210.12]

210.12 Arc-Fault Circuit-Interrupter Protection.

Arc-fault circuit-interrupter (AFCI) protection shall be installed in accordance with 210.12(B) through (~~E~~ F) by any of the means described in 210.12(A)(1) through (A)(6). The AFCI shall be listed and installed in a readily accessible location.

(A) Means of Protection.

AFCI protection shall be provided by any of the following means:

(1) A listed combination-type AFCI installed to provide protection of the entire branch circuit.

(2) A listed branch/feeder-type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet box, which shall be marked to indicate that it is the first outlet of the branch circuit.

(3) A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet box if all of the following conditions are met:

(4) The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.

(5) The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.

(6) The first outlet box shall be marked to indicate that it is the first outlet of the branch circuit.

(7) A listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet in combination with a listed branch-circuit overcurrent protective device if all of the following conditions are met:

(8) The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.

(9) The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.

(10) The first outlet box shall be marked to indicate that it is the first outlet of the branch circuit.

(11) The combination of the branch-circuit overcurrent device and outlet branch-circuit AFCI shall be identified as meeting the requirements for a system combination-type AFCI and listed as such.

(12) If metal raceway, metal wireways, metal auxiliary gutters, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, metal conduit bodies, and metal enclosures are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

(13) Where a listed metal or nonmetallic conduit or tubing or Type MC cable is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

Informational Note: See UL 1699-2011, *Standard for Arc-Fault Circuit-Interrupters*, for information on combination-type and branch/feeder-type AFCI devices. See UL Subject 1699A, *Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters*, for information on outlet branch-circuit type AFCI devices. See UL Subject 1699C, *Outline of Investigation for System Combination Arc-Fault Circuit Interrupters*, for information on system combination AFCIs.

(B) Dwelling Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Kitchens

(2) Family rooms

(3) Dining rooms

(4) Living rooms

(5) Parlors

(6) Libraries

(7) Dens

(8) Bedrooms

(9) Sunrooms

(10) Recreation rooms

(11) Closets

(12) Hallways

(13) Laundry areas

(14) Similar areas

Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

Informational Note No. 1: See *NFPA 72*-2022, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

(C) Dormitory Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Bedrooms

(2) Living rooms

(3) Hallways

(4) Closets

(5) Bathrooms

(6) Similar rooms

(D) Other Occupancies.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Guest rooms and guest suites of hotels and motels

(2) Areas used exclusively as patient sleeping rooms in nursing homes and limited-care facilities

(3) Areas designed for use exclusively as sleeping quarters in fire stations, police stations, ambulance stations, rescue stations, ranger stations, and similar locations

(E) DC circuits.

All dc branch circuits greater than 30 V dc supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1), (A)(2), (A)(5) and (A)(6) or a listed device providing arc-fault protection equivalent to an AFCI:

(1) Branch circuits supplying dwelling units installed in locations as specified in 210.12(B)(1) through (B)(14)

(2) Branch circuits supplying dormitory units installed in locations as specified in 210.12(C)(1) through (C)(6)

(3) Branch circuits supplying other occupancies installed in locations as specified in 210.12(D)(1) through (D)(3)

Exception: AFCI protection is not required for a Class 2, Class 3, Class 4 or communications circuit.

(F) Branch Circuit Wiring Extensions, Modifications, or Replacements.

If branch-circuit wiring for any of the areas specified in 210.12(B), (C), ~~or~~ (D) or (E) is modified, replaced, or extended, the branch circuit shall be protected by one of the following:

(1) By any of the means described in 210.12(A)(1) through (A)(6) for ac circuits

(2) By any of the means described in 210.12(A)(1), (A)(2), (A)(5) and (A)(6) for dc circuits

(3) A listed outlet branch-circuit-type AFCI located at the first receptacle outlet of the existing branch circuit

Exception: AFCI protection shall not be required where the extension of the existing branch-circuit conductors is not more than 1.8 m (6 ft) and does not include any additional outlets or devices, other than splicing devices. This measurement shall not include the conductors inside an enclosure, cabinet, or junction box.

Additional Proposed Changes

File Name	Description	Approved
Revisions_for_210.12.pdf	Revisions for 210.12	

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee DC Task Group consisting of Danish Zia, Jason Fisher, Randy Dollar, Larry Wildermuth, Scott Higgins, Scott Harding, Mark Earley, Jason Hopkins, Christopher Vance, Chad Kennedy and Derrick Atkins. This Public Input, along with other Public Inputs, was developed with the goal of improving usability and accuracy on requirements associated with DC circuits.

DC residential and commercial installations are emerging in the electrical infrastructure and are expected to be a growing alternative to the traditional AC only utility fed building. Examples include the US DOE Grid-interactive Efficient Buildings project (Note 1), the Purdue University RENEWW house (Note 2), and a DC Microgrid community in Vermont (Note 3). These installations may involve buildings that are distributed entirely with DC, or with an AC/DC hybrid distribution.

The requirements of Section 210.12 are intended to provide protection from arcing faults which can result in fires in areas occupied by personnel. However, the requirements are currently applied to AC circuits only, even though the potential for arcing faults also exist in DC circuits and the hazards may be more significant due to the lack of a zero crossing in DC waveforms. As there is continued expansion of DC throughout the electrical infrastructure it is necessary to ensure the same level of protection is provided from arcing faults occurring in these locations. This proposal closes a gap in the Code for DC circuits where similar hazards exist but arc fault circuit interrupter protection may not be provided for the same locations currently addressed in 210.12. The options of utilizing 210.12(A)(3) and 210.12(A)(4) are specifically omitted for DC circuits as these options are based specifically on calculations of wire size and available fault current at the panel, and would require further investigation to determine suitability. An exception is also provided for a Class 2, Class 3, Class 4 or communications circuit as the risk of initiation of fire for these are addressed in Chapter 7 and 8.

Note 1 - https://www.energy.gov/sites/default/files/2020/09/f79/bto-geb-project-summary-093020.pdf
Note 2 - https://engineering.purdue.edu/ME/News/2022/purdue-house-runs-entirely-on-dc-power
Note 3 - https://www.efficiencyvermont.com/Media/Default/docs/white-papers/Energy_Resilience.pdf

Additional note - No changes are being made to 210.12(A)(3) or 210.12(A)(4) and any changes shown are due to TerraView formatting issues. See attached document for changes proposed.

Submitter Information Verification

Submitter Full Name: Danish Zia
Organization: UL Solutions
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 09:16:53 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Despite the merits of providing arc-fault protection for dc circuits, there are currently no listed products commercially available for this purpose.

210.12 Arc-Fault Circuit-Interrupter Protection.
Arc-fault circuit-interrupter (AFCI) protection shall be installed in accordance with 210.12(B) through (~~E~~F) by any of the means described in 210.12(A)(1) through (A)(6). The AFCI shall be listed and installed in a readily accessible location.

(A) Means of Protection.
AFCI protection shall be provided by any of the following means:

- (1) A listed combination-type AFCI installed to provide protection of the entire branch circuit.
- (2) A listed branch/feeder-type AFCI installed at the origin of the branchcircuit in combination with a listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet box, which shall be marked to indicate that it is the first outlet of the branch circuit.
- (3) A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet box if all of the following conditions are met:
  - a. The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.
  - b. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.
  - c. The first outlet box shall be marked to indicate that it is the first outlet of the branch circuit.
- (4) A listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet in combination with a listed branch-circuit overcurrent protective device if all of the following conditions are met:
  - a. The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.
  - b. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.
  - c. The first outlet box shall be marked to indicate that it is the first outlet of the branch circuit.
  - d. The combination of the branch-circuit overcurrent device and outlet branch-circuit AFCI shall be identified as meeting the requirements for a system combination-type AFCI and listed as such.
- (5) If metal raceway, metal wireways, metal auxiliary gutters, or Type MC or Type AC cable meeting the applicable requirements of **250.118**, with metal boxes, metal conduit bodies, and metal enclosures are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.
- (6) Where a listed metal or nonmetallic conduit or tubing or Type MC cable is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

Informational Note:
See UL 1699-2011, *Standard for Arc-Fault Circuit-Interrupters*, for information on combination-type and branch/feeder-type AFCI devices. See UL Subject 1699A, *Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters*, for information on outlet branch-circuit type AFCI devices. See UL Subject 1699C, *Outline of Investigation for System Combination Arc-Fault Circuit Interrupters*, for information on system combination AFCIs.

(B) Dwelling Units.
All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in **210.12(A)(1)** through (A)(6):

- (1) Kitchens
- (2) Family rooms
- (3) Dining rooms
- (4) Living rooms
- (5) Parlors
- (6) Libraries
- (7) Dens
- (8) Bedrooms
- (9) Sunrooms
- (10) Recreation rooms
- (11) Closets
- (12) Hallways
- (13) Laundry areas
- (14) Similar areas

*Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with **760.41(B)** or **760.121(B)**. The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of **250.118**, with metal boxes, conduit bodies, and enclosures.*

Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

Informational Note No. 1:

See *NFPA 72*-2022, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2:

See **760.41(B)** and **760.121(B)** for power source requirements for fire alarm systems.

(C) Dormitory Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in **210.12(A)(1)** through (A)(6):

- (1) Bedrooms
- (2) Living rooms
- (3) Hallways
- (4) Closets
- (5) Bathrooms
- (6) Similar rooms

(D) Other Occupancies.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in **210.12(A)(1)** through (A)(6):

- (1) Guest rooms and guest suites of hotels and motels
- (2) Areas used exclusively as patient sleeping rooms in nursing homes and limited-care facilities
- (3) Areas designed for use exclusively as sleeping quarters in fire stations, police stations, ambulance stations, rescue stations, ranger stations, and similar locations

(E) DC circuits.

All dc branch circuits greater than 30 V dc supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1), (A)(2), (A)(5) and (A)(6) or a listed device providing arc-fault protection equivalent to an AFCI:

(1) Branch circuits supplying dwelling units installed in locations as specified in 210.12(B)(1) through (B)(14)

(2) Branch circuits supplying dormitory units installed in locations as specified in 210.12(C)(1) through (C)(6)

(3) Branch circuits supplying other occupancies installed in locations as specified in 210.12(D)(1) through (D)(3)

Exception: AFCI protection is not required for a Class 2, Class 3, Class 4 or communications circuit.

(~~E~~F) Branch Circuit Wiring Extensions, Modifications, or Replacements.

If branch-circuit wiring for any of the areas specified in 210.12(B), (C), ~~or~~ (D) or (E) is modified, replaced, or extended, the branch circuit shall be protected by one of the following:

- (1) By any of the means described in **210.12(A)(1)** through (A)(6) for ac circuits
- (2) By any of the means described in 210.12(A)(1), (A)(2), (A)(5) and (A)(6) for dc circuits
- (~~2~~3) A listed outlet branch-circuit-type AFCI located at the first receptacle outlet of the existing branch circuit

Exception:

AFCI protection shall not be required where the extension of the existing branch-circuit conductors is not more than 1.8 m (6 ft) and does not include any additional outlets or devices, other than splicing devices. This measurement shall not include the conductors inside an enclosure, cabinet, or junction box.

Public Input No. 2794-NFPA 70-2023 [Section No. 210.12(A)]

(A) Means of Protection.

AFCI protection shall be provided by any of the following means:

(1) A listed combination-type AFCI installed to provide protection of the entire branch circuit.

(2) A listed branch/feeder-type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet box, which shall be marked to indicate that it is the first outlet of the branch circuit.

(3) A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet box if all of the following conditions are met:

(4) The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.

(5) The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.

(6) The first outlet box shall be marked to indicate that it is the first outlet of the branch circuit.

(7) A listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet in combination with a listed branch-circuit overcurrent protective device if all of the following conditions are met:

(8) The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.

(9) The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.

(10) The first outlet box shall be marked to indicate that it is the first outlet of the branch circuit.

(11) The combination of the branch-circuit overcurrent device and outlet branch-circuit AFCI shall be identified as meeting the requirements for a system combination-type AFCI and listed as such.

(12)

A listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet in combination with a listed branch-circuit overcurrent protective device installed at the service equipment if all of the following conditions are met:

a. The branch-circuit wiring shall be unspliced and untapped from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.

b. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG copper conductor or 21.3 m (70 ft) for a 12 AWG copper conductor.

c. The first outlet box shall be marked to indicate that it is the first outlet of the branch circuit.

d. The transformer directly supplying the service equipment shall have a minimum rating of 25 kVA .

e. The service conductor from the transformer directly supplying the service equipment shall not be installed in ferro-magnetic conduit.

f. The maximum service conductor length from the transformer directly supplying the service equipment shall not exceed 38 m (125 ft) with minimum 3/0 aluminum conductors or 22.9 m (75 ft) with minimum 1/0 aluminum conductors.

g. The branch-circuit overcurrent protective device shall be a listed single pole thermal- magnetic circuit breaker and shall be located in the service equipment.

h. The branch-circuit overcurrent protective device shall not be a circuit breaker identified as high magnetic trip .

Informational Note: Some manufacturers mark their high magnetic trip circuit breakers as “H” or “HM” and can be found in their product literature.

(13) If metal raceway, metal wireways, metal auxiliary gutters, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, metal conduit bodies, and metal enclosures are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

(14) Where a listed metal or nonmetallic conduit or tubing or Type MC cable is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

Informational Note: See UL 1699-2011, *Standard for Arc-Fault Circuit-Interrupters*, for information on combination-type and branch/feeder-type AFCI devices. See UL Subject 1699A, *Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters*, for information on outlet branch-circuit type AFCI devices. See UL Subject 1699C, *Outline of Investigation for System Combination Arc-Fault Circuit Interrupters*, for information on system combination AFCIs.

Additional Proposed Changes

File Name	Description	Approved
NEC_PI_2794_John_Kovacik_Submission.docx		
Attachment_No._1_-_Utility_Info_Web_Links.docx		
Attachment_No._2_-_Bentley_Systems_Report_8_18_2023.pdf		
Attachment_No._3_-_Expanded_tables_from_Bentley_Report.pdf		

Statement of Problem and Substantiation for Public Input

The only changes proposed are the addition of new 210.12(A)(5) and associated editorial numbering changes. There are no technical changes proposed to 210.12(A)(1) through (4) and existing (5) and (6). Any spurious underlining and renumbering were caused by a problematic Terra. A clean copy of the proposed changes is provided in the attachments.

It is important to have multiple options available to installers for providing arc-fault protection. This Public Input provides a real, and immediately available, alternative with many years of proven service.

In the following substantiation, the term “home run” is defined as the conductor from the overcurrent device to the first outlet in the branch circuit.

PI OVERVIEW
Arc faults are not a new hazard and the proponents of this PI support the use of arc fault detection devices to protect people and property. Although arc faults are not a newly realized hazard, the technology to detect them is relatively new. This detection technology is still evolving along with the electronics used in the devices which supply this protection. Due to this, the proponents of this PI believe that as many valid options as possible should be offered to installers. This option, the OBC AFCI device, is versatile since it can be used regardless of the brand of load center installed in the home. This proposed option requires eight conditions to be met to offer the equivalent level of protection as the other options currently in the Code.

The proposed new 210.12(A)(5) allows an OBC AFCI device that provides an equivalent level of protection to present AFCI requirements. These conditions are based on 2023 Panel member feedback, conservative parameters, and ensure sufficient available fault current to reliably cause a thermal-magnetic circuit breaker to trip for a parallel arc fault. Below, justification for each of the eight conditions is provided.

Conditions (a) through (c) are identical to the first three conditions of existing 210.12(A)(4) (with the exception of editorially changing the word “continuous” to “unspliced and untapped”).

Condition (d) -- a minimum supply service transformer of 25 kVA was chosen to ensure there would be at least 3000A of fault current to magnetically trip the breaker. By adding this requirement, the concern about not having enough fault current at the service to reliably trip a thermal magnetic breaker is addressed. Representatives from utilities, that are members of EEI, have also stated that 25 kVA is the smallest transformer typically installed for new residential developments.

Condition (e) -- since impedance is increased when a ferrous-metal conduit is used, a restriction is included for not allowing the use of ferrous metal conduit with this option.

Condition (f) -- the maximum service conductor length was determined mathematically, based on the size of service conductors used by utilities (1/0 and 3/0 aluminum, according to EEI). Each of the two lengths chosen (75’ and 125’ respectively) would ensure there would be at least 3000A at the service equipment, when used with a minimally sized transformer of 25 kVA.

Condition (g) -- this condition is to limit installation to single-pole 120-volt single-phase branch circuits, safeguarding against the use of two-pole high magnetic trip level circuit breakers that are often used to protect HVAC units; along with not permitting multiwire branch circuits utilizing two-pole breakers. Disallowing high magnetic trip level circuit breakers would ensure tripping at the available fault currents provided by the transformer rating, conduit used, and service conductor sizing described above in (d) through (f).

Condition (h) -- testing was done by UL that confirmed the ability of standard thermal-magnetic breakers to respond to parallel arc faults under the proposed installation option. To enforce the use of this type of breaker, high magnetic type breakers are intentionally called out as prohibited. These UL research reports have been previously submitted and are noted in the reference section.

The informational note has been provided to assist users with understanding and identifying the “high magnetic trip” circuit breakers.

UL’S TECHNICAL CONCERNS ADDRESSED. During the 2023 code cycle, UL stated that all the conditions outlined in this new option (still technically unchanged) addressed any technical concerns they may have had.

OVERVIEW OF CURRENT INSTALLATION OPTIONS. Reviewing the existing installation options in 210.12(A) we see:

Option (1) - This option is predominantly used
Option (2) - This option is commercially unavailable
Option (3) - This option addresses technology that was never brought to the market
Option (4) – This option is continually debated about its commercial availability and viability
Option (5) – This option is a viable option for locations where Type NM wiring is prohibited
Option (6) – This option is to encase the home run in concrete and is impractical for most residential installations

THE “HOME RUN” IS PROTECTED WITH THIS PROPOSED OBC ALTERNATIVE.

Past concerns raised for protection of the home run, for the circuit lengths permitted in the NEC included not having sufficient available fault current at the service to reliably trip a standard thermal-magnetic circuit breaker in the instantaneous range. It was alleged that there would be no protection of the home run, if Type NM-B cable were used, from parallel arc faults since the OBC looks upstream only for series arc faults. The conditions included in the PI code text and the technical substantiation resolves these concerns by providing:

- Series protection for the home run by the AFCI receptacle installed at the first outlet in the branch circuit

- Parallel protection for the home run by the standard thermal magnetic circuit breaker, when installed with the required conditions listed above

- Series/Parallel protection downstream of the first outlet by the AFCI receptacle

DATA TO SUPPORT THIS PUBLIC INPUT.
1. THE OBC OPTION IS EQUIVALENT TO THE EXISTING AFCI BREAKER OPTION, AND IN SOME SITUATIONS, BETTER. New Section 210.12(A)(5), with all its conditions, ensures there is adequate available fault current to trip the branch circuit breaker to protect the home run from a parallel arc fault.

A UL report confirmed 99% reliability of magnetic element tripping (at 300 amps [15-amp breaker] and 350 amps [20-amp breaker] at the conductor lengths proposed in the PI. The calculations with an available fault current of 3000 amps or more demonstrate that the distances chosen will trip the branch circuit breaker greater than 99% of the time. These results are 10% better than the 89% effectiveness of AFCI tripping. Both are cited in UL's report, "Effectiveness of Circuit Breakers in Mitigating Parallel Arcing Faults in the Home Run - Revised 11 January 2012" on page 55 and in Table 10. This OBC option presented in this PI is 10% more reliable.

2. OBC OPTION NECESSARY WHEN INCOMPATIBILITIES (NUISANCE TRIPS) ARISE – POTENTIALLY RESULTING IN REMOVAL OF AFCI BREAKERS. By offering this new option, we are giving installers an alternative to provide safety in case of nuisance tripping in some installations. If incompatibilities arise with an AFCI circuit breaker installation, there needs to be an alternative that will continue to provide equivalent protection when the only currently available option is to replace the AFCI breaker with a standard breaker.

Properly operating equipment does not cause nuisance trips if it is protected solely by a thermal-magnetic circuit breaker. Due to current arc fault detection technology, AFCIs are being tripped due to unusual signatures created by the waveform of some equipment. The interoperability of utilization equipment with the AFCI electronic circuitry seems to be a problem. Unfortunately, in many cases, the solution to tripping due to incompatibility has been to remove the AFCI circuit breaker and to replace it with a thermal-magnetic circuit breaker. The OBC AFCI device provides an alternative to address AFCI Circuit breaker incompatibility. Incompatibilities with an AFCI circuit breaker causing multiple trips could be mitigated by applying the option proposed in this PI.
A. GRANTING WAIVERS IN CANADA TO REMOVE AFCI BREAKERS. When reported problematic tripping cannot be resolved, the Electrical Safety Authority in Ontario, Canada (the most populous Canadian province) grants permission for the replacement of AFCI breakers with thermal-magnetic breakers. This forgoes AFCI protection. Unless the AHJ requires it, there could also be loss of the GFCI protection provided by the original circuit breaker if it were a dual function AFCI/GFCI breaker. The loss of the AFCI protection may be an issue, as the hazards of arc faults still exist. The additional loss of GFCI protection is even more concerning because GFCI protection has a long history of reducing electrical shocks and the resulting injuries or electrocutions. Data collected since 2018 shows the most waivers granted for microwave ovens, washing machines, vacuum cleaners, and TVs. Other exemptions included various appliances and power tools. The installation with the OBC AFCI device (as proposed in this PI) would provide a suitable alternative in this situation.

B. NUISANCE TRIPS. AFCIs are relatively new and still evolving with changes to the electronics in the devices. However, trips due to incompatibilities continue to be a problem that is damaging the credibility of present-day AFCI protection. According to the 2023 East Carolina University study, electrical contractors reported that refrigerators, microwave ovens, dishwashers and vacuum cleaners are the primary culprits that have incompatibilities. Appliances that incorporate power conversion equipment, variable speed motor controllers, switching mode power supplies, soft start equipment, and other similar non-linear power conversion equipment are also associated with frequent nuisance tripping. It is also noted that CMP2 created an exception for AFCIs for arc welders in the 2023 NEC.

THERE IS SUFFICIENT FAULT CURRENT TO PROTECT THE HOME RUN. The issue raised in the past is whether there is sufficient fault current available to reliably protect the home run from parallel faults using a thermal-magnetic circuit breaker. It has been proven that there is sufficient fault current to protect the home run.

This statement is based on the UL report, "Effectiveness of Circuit Breakers in Mitigating Parallel Arcing Faults in the Home Run - Revised 11 January 2012" in the updated version of the Part II report previously issued, in the section entitled, "Probability of Protection" and conclusion. Among other revisions, this final report accounts for higher instantaneous trip currents for present-day standard molded case circuit breakers and added the 20-amp breaker information to the final analysis. The following excerpt is from the conclusions in this report:

"The following observations are now made concerning an ability of a circuit breaker to mitigate a parallel arcing fault in lieu of a panel-mounted AFCI:
New 15 A circuit breakers show magnetic trip levels that are normally distributed around an average value of 213 A, and a standard deviation of 33 A. This suggests that 95% of all 15 A residential breakers will instantaneously trip at or above 278 A, and 99% of all breakers will magnetically trip at or above 299 A. New 20 A circuit breakers showed a mean value of 202 A, with 95% of all 20 A residential breakers instantaneously tripping at or above 314 A, and 99% of all breakers magnetically tripping at or above 349 A."

The circuit breaker trip values of 300 and 350 amps were then taken and applied using the UL formula, provided in the cited report, to determine what would be the required available fault current at the service. This available fault current at the service is based on having the 300 amps for 14 AWG at 50 feet and 350 amps for 12 AWG at 70 feet.

The Outlet Branch Circuit (OBC) device provides series and parallel AFCI protection downstream of the device. In addition, the OBC device can detect an upstream series arc back to the service equipment panelboard; an AFCI circuit breaker is not required to do this, as the circuit breaker AFCIs are only evaluated to look downstream. The OBC can react to a panelboard fire, when the circuit breaker cannot (such as "back-stab" arcing). The OBC would react with a justifiable trip if there is a problem upstream.
SUFFICIENT FAULT CURRENT IS AVAILABLE AT SERVICE FOR THIS OBC OPTION.

Research by UL overwhelmingly indicates that with sufficient fault current at the service, the fault current on residential branch circuits of specified lengths will cause a circuit breaker to trip in its instantaneous range. This is clearly within the required 8 half cycles specified in UL 1699 for AFCI devices. In older installations, there may be very rare instances where the available fault current will not provide enough current to trip a circuit breaker in time to avoid damage. That is extremely unlikely in the construction of new residential neighborhoods, where the electric utility has made the necessary upgrades to their system to accommodate the added load as well as having to meet present federally mandated energy efficiency requirements. Remembering that if this PI is accepted, it applies to new construction only, assuring the available short-circuit current.
One result from the Parks Associates study of 180 homes found the available fault current to be from 1000 to 7000 amperes (Kerber, 2012 p.3). It is noted that this study was done in existing neighborhoods, not necessarily new developments.

According to representatives from the Edison Electric Institute (EEI) with respect to the Energy Policy Act of 2005, "The EPACT 2005 required a higher minimum efficiency for distribution transformers which generally resulted in lower transformer impedance. Therefore, the available fault current in new residential developments is higher than when AFCI protection was originally developed (in 1996 or earlier for the 1999 NEC). This higher available fault current can result in appropriate tripping of a thermal-magnetic circuit breaker on a parallel arc-fault on the home run." Written statements from EEI noted: “The available fault currents in new residential housing developments provide typically over 3000 amperes of fault current which is more than the minimum needed to cause the thermal magnetic breaker to trip with the wire lengths set in the proposed text.”

EEI also added, “The increased power demand due to electric vehicle charging and high efficiency HVAC is requiring higher rated transformers. In addition, the energy efficiency requirements lower the impedance of these transformers. The combination of increased kVA size and reduced impedance results in a significant increase in available fault current at the service.” For example, 25 kVA transformer having a 1.5 percent impedance and supplying eight homes with 200-amp services with 3/0 aluminum service conductor, will have an available fault current of 5,995 amperes at 25 feet and 3,059 amperes at 200 feet from the service equipment.

Research indicates that a magnetic trip element that trips at 300 amps for 15 amp rated and 350 amps for 20 amp rated branch circuits is sufficient to provide parallel arc protection (Brazis et al., 2012). The available fault currents in new residential housing developments provide over 3000 amps of fault current which is more than the minimum needed to cause the thermal-magnetic breaker to trip within the wire lengths set in the proposed text.

What is the expected amount of fault current? In some areas of the country, sales of residential panelboards with a 22 kA short-circuit current rating (SCCR) are being required due to the increased available fault current as discovered in the Parks Associates study for new construction. The higher available fault current increases the ability of the magnetic portion of a thermal-magnetic circuit breaker to detect and react to a parallel arcing fault with the conductor lengths, as proposed in this Public Input. See Attachment 1, Utility information on available fault currents; See Attachment 2 for the Bentley report and data tables that validates the 3000-ampere trip level as previously determined using Eaton/Bussmann software and submitted last code cycle; See Attachment 3 for a document of tables that allow for easier reading of the spreadsheets in the Bentley report.

SUMMARY. This Public Input supports the use of AFCI protection to protect both property and people. This issue has been well researched by UL, concluding that OBC AFCIs provide reliable AFCI protection when used in combination with a common thermal-magnetic circuit breaker within the specified limited home run lengths.

The acceptance of the proposed text will result in increased safety through increased adoption by offering installers a reasonable alternative to AFCI breakers. As has been noted by Panel 2 members, there is more innovation in products developed by having alternatives, and acceptance of this PI adds another safe alternative. This is presented as an additional alternative; if for any reason the AHJ cannot verify any of the required conditions, then the AHJ shall not approve that installation .

REFERENCES
Brazis, P.W., Dini, D.A., He, Fan (2012). Evaluation of Run Length and Available Current on Breaker Ability to Mitigate Parallel Arcing Faults, Part II: Effect of Run Length with 500A Available at the Panelboard. UL, Northbrook, IL, USA.
Brazis, P.W., He, Fan (2012). Effectiveness of Circuit Breakers in Mitigating Parallel Arcing Faults in the Home Run. UL, Northbrook, IL, USA.
Brazis, P.W., He Fan (2012). Effectiveness of Circuit Breakers in Mitigating Parallel Arcing Faults in the Home Run, Revised 11 January 2012
Campbell, R. (2017). Electrical Fires. NFPA, Quincy, MA, USA, Tech Rep. USS12A.
Campbell, R. (2019). Home Electrical Fires. NFPA, Quincy, MA, USA, NFPA No. USS37.
Kerber, T. (2012). Short Circuit Fault Current Study, Parks Associates, Dallas, TX.
Bentley Systems Report, August 18, 2023. Bentley Systems is the provider of the EasyPower™ power system analysis software and provides engineering services using the EasyPower™ software.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3492-NFPA 70-2023 [Section No. 210.12 [Excluding any Sub-Sections]]	The related PI proposes revisions to the charging paragraph for 210.12.
Public Input No. 3492-NFPA 70-2023 [Section No. 210.12 [Excluding any Sub-Sections]]	

Submitter Information Verification

Submitter Full Name:	John Kovacik
Organization:	Trusted Safety Solutions LLC

Affiliation: Arc Fault Circuit Interrupter Wiring Device Joint Research and Development Consortium

Street Address:

City:

State:

Zip:

Submittal Date: Thu Aug 24 23:42:56 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: It is not possible to ensure that all the requirements of this method would always be able to be met or enforced. The protections afforded by this section could be lost if the utility service changed during the life of the installation, changing the impedance. Absence of a marking that is not controlled nor required to be on the circuit breaker inherently leads to a possible misapplication. A circuit breaker that is not marked as high magnetic could have a high instantaneous and not be adequate yet still meet the requirement as written. In addition, the use of the term “high magnetic” is unenforceable and vague. High magnetic to one manufacturer may mean something different to another.

PI 2794 - NFPA 70-2026 [Section 210.12(A)] and Substantiation

210.12 Arc-Fault Circuit-Interrupter Protection. Arc-fault circuit-interrupter (AFCI) protection shall be installed in accordance with 210.12(B) through (E) by any of the means described in 210.12(A) ~~(1) through (A)(6)~~. The AFCI shall be listed and installed in a readily accessible location.

Commented [JK1]: This revision is being proposed in PI 3492.

(A) Means of Protection. AFCI protection shall be provided by any of the following means:

(1) A listed combination-type AFCI installed to provide protection of the entire branch circuit.

(2) A listed branch/feeder-type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet box, which shall be marked to indicate that it is the first outlet of the branch circuit.

(3) A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet box if all of the following conditions are met:

a. The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.
b. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.
c. The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.

(4) A listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet in combination with a listed branch- circuit overcurrent protective device if all of the following conditions are met:

a. The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.
b. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.
c. The first outlet box shall be marked to indicate that it is the first outlet of the branch circuit.
d. The combination of the branch-circuit overcurrent device and outlet branch-circuit AFCI shall be identified as meeting the requirements for a system combination-type AFCI and listed as such.

<u>(5) A listed outlet branch-circuit-type AFCI installed on the branch circuit at the first outlet in combination with a listed branch-circuit overcurrent protective device installed at the service equipment if all of the following conditions are met:</u>

<u>a. The branch-circuit wiring shall be unspliced and untapped from the branch-circuit overcurrent device to the outlet branch-circuit AFCI.</u>

b. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG copper conductor or 21.3 m (70 ft) for a 12 AWG copper conductor.

c. The first outlet box shall be marked to indicate that it is the first outlet of the branch circuit.

d. The transformer directly supplying the service equipment shall have a minimum rating of 25 kVA.

e. The service conductor from the transformer directly supplying the service equipment shall not be installed in ferro-magnetic conduit.

f. The maximum service conductor length from the transformer directly supplying the service equipment shall not exceed 38 m (125 ft) with minimum 3/0 aluminum conductors or 22.9 m (75 ft) with minimum 1/0 aluminum conductors.

g. The branch-circuit overcurrent protective device shall be a listed single pole thermal-magnetic circuit breaker and shall be located in the service equipment.

h. The branch-circuit overcurrent protective device shall not be a circuit breaker identified as high magnetic trip .

Informational Note: Some manufacturers mark their high magnetic trip circuit breakers as “H” or “HM” and can be found in their product literature.

(6)~~(5)~~ If metal raceway, metal wireways, metal auxiliary gutters, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, metal conduit bodies, and metal enclosures are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

(7) ~~(6)~~ Where a listed metal or nonmetallic conduit or tubing or Type MC cable is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

Informational Note: See UL 1699-2011, *Standard for Arc-Fault Circuit Interrupters*, for information on combination-type and branch/feeder-type AFCI devices. See UL Subject 1699A, *Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters*, for information on outlet branch-circuit type AFCI devices. See UL Subject 1699C, *Outline of Investigation for System Combination Arc-Fault Circuit Interrupters*, for information on system combination AFCIs.

STATEMENT OF PROBLEM AND SUBSTANTIATION FOR PUBLIC INPUT.

The only changes proposed are the addition of new 210.12(A)(5) and associated editorial numbering changes. There are no technical changes proposed to 210.12(A)(1) through (4) and existing (5) and (6). Any spurious underlining and renumbering were caused by a problematic Terra. A clean copy of the proposed changes is provided in the attachment.

It is important to have multiple options available to installers for providing arc-fault protection. This Public Input provides a real, and immediately available, alternative with many years of proven service.

In the following substantiation, the term “home run” is defined as the conductor from the overcurrent device to the first outlet in the branch circuit.

PI OVERVIEW
Arc faults are not a new hazard and the proponents of this PI support the use of arc fault detection devices to protect people and property. Although arc faults are not a newly realized hazard, the technology to detect them is relatively new. This detection technology is still evolving along with the electronics used in the devices which supply this protection. Due to this, the proponents of this PI believe that as many valid options as possible should be offered to installers. This option, the OBC AFCI device, is versatile since it can be used regardless of the brand of load center installed in the home. This proposed option requires eight conditions to be met to offer the equivalent level of protection as the other options currently in the Code.

The proposed new 210.12(A)(5) allows an OBC AFCI device that provides an equivalent level of protection to present AFCI requirements. These conditions are based on 2023 Panel member feedback, conservative parameters, and ensure sufficient available fault current to reliably cause a thermal-magnetic circuit breaker to trip for a parallel arc fault. Below, justification for each of the eight conditions is provided.

Conditions (a) through (c) are identical to the first three conditions of existing 210.12(A)(4) (with the exception of editorially changing the word “continuous” to “unspliced and untapped”).

Condition (d) -- a minimum supply service transformer of 25 kVA was chosen to ensure there would be at least 3000A of fault current to magnetically trip the breaker. By adding this requirement, the concern about not having enough fault current at the service to reliably trip a thermal magnetic breaker is addressed. Representatives from utilities, that are members of EEI, have also stated that 25 kVA is the smallest transformer typically installed for new residential developments.

Condition (e) -- since impedance is increased when a ferrous-metal conduit is used, a restriction is included for not allowing the use of ferrous metal conduit with this option.

Condition (f) -- the maximum service conductor length was determined mathematically, based on the size of service conductors used by utilities (1/0 and 3/0 aluminum, according to EEI). Each of the two lengths chosen (75’ and 125’ respectively) would ensure there would be at least 3000A at the service equipment, when used with a minimally sized transformer of 25 kVA.

Condition (g) -- this condition is to limit installation to single-pole 120-volt single-phase branch circuits, safeguarding against the use of two-pole high magnetic trip level circuit breakers that are often used to protect HVAC units; along with not permitting multiwire branch circuits utilizing two-pole breakers. Disallowing high magnetic trip level circuit breakers would ensure tripping at the available fault currents provided by the transformer rating, conduit used, and service conductor sizing described above in (d) through (f).

Condition (h) -- testing was done by UL that confirmed the ability of standard thermal-magnetic breakers to respond to parallel arc faults under the proposed installation option. To enforce the use of this type of breaker, high magnetic type breakers are intentionally called out as prohibited. These UL research reports have been previously submitted and are noted in the reference section.

The informational note has been provided to assist users with understanding and identifying the “high magnetic trip” circuit breakers.

UL’S TECHNICAL CONCERNS ADDRESSED. During the 2023 code cycle, UL stated that all the conditions outlined in this new option (still technically unchanged) addressed any technical concerns they may have had.

OVERVIEW OF CURRENT INSTALLATION OPTIONS. Reviewing the existing installation options in 210.12(A) we see:

Option (1) - This option is predominantly used

Option (2) - This option is commercially unavailable

Option (3) - This option addresses technology that was never brought to the market

Option (4) – This option is continually debated about its commercial availability and viability

Option (5) – This option is a viable option for locations where Type NM wiring is prohibited

Option (6) – This option is to encase the home run in concrete and is impractical for most residential installations

THE “HOME RUN” IS PROTECTED WITH THIS PROPOSED OBC ALTERNATIVE.

Past concerns raised for protection of the home run, for the circuit lengths permitted in the NEC included not having sufficient available fault current at the service to reliably trip a standard thermal-magnetic circuit breaker in the instantaneous range. It was alleged that there would be no protection of the home run, if Type NM-B cable were used, from parallel arc faults since the OBC looks upstream only for series arc faults. The conditions included in the PI code text and the technical substantiation resolves these concerns by providing:

- Series protection for the home run by the AFCI receptacle installed at the first outlet in the branch circuit

- Parallel protection for the home run by the standard thermal magnetic circuit breaker, when installed with the required conditions listed above

- Series/Parallel protection downstream of the first outlet by the AFCI receptacle

DATA TO SUPPORT THIS PUBLIC INPUT.
1. THE OBC OPTION IS EQUIVALENT TO THE EXISTING AFCI BREAKER OPTION, AND IN SOME SITUATIONS, BETTER. New Section 210.12(A)(5), with all its conditions, ensures there is adequate available fault current to trip the branch circuit breaker to protect the home run from a parallel arc fault.

A UL report confirmed 99% reliability of magnetic element tripping (at 300 amps [15-amp breaker] and 350 amps [20-amp breaker] at the conductor lengths proposed in the PI. The calculations with an available fault current of 3000 amps or more demonstrate that the distances chosen will trip the branch circuit breaker greater than 99% of the time. These results are 10% better than the 89% effectiveness of AFCI tripping. Both are cited in UL’s report, “Effectiveness of Circuit Breakers in Mitigating Parallel Arcing Faults in the Home Run - Revised 11 January 2012” on page 55 and in Table 10. This OBC option presented in this PI is 10% more reliable.

2. OBC OPTION NECESSARY WHEN INCOMPATIBILITIES (NUISANCE TRIPS) ARISE – POTENTIALLY RESULTING IN REMOVAL OF AFCI BREAKERS. By offering this new option, we are giving installers an alternative to provide safety in case of nuisance tripping in

some installations. If incompatibilities arise with an AFCI circuit breaker installation, there needs to be an alternative that will continue to provide equivalent protection when the only currently available option is to replace the AFCI breaker with a standard breaker.

Properly operating equipment does not cause nuisance trips if it is protected solely by a thermal-magnetic circuit breaker. Due to current arc fault detection technology, AFCIs are being tripped due to unusual signatures created by the waveform of some equipment. The interoperability of utilization equipment with the AFCI electronic circuitry seems to be a problem. Unfortunately, in many cases, the solution to tripping due to incompatibility has been to remove the AFCI circuit breaker and to replace it with a thermal-magnetic circuit breaker. The OBC AFCI device provides an alternative to address AFCI Circuit breaker incompatibility. Incompatibilities with an AFCI circuit breaker causing multiple trips could be mitigated by applying the option proposed in this PI.

A. GRANTING WAIVERS IN CANADA TO REMOVE AFCI BREAKERS. When reported problematic tripping cannot be resolved, the Electrical Safety Authority in Ontario, Canada (the most populous Canadian province) grants permission for the replacement of AFCI breakers with thermal-magnetic breakers. This forgoes AFCI protection. Unless the AHJ requires it, there could also be loss of the GFCI protection provided by the original circuit breaker if it were a dual function AFCI/GFCI breaker. The loss of the AFCI protection may be an issue, as the hazards of arc faults still exist. The additional loss of GFCI protection is even more concerning because GFCI protection has a long history of reducing electrical shocks and the resulting injuries or electrocutions. Data collected since 2018 shows the most waivers granted for microwave ovens, washing machines, vacuum cleaners, and TVs. Other exemptions included various appliances and power tools. The installation with the OBC AFCI device (as proposed in this PI) would provide a suitable alternative in this situation.

B. NUISANCE TRIPS. AFCIs are relatively new and still evolving with changes to the electronics in the devices. However, trips due to incompatibilities continue to be a problem that is damaging the credibility of present-day AFCI protection. According to the 2023 East Carolina University study, electrical contractors reported that refrigerators, microwave ovens, dishwashers and vacuum cleaners are the primary culprits that have incompatibilities. Appliances that incorporate power conversion equipment, variable speed motor controllers, switching mode power supplies, soft start equipment, and other similar non-linear power conversion equipment are also associated with frequent nuisance tripping. It is also noted that CMP2 created an exception for AFCIs for arc welders in the 2023 NEC.

THERE IS SUFFICIENT FAULT CURRENT TO PROTECT THE HOME RUN. The issue raised in the past is whether there is sufficient fault current available to reliably protect the home run from parallel faults using a thermal-magnetic circuit breaker. It has been proven that there is sufficient fault current to protect the home run.

This statement is based on the UL report, “Effectiveness of Circuit Breakers in Mitigating Parallel Arcing Faults in the Home Run - Revised 11 January 2012” in the updated version of the Part II report previously issued, in the section entitled, “Probability of Protection” and conclusion. Among other revisions, this final report accounts for higher instantaneous trip currents for present-day standard molded case circuit breakers and added the 20-amp breaker information to the final analysis. The following excerpt is from the conclusions in this report:

“The following observations are now made concerning an ability of a circuit breaker to mitigate a parallel arcing fault in lieu of a panel-mounted AFCI:
New 15 A circuit breakers show magnetic trip levels that are normally distributed around an average value of 213 A, and a standard deviation of 33 A. This suggests that 95% of all 15 A residential breakers will instantaneously trip at or above 278 A, and 99% of all breakers will magnetically trip at or above 299 A. New 20 A circuit breakers showed a mean value of 202 A, with 95% of all 20 A residential breakers instantaneously tripping at or above 314 A, and 99% of all breakers magnetically tripping at or above 349 A.”

The circuit breaker trip values of 300 and 350 amps were then taken and applied using the UL formula, provided in the cited report, to determine what would be the required available fault current at the service. This available fault current at the service is based on having the 300 amps for 14 AWG at 50 feet and 350 amps for 12 AWG at 70 feet.

The Outlet Branch Circuit (OBC) device provides series and parallel AFCI protection downstream of the device. In addition, the OBC device can detect an upstream series arc back to the service equipment panelboard; an AFCI circuit breaker is not required to do this, as the circuit breaker AFCIs are only evaluated to look downstream. The OBC can react to a panelboard fire, when the circuit breaker cannot (such as “back-stab” arcing). The OBC would react with a justifiable trip if there is a problem upstream.

SUFFICIENT FAULT CURRENT IS AVAILABLE AT SERVICE FOR THIS OBC OPTION. Research by UL overwhelmingly indicates that with sufficient fault current at the service, the fault current on residential branch circuits of specified lengths will cause a circuit breaker to trip in its instantaneous range. This is clearly within the required 8 half cycles specified in UL 1699 for AFCI devices. In older installations, there may be very rare instances where the available fault current will not provide enough current to trip a circuit breaker in time to avoid damage. That is extremely unlikely in the construction of new residential neighborhoods, where the electric utility has made the necessary upgrades to their system to accommodate the added load as well as having to meet present federally mandated energy efficiency requirements. Remembering that if this PI is accepted, it applies to new construction only, assuring the available short-circuit current.

One result from the Parks Associates study of 180 homes found the available fault current to be from 1000 to 7000 amperes (Kerber, 2012 p.3). It is noted that this study was done in existing neighborhoods, not necessarily new developments.

According to representatives from the Edison Electric Institute (EEI) with respect to the Energy Policy Act of 2005, "The EPACT 2005 required a higher minimum efficiency for distribution transformers which generally resulted in lower transformer impedance. Therefore, the available fault current in new residential developments is higher than when AFCI protection was originally developed (in 1996 or earlier for the 1999 NEC). This higher available fault current can result in appropriate tripping of a thermal-magnetic circuit breaker on a parallel arc-fault on the home run." Written statements from EEI noted: “The available fault currents in new residential housing developments provide typically over 3000 amperes of fault current which is more than the minimum needed to cause the thermal magnetic breaker to trip with the wire lengths set in the proposed text.”

EEI also added, “The increased power demand due to electric vehicle charging and high efficiency HVAC is requiring higher rated transformers. In addition, the energy efficiency requirements lower the impedance of these transformers. The combination of increased kVA size and reduced impedance results in a significant increase in available fault current at the service.” For example, 25 kVA transformer having a 1.5 percent impedance and supplying eight homes with 200-amp services with 3/0 aluminum service conductor, will have an available fault current of 5,995 amperes at 25 feet and 3,059 amperes at 200 feet from the service equipment.

Research indicates that a magnetic trip element that trips at 300 amps for 15 amp rated and 350 amps for 20 amp rated branch circuits is sufficient to provide parallel arc protection (Brazis et al., 2012). The available fault currents in new residential housing developments provide over 3000 amps of fault current which is more than the minimum needed to cause the thermal-magnetic breaker to trip within the wire lengths set in the proposed text.

What is the expected amount of fault current? In some areas of the country, sales of residential panelboards with a 22 kA short-circuit current rating (SCCR) are being required due to the increased available fault current as discovered in the Parks Associates study for new construction. The higher available fault current increases the ability of the magnetic portion of a thermal-magnetic circuit breaker to detect and react to a parallel arcing fault with the conductor lengths, as proposed in this Public Input. See Attachment 1, Utility information on available fault currents; See Attachment 2 for the Bentley report and data tables that validates the 3000-ampere trip level as previously determined using Eaton/Bussmann software and submitted last code cycle; See Attachment 3 for a document of tables that allow for easier reading of the spreadsheets in the Bentley report.

SUMMARY. This Public Input supports the use of AFCI protection to protect both property and people. This issue has been well researched by UL, concluding that OBC AFCIs provide reliable AFCI protection when used in combination with a common thermal-magnetic circuit breaker within the specified limited home run lengths.

The acceptance of the proposed text will result in increased safety through increased adoption by offering installers a reasonable alternative to AFCI breakers. As has been noted by Panel 2 members, there is more innovation in products developed by having alternatives, and acceptance of this PI adds another safe alternative. This is presented as an additional alternative; if for any reason the AHJ cannot verify any of the required conditions, then the AHJ shall not approve that installation .

REFERENCES

Brazis, P.W., Dini, D.A., He, Fan (2012). Evaluation of Run Length and Available Current on Breaker Ability to Mitigate Parallel Arcing Faults, Part II: Effect of Run Length with 500A Available at the Panelboard. UL, Northbrook, IL, USA.

Brazis, P.W., He, Fan (2012). Effectiveness of Circuit Breakers in Mitigating Parallel Arcing Faults in the Home Run. UL, Northbrook, IL, USA.

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Campbell, R. (2017). Electrical Fires. NFPA, Quincy, MA, USA, Tech Rep. USS12A.

Campbell, R. (2019). Home Electrical Fires. NFPA, Quincy, MA, USA, NFPA No. USS37.

Kerber, T. (2012). Short Circuit Fault Current Study, Parks Associates, Dallas, TX.

Bentley Systems Report, August 18, 2023. Bentley Systems is the provider of the EasyPower™ power system analysis software and provides engineering services using the EasyPower™ software.

Attachment No. 1

The following are website links to utility information on available fault currents

Utility Name	Website link where available fault current found
Alabama Power	https://www.alabamapower.com/content/dam/alabamapower/Business/Services%20by%20Industry/ Architects%20%26%20Engineers/A-E-Fault-Currents-Tables-FINAL-8-2003.pdf
Arizona Public Service	https://www.aps.com/-/media/APS/APSCOM-PDFs/About/Construction-and-Power-Line-Siting/Construction-Services/Electric-Service-Requirements-Manual/800.ashx?la=en&hash=02E41D48D3C806F22B3FBE177CF83ED9
Austin Energy	https://austinenergy.com/wcm/connect/ae/ae/contractors/electric-service-design-and-planning/other-resources/transformer-fault-current-tables
Detroit Edison	https://newlook.dteenergy.com/wps/wcm/connect/dte-web/quicklinks/landing-pages-temp/builders-electric/electric-service
Duke Energy	http://www.swohioiaei.org/files/Utilities/Ohio_Metering_Installations_Red_Book_2019.pdf
Minnesota Power	https://www.mnpower.com/Content/Documents/CustomerService/ConstructionCenter/short-circuit-currents.pdf
National Grid	https://www.nationalgridus.com/media/pronet/constr_esb750.pdf
NV Energy	https://www.nvenergy.com/publish/content/dam/nvenergy/brochures_arch/account-services/building-and-new-construction/electric-service-standards-south/re/ESRNPC-RE010-REV00.pdf
Omaha Public Power	https://www.oppd.com/media/250383/max-fault-currents-for-padmounted-transformers.pdf
Snohomish County PUD	https://www.snopud.com/Site/Content/Documents/esr/DT_impedance-fault_418.pdf

Notes:

1) For Alabama Power the link has a line break put in as the overall link will not fit on the page.
2) For some of these sites you get a large service requirements manual then have to go to the right section or table for the information.
3) For Detroit Edison on the web site there are expansion links and the bottom one is for “Transformer Impedances” where I downloaded the table that was used.

A Memo for:

The Arc Fault Circuit Interrupter Wiring Device Joint Research and Development Consortium

»»» *Single-phase Short Circuit Calculations*

August 18, 2023

Mr. Eric J. Munoz
The Arc Fault Circuit Interrupter Wiring Device Joint Research and Development Consortium ("AFCI Consortium")
55 E. Monroe Street, Suite 3440
Chicago, IL 60603

Dear Eric,

INTRODUCTION

Bentley Systems (Bentley) was asked to perform single-phase short calculations to aid the AFCI Consortium in their comment process for the latest revision to NFPA 70 National Electrical Code (NEC). Specifically, AFCI Consortium is interested in comparing single-phase short circuit calculations performed using the EasyPower® software on the secondary sides of service entrance transformers of varying impedances and secondary cable lengths/sizes with results obtained using the point-point short circuit calculation procedure. Figure 1 shows an example of the EasyPower® software one-line diagram used for single-phase short circuit calculations.

CRITICAL NOTES AND ASSUMPTIONS

The following apply to the analytical study results included with this memo:

- Infinite bus utility source impedance assumed (100,000 MVA with X/R = 150).
- Pre-fault bus voltages were 1.0 p.u. for all short circuit calculations.
- All service entrance transformer secondary cables were modeled as aluminum conductor installed in PVC conduit, except for selected steel conduit short circuit cases contained in Table 1.

ANALYSIS AND RESULTS

Attached to this memo is an Excel printout containing the results of single-phase short circuit calculations performed using the EasyPower® software compared against similar values obtained using the point-point short circuit calculation procedure. A native copy of the Excel file will be provided as an addendum to this memo. Additionally, Table 1 below compares single-phase short circuit calculations performed at the service conductor end for one (1) utility service entrance transformer configuration, with the service conductor raceway material changed from PVC conduit to steel conduit. The intent of Table 1 is to illustrate the impact of raceway material on single-phase short circuit calculations performed at the end of the service entrance cables due to inductive coupling between the cable and raceway material.

TABLE 1: COMPARISON OF SERVICE ENTRANCE SINGLE-PHASE SHORT CIRCUIT CALCULATIONS - PVC VS STEEL CONDUIT

Configuration	PVC Conduit – LL	Steel Conduit – LL	PVC Conduit – LN	Steel Conduit - LN
Z=1.0% @ 75 kVA 200 ft. 3/0 AWG	4,471 amps	4,373 amps	2,404 amps	2,357 amps

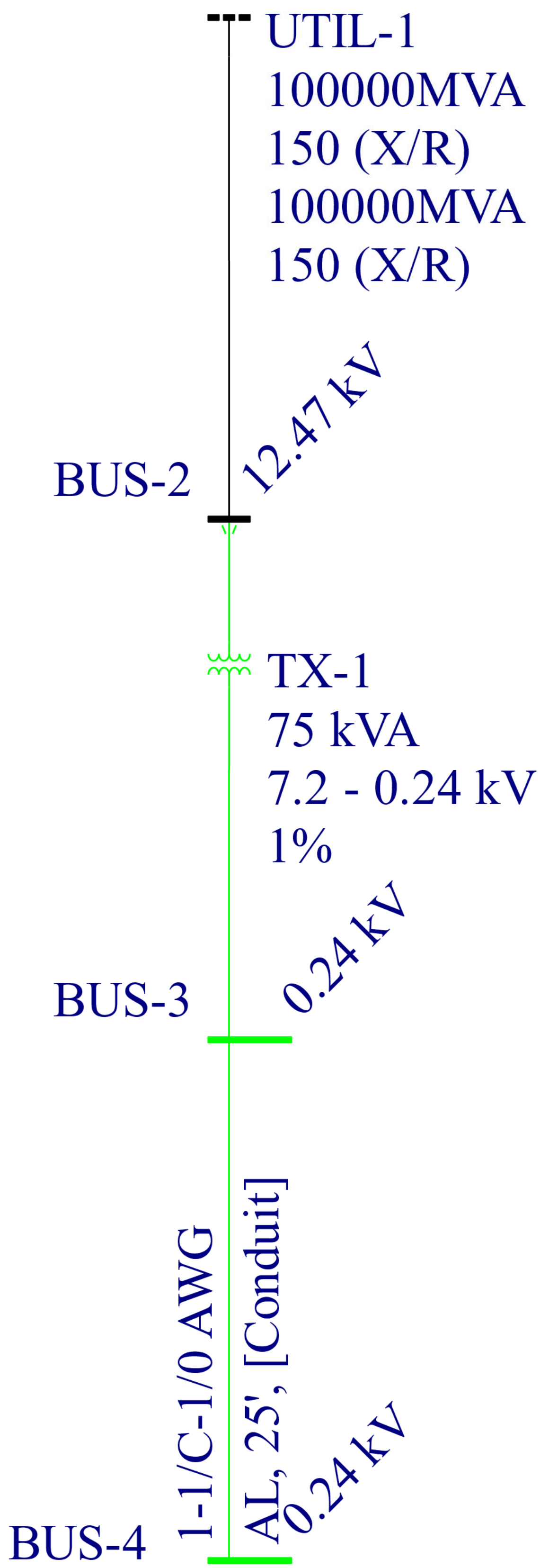


FIGURE 1: EASYPOWER® SOFTWARE ONE-LINE DIAGRAM EXAMPLE

Figure 1 shows an example of the EasyPower® software one-line diagram used for single-phase short circuit calculations. To produce the various short circuit calculation results, transformer impedances and secondary service entrance cable values were adjusted in the EasyPower® software prior to each calculation, as required.

CONCLUSION
Thank you for collaborating with Bentley. If you have questions or require additional information, please do not hesitate to get in touch.

Regards,

Ian Higginson, P.E.
Manager of Consulting, Grid Infrastructure
Bentley Systems
Direct: +1 503 776 7883
Email: ian.higginson@bentley.com

Residential Service Fault Currents w/1/0 AWG

Transformer KVA - Single Phase 240/120 Volts	Transformer Impedance	Full Load Current @ 240 Volts Single Phase	Available Fault Current Phase to Phase		Available Fault Current Phase to Neutral		Available Fault Current Phase to Phase, 200 Amp Service, 1/0 Aluminum Service Conductor length (feet)								Available Fault Current Phase to Neutral, 200 Amp Service, 1/0 Aluminum Service Conductor length (feet)								240 Volt Line to Line Service: Maximum Length 1/0 Aluminum Service Conductor for 3000 Amps (feet)	120 Volt Line to Neutral Service: Maximum Length 1/0 Aluminum Service Conductor for 3000 Amps (feet)
							25		50		100		200		25		50		100		200		(Isca-Iscb)*C*n*Ell/(2*Isca*Iscb)	(Isca-Iscb)*C*n*Eln/(2*Isca*Iscb)
25	1.00	104	10,420	10,416	15,630	16,116	7,596	7,963	5,976	6,279	4,189	4,317	2,622	2,611	7,388	7,637	4,837	4,846	2,862	2,774	1,576	1,490	166	94
	1.25		8,336	8,333	12,504	12,893	6,425	6,709	5,227	5,500	3,806	3,957	2,467	2,485	6,607	6,881	4,490	4,547	2,736	2,679	1,537	1,463	149	89
	1.5		6,947	6,944	10,421	10,744	5,567	5,792	4,644	4,884	3,488	3,646	2,329	2,368	5,976	6,254	4,189	4,279	2,622	2,589	1,500	1,437	133	83
	1.75		5,954	5,952	8,931	9,209	4,910	5,093	4,179	4,389	3,219	3,375	2,205	2,259	5,454	5,726	3,926	4,037	2,516	2,504	1,465	1,402	116	78
	2.00		5,210	5,208	7,815	8,058	4,393	4,543	3,798	3,982	2,988	3,140	2,094	2,159	5,016	5,276	3,694	3,818	2,419	2,423	1,431	1,387	99	72
	2.25		4,631	4,629	6,947	7,163	3,974	4,099	3,481	3,642	2,788	2,933	1,994	2,065	4,644	4,890	3,488	3,621	2,329	2,346	1,398	1,363	82	66
37.5	1.00	156	15,630	15,623	23,445	24,243	10,033	10,586	7,388	7,718	4,837	4,902	2,862	2,798	8,771	8,939	5,395	5,309	3,048	2,913	1,629	1,528	189	102
	1.25		12,504	12,499	18,756	19,395	8,647	9,108	6,607	6,943	4,490	4,601	2,736	2,705	8,020	8,260	5,100	5,077	2,952	2,845	1,602	1,510	177	98
	1.5		10,420	10,416	15,630	16,163	7,596	7,982	5,976	6,298	4,189	4,329	2,622	2,616	7,388	7,667	4,837	4,860	2,862	2,779	1,576	1,492	166	94
	1.75		8,931	8,928	13,397	13,854	6,772	7,097	5,454	5,755	3,926	4,083	2,516	2,532	6,849	7,147	4,601	4,658	2,777	2,716	1,549	1,474	155	91
	2.00		7,815	7,812	11,723	12,122	6,111	6,386	5,016	5,293	3,694	3,859	2,419	2,451	6,383	6,688	4,386	4,470	2,697	2,655	1,524	1,457	144	87
	2.25		6,947	6,944	10,421	10,775	5,567	5,803	4,644	4,897	3,488	3,656	2,329	2,374	5,976	6,281	4,189	4,294	2,622	2,595	1,500	1,439	133	83
50	1.00	208	20,830	20,831	31,245	32,410	11,948	12,630	8,376	8,681	5,243	5,243	3,000	2,898	9,673	9,747	5,724	5,568	3,149	2,986	1,659	1,547	200	106
	1.25		16,664	16,665	24,996	25,929	10,450	11,059	7,612	7,958	4,933	4,992	2,895	2,826	8,979	9,153	5,472	5,381	3,072	2,934	1,637	1,534	191	103
	1.5		13,887	13,888	20,831	21,608	9,285	9,819	6,974	7,333	4,656	4,759	2,797	2,755	8,376	8,617	5,243	5,203	2,998	2,883	1,616	1,520	183	100
	1.75		11,903	11,904	17,855	18,521	8,355	8,820	6,436	6,790	4,410	4,542	2,707	2,687	7,851	8,134	5,032	5,034	2,928	2,833	1,594	1,506	175	97
	2.00		10,415	10,416	15,623	16,206	7,593	7,999	5,974	6,315	4,188	4,340	2,621	2,621	7,387	7,696	4,837	4,873	2,861	2,784	1,575	1,493	166	94
	2.25		9,258	9,259	13,887	14,405	6,959	7,315	5,574	5,898	3,988	4,153	2,541	2,558	6,974	7,299	4,656	4,721	2,797	2,737	1,555	1,480	158	92
75	1.00	313	31,250	31,244	46,875	48,831	14,775	15,554	9,675	9,863	5,722	5,618	3,150	3,002	10,786	10,681	6,094	5,846	3,258	3,061	1,687	1,567	211	109
	1.25		25,000	24,996	37,500	39,066	13,213	13,993	8,980	9,264	5,473	5,435	3,073	2,953	10,200	10,222	5,903	5,714	3,203	3,026	1,673	1,558	205	107
	1.5		20,833	20,831	31,250	32,556	11,950	12,691	8,377	8,720	5,242	5,260	2,998	2,904	9,675	9,763	5,722	5,585	3,150	2,991	1,659	1,549	200	106
	1.75		17,857	17,855	26,786	27,905	10,907	11,594	7,852	8,226	5,032	5,092	2,929	2,856	9,198	9,392	5,553	5,461	3,096	2,957	1,645	1,540	194	104
	2.00		15,625	15,623	23,438	24,417	10,031	10,662	7,388	7,777	4,838	4,932	2,861	2,809	8,768	9,018	5,393	5,340	3,047	2,923	1,629	1,531	189	102
	2.25		13,889	13,888	20,834	21,705	9,286	9,862	6,975	7,369	4,657	4,778	2,797	2,763	8,377	8,668	5,242	5,224	2,998	2,890	1,615	1,522	183	100

Calculations using client's point to point method

Calculations using EasyPower software

Isca = Line to Line Fault Current at transformer	
Iscb = final line to line fault current at service fixed at	3000
n = number of conductors per phase, fixed at 1	
Ell = Line to line voltage fixed at 240	
C = impedance constant for Aluminum 1/0 =	5838

Isca = Line to neutral Fault Current at transformer	
Iscb = final line to neutral fault current at service fixed at	3000
n = number of conductors per phase, fixed at 1	
Eln = Line to neutral voltage fixed at 120	
C = impedance constant for Aluminum 1/0 =	5838

Residential Service Fault Currents w/3/0 AWG

Transformer KVA - Single Phase 240/120 Volts	Transformer Impedance	Full Load Current @ 240 Volts Single Phase	Available Fault Current Phase to Phase		Available Fault Current Phase to Neutral		Available Fault Current Phase to Phase, 200 Amp Service, 3/0 Aluminum Service Conductor length (feet)								Available Fault Current Phase to Neutral, 200 Amp Service, 3/0 Aluminum Service Conductor length (feet)								240 Volt Line to Line Service: Maximum Length 3/0 Aluminum Service Conductor for 3000 Amps (feet)	120 Volt Line to Neutral Service: Maximum Length 3/0 Aluminum Service Conductor for 3000 Amps (feet)
							25		50		100		200		25		50		100		200		(Isca-Iscb)*C*n*Ell/(2*Isca*Iscb)	(Isca-Iscb)*C*n*Eln/(2*Isca*Iscb)
25	1.00	104	10,420	10,416	15,630	16,116	8,415	8,647	7,056	7,296	5,335	5,476	3,586	3,593	9,114	9,394	6,433	6,480	4,050	3,960	2,326	2,216	259	147
	1.25		8,336	8,333	12,504	12,893	7,643	7,172	6,506	6,234	5,014	4,876	3,437	3,338	8,496	8,236	6,118	5,927	3,923	3,755	2,284	2,153	233	138
	1.5		6,947	6,944	10,421	10,744	5,995	6,124	5,272	5,436	4,247	4,388	3,059	3,114	7,097	7,325	5,336	5,455	3,586	3,568	2,165	2,092	207	130
	1.75		5,954	5,952	8,931	9,209	5,240	5,343	4,680	4,817	3,855	3,985	2,850	2,915	6,341	6,592	4,916	5,049	3,391	3,397	2,093	2,035	181	121
	2.00		5,210	5,208	7,815	8,058	4,656	4,737	4,208	4,323	3,528	3,648	2,668	2,738	5,757	5,991	4,557	4,697	3,217	3,240	2,025	1,980	155	112
	2.25		4,631	4,629	6,947	7,163	4,187	4,255	3,822	3,921	3,253	3,362	2,507	2,580	5,272	5,488	4,247	4,389	3,059	3,096	1,961	1,928	128	104
37.5	1.00	156	15,630	15,623	23,445	24,243	11,515	11,911	9,114	9,428	6,433	6,537	4,050	3,993	11,315	11,564	7,456	7,402	4,433	4,272	2,448	2,307	294	159
	1.25		12,504	12,499	18,756	19,395	9,724	10,033	7,955	8,243	5,833	5,973	3,804	3,789	10,096	10,395	6,906	6,926	4,233	4,116	2,386	2,262	277	153
	1.5		10,420	10,416	15,630	16,163	8,415	8,661	7,056	7,313	5,335	5,490	3,586	3,601	9,114	9,431	6,433	6,502	4,050	3,969	2,326	2,219	259	147
	1.75		8,931	8,928	13,397	13,854	7,416	7,616	6,341	6,567	4,916	5,075	3,391	3,428	8,307	8,625	6,019	6,123	3,882	3,831	2,269	2,177	242	141
	2.00		7,815	7,812	11,723	12,122	6,630	6,794	5,757	5,956	4,557	4,714	3,217	3,268	7,632	7,941	5,656	5,782	3,728	3,701	2,217	2,136	225	136
	2.25		6,947	6,944	10,421	10,775	5,995	6,132	5,272	5,447	4,247	4,399	3,059	3,122	7,057	7,355	5,336	5,475	3,586	3,578	2,165	2,096	207	130
50	1.00	208	20,830	20,831	31,245	32,410	14,108	14,658	10,667	11,007	7,170	7,217	4,331	4,222	12,864	13,044	8,099	7,955	4,652	4,443	2,512	2,355	312	165
	1.25		16,664	16,665	24,996	25,929	12,066	12,518	9,457	9,800	6,601	6,708	4,116	4,054	11,663	11,936	7,606	7,549	4,484	4,319	2,465	2,320	299	160
	1.5		13,887	13,888	20,831	21,608	10,540	10,913	8,492	8,819	6,117	6,258	3,922	3,896	10,668	10,990	7,170	7,176	4,331	4,200	2,416	2,287	286	156
	1.75		11,903	11,904	17,855	18,521	9,356	9,667	7,707	8,008	5,698	5,859	3,746	3,748	9,829	10,175	6,781	6,835	4,185	4,086	2,369	2,254	273	152
	2.00		10,415	10,416	15,623	16,206	8,411	8,674	7,054	7,329	5,334	5,504	3,585	3,608	9,111	9,467	6,432	6,522	4,049	3,978	2,326	2,222	259	147
	2.25		9,258	9,259	13,887	14,405	7,641	7,864	6,504	6,753	5,012	5,186	3,437	3,477	8,492	8,847	6,117	6,234	3,922	3,874	2,283	2,190	246	143
75	1.00	313	31,250	31,244	46,875	48,831	18,225	18,981	12,863	13,157	8,100	8,025	4,653	4,471	14,911	14,908	8,864	8,582	4,894	4,626	2,583	2,404	329	171
	1.25		25,000	24,996	37,500	39,066	15,908	16,590	11,663	12,025	7,605	7,618	4,485	4,350	13,811	13,961	8,464	8,275	4,770	4,538	2,546	2,381	321	168
	1.5		20,833	20,831	31,250	32,556	14,110	14,714	10,669	11,055	7,171	7,243	4,329	4,233	12,863	13,115	8,100	7,985	4,653	4,453	2,513	2,358	312	165
	1.75		17,857	17,855	26,786	27,905	12,678	13,208	9,828	10,218	6,780	6,898	4,186	4,120	12,038	12,357	7,763	7,712	4,540	4,371	2,480	2,335	303	162
	2.00		15,625	15,623	23,438	24,417	11,513	11,974	9,113	9,491	6,431	6,579	4,050	4,012	11,311	11,674	7,456	7,454	4,432	4,291	2,447	2,313	294	159
	2.25		13,889	13,888	20,834	21,705	10,542	10,948	8,493	8,855	6,117	6,285	3,922	3,909	10,669	11,058	7,169	7,211	4,329	4,213	2,417	2,291	286	156

Calculations using client's point to point method

Calculations using EasyPower software

Isca = Line to Line Fault Current at transformer	
Iscb = final line to line fault current at service fixed at	3000
n = number of conductors per phase, fixed at 1	
Ell = Line to line voltage fixed at 240	
C = impedance constant for Aluminum 3/0 =	9110

Isca = Line to neutral Fault Current at transformer	
Iscb = final line to neutral fault current at service fixed at	3000
n = number of conductors per phase, fixed at 1	
Eln = Line to neutral voltage fixed at 120	
C = impedance constant for Aluminum 3/0 =	9110

Residential Service Fault Currents w/3/0 AWG

Transformer KVA - Single Phase 240/120 Volts	Transformer Impedance	Full Load Current @ 240 Volts Single Phase	Available Fault Current Phase to Phase		Available Fault Current Phase to Neutral		Available Fault Current Phase to Phase, 200 Amp Service, 3/0 Aluminum Service Conductor length (feet)								Available Fault Current Phase to Neutral, 200 Amp Service, 3/0 Aluminum Service Conductor length (feet)								240 Volt Line to Line Service Maximum Length 3/0 Aluminum Service Conductor for 3000 Amps (feet)	120 Volt Line to Neutral Service Maximum Length 3/0 Aluminum Service Conductor for 3000 Amps (feet)
							25		50		100		200		25		50		100		200		(Isca-Iscb)*C*n*Ell/(2*Isca*Iscb)	(Isca-Iscb)*C*n*Eln/(2*Isca*Iscb)
25	1.00	104	10,420	10,416	15,630	16,116	8,415	8,647	7,056	7,296	5,335	5,476	3,586	3,593	9,114	9,394	6,433	6,480	4,050	3,960	2,326	2,216	259	147
	1.25		8,336	8,333	12,504	12,893	7,643	7,172	6,506	6,234	5,014	4,876	3,437	3,338	8,496	8,236	6,118	5,927	3,923	3,755	2,284	2,153	233	138
	1.5		6,947	6,944	10,421	10,744	5,995	6,124	5,272	5,436	4,247	4,388	3,059	3,114	7,097	7,325	5,336	5,455	3,586	3,568	2,165	2,092	207	130
	1.75		5,954	5,952	8,931	9,209	5,240	5,343	4,680	4,817	3,855	3,985	2,850	2,915	6,341	6,592	4,916	5,049	3,391	3,397	2,093	2,035	181	121
	2.00		5,210	5,208	7,815	8,058	4,656	4,737	4,208	4,323	3,528	3,648	2,668	2,738	5,757	5,991	4,557	4,697	3,217	3,240	2,025	1,980	155	112
	2.25		4,631	4,629	6,947	7,163	4,187	4,255	3,822	3,921	3,253	3,362	2,507	2,580	5,272	5,488	4,247	4,389	3,059	3,096	1,961	1,928	128	104
37.5	1.00	156	15,630	15,623	23,445	24,243	11,515	11,911	9,114	9,428	6,433	6,537	4,050	3,993	11,315	11,564	7,456	7,402	4,433	4,272	2,448	2,307	294	159
	1.25		12,504	12,499	18,756	19,395	9,724	10,033	7,955	8,243	5,833	5,973	3,804	3,789	10,096	10,395	6,906	6,926	4,233	4,116	2,386	2,262	277	153
	1.5		10,420	10,416	15,630	16,163	8,415	8,661	7,056	7,313	5,335	5,490	3,586	3,601	9,114	9,431	6,433	6,502	4,050	3,969	2,326	2,219	259	147
	1.75		8,931	8,928	13,397	13,854	7,416	7,616	6,341	6,567	4,916	5,075	3,391	3,428	8,307	8,625	6,019	6,123	3,882	3,831	2,269	2,177	242	141
	2.00		7,815	7,812	11,723	12,122	6,630	6,794	5,757	5,956	4,557	4,714	3,217	3,268	7,632	7,941	5,656	5,782	3,728	3,701	2,217	2,136	225	136
	2.25		6,947	6,944	10,421	10,775	5,995	6,132	5,272	5,447	4,247	4,399	3,059	3,122	7,057	7,355	5,336	5,475	3,586	3,578	2,165	2,096	207	130
50	1.00	208	20,830	20,831	31,245	32,410	14,108	14,658	10,667	11,007	7,170	7,217	4,331	4,222	12,864	13,044	8,099	7,955	4,652	4,443	2,512	2,355	312	165
	1.25		16,664	16,665	24,996	25,929	12,066	12,518	9,457	9,800	6,601	6,708	4,116	4,054	11,663	11,936	7,606	7,549	4,484	4,319	2,465	2,320	299	160
	1.5		13,887	13,888	20,831	21,608	10,540	10,913	8,492	8,819	6,117	6,258	3,922	3,896	10,668	10,990	7,170	7,176	4,331	4,200	2,416	2,287	286	156
	1.75		11,903	11,904	17,855	18,521	9,356	9,667	7,707	8,008	5,698	5,859	3,746	3,748	9,829	10,175	6,781	6,835	4,185	4,086	2,369	2,254	273	152
	2.00		10,415	10,416	15,623	16,206	8,411	8,674	7,054	7,329	5,334	5,504	3,585	3,608	9,111	9,467	6,432	6,522	4,049	3,978	2,326	2,222	259	147
	2.25		9,258	9,259	13,887	14,405	7,641	7,864	6,504	6,753	5,012	5,186	3,437	3,477	8,492	8,847	6,117	6,234	3,922	3,874	2,283	2,190	246	143
75	1.00	313	31,250	31,244	46,875	48,831	18,225	18,981	12,863	13,157	8,100	8,025	4,653	4,471	14,911	14,908	8,864	8,582	4,894	4,626	2,583	2,404	329	171
	1.25		25,000	24,996	37,500	39,066	15,908	16,590	11,663	12,025	7,605	7,618	4,485	4,350	13,811	13,961	8,464	8,275	4,770	4,538	2,546	2,381	321	168
	1.5		20,833	20,831	31,250	32,556	14,110	14,714	10,669	11,055	7,171	7,243	4,329	4,233	12,863	13,115	8,100	7,985	4,653	4,453	2,513	2,358	312	165
	1.75		17,857	17,855	26,786	27,905	12,678	13,208	9,828	10,218	6,780	6,898	4,186	4,120	12,038	12,357	7,763	7,712	4,540	4,371	2,480	2,335	303	162
	2.00		15,625	15,623	23,438	24,417	11,513	11,974	9,113	9,491	6,431	6,579	4,050	4,012	11,311	11,674	7,456	7,454	4,432	4,291	2,447	2,313	294	159
	2.25		13,889	13,888	20,834	21,705	10,542	10,948	8,493	8,855	6,117	6,285	3,922	3,909	10,669	11,058	7,169	7,211	4,329	4,213	2,417	2,291	286	156

Calculations using client's point to point method

Calculations using EasyPower software

Isca = Line to Line Fault Current at transformer		Isca = Line to neutral Fault Current at	Isca = Line to neutral Fault Current at transformer	
Iscb = final line to line fault current at service fixed at	3000	Iscb = final line to neutral fault curre	Iscb = final line to neutral fault curre	3000
n = number of conductors per phase, fixed at 1		n = number of conductors per phase,	n = number of conductors per phase, fixed at 1	
Ell = Line to line voltage fixed at 240		Eln = Line to neutral voltage fixed at	Eln = Line to neutral voltage fixed at 120	
C = impedance constant for Aluminum 3/0 =	9110	C = impedance constant for Aluminu	C = impedance constant for Aluminu	9110

Residential Service Fault Currents w/3/0 AWG

Transformer KVA - Single Phase 240/120 Volts	Transformer Impedance	Full Load Current @ 240 Volts Single Phase	Available Fault Current Phase to Phase		Available Fault Current Phase to Neutral		Available Fault Current Phase to Phase, 200 Amp Service, 3/0 Aluminum Service Conductor length (feet)								Available Fault Current Phase to Neutral, 200 Amp Service, 3/0 Aluminum Service Conductor length (feet)							
							25		50		100		200		25		50		100		200	
25	1.00	104	10,420	10,416	15,630	16,116	8,415	8,647	7,056	7,296	5,335	5,476	3,586	3,593	9,114	9,394	6,433	6,480	4,050	3,960	2,326	2,216
	1.25		8,336	8,333	12,504	12,893	7,643	7,172	6,506	6,234	5,014	4,876	3,437	3,338	8,496	8,236	6,118	5,927	3,923	3,755	2,284	2,153
	1.5		6,947	6,944	10,421	10,744	5,995	6,124	5,272	5,436	4,247	4,388	3,059	3,114	7,097	7,325	5,336	5,455	3,586	3,568	2,165	2,092
	1.75		5,954	5,952	8,931	9,209	5,240	5,343	4,680	4,817	3,855	3,985	2,850	2,915	6,341	6,592	4,916	5,049	3,391	3,397	2,093	2,035
	2.00		5,210	5,208	7,815	8,058	4,656	4,737	4,208	4,323	3,528	3,648	2,668	2,738	5,757	5,991	4,557	4,697	3,217	3,240	2,025	1,980
	2.25		4,631	4,629	6,947	7,163	4,187	4,255	3,822	3,921	3,253	3,362	2,507	2,580	5,272	5,488	4,247	4,389	3,059	3,096	1,961	1,928
37.5	1.00	156	15,630	15,623	23,445	24,243	11,515	11,911	9,114	9,428	6,433	6,537	4,050	3,993	11,315	11,564	7,456	7,402	4,433	4,272	2,448	2,307
	1.25		12,504	12,499	18,756	19,395	9,724	10,033	7,955	8,243	5,833	5,973	3,804	3,789	10,096	10,395	6,906	6,926	4,233	4,116	2,386	2,262
	1.5		10,420	10,416	15,630	16,163	8,415	8,661	7,056	7,313	5,335	5,490	3,586	3,601	9,114	9,431	6,433	6,502	4,050	3,969	2,326	2,219
	1.75		8,931	8,928	13,397	13,854	7,416	7,616	6,341	6,567	4,916	5,075	3,391	3,428	8,307	8,625	6,019	6,123	3,882	3,831	2,269	2,177
	2.00		7,815	7,812	11,723	12,122	6,630	6,794	5,757	5,956	4,557	4,714	3,217	3,268	7,632	7,941	5,656	5,782	3,728	3,701	2,217	2,136
	2.25		6,947	6,944	10,421	10,775	5,995	6,132	5,272	5,447	4,247	4,399	3,059	3,122	7,057	7,355	5,336	5,475	3,586	3,578	2,165	2,096
50	1.00	208	20,830	20,831	31,245	32,410	14,108	14,658	10,667	11,007	7,170	7,217	4,331	4,222	12,864	13,044	8,099	7,955	4,652	4,443	2,512	2,355
	1.25		16,664	16,665	24,996	25,929	12,066	12,518	9,457	9,800	6,601	6,708	4,116	4,054	11,663	11,936	7,606	7,549	4,484	4,319	2,465	2,320
	1.5		13,887	13,888	20,831	21,608	10,540	10,913	8,492	8,819	6,117	6,258	3,922	3,896	10,668	10,990	7,170	7,176	4,331	4,200	2,416	2,287
	1.75		11,903	11,904	17,855	18,521	9,356	9,667	7,707	8,008	5,698	5,859	3,746	3,748	9,829	10,175	6,781	6,835	4,185	4,086	2,369	2,254
	2.00		10,415	10,416	15,623	16,206	8,411	8,674	7,054	7,329	5,334	5,504	3,585	3,608	9,111	9,467	6,432	6,522	4,049	3,978	2,326	2,222
	2.25		9,258	9,259	13,887	14,405	7,641	7,864	6,504	6,753	5,012	5,186	3,437	3,477	8,492	8,847	6,117	6,234	3,922	3,874	2,283	2,190
75	1.00	313	31,250	31,244	46,875	48,831	18,225	18,981	12,863	13,157	8,100	8,025	4,653	4,471	14,911	14,908	8,864	8,582	4,894	4,626	2,583	2,404
	1.25		25,000	24,996	37,500	39,066	15,908	16,590	11,663	12,025	7,605	7,618	4,485	4,350	13,811	13,961	8,464	8,275	4,770	4,538	2,546	2,381
	1.5		20,833	20,831	31,250	32,556	14,110	14,714	10,669	11,055	7,171	7,243	4,329	4,233	12,863	13,115	8,100	7,985	4,653	4,453	2,513	2,358
	1.75		17,857	17,855	26,786	27,905	12,678	13,208	9,828	10,218	6,780	6,898	4,186	4,120	12,038	12,357	7,763	7,712	4,540	4,371	2,480	2,335
	2.00		15,625	15,623	23,438	24,417	11,513	11,974	9,113	9,491	6,431	6,579	4,050	4,012	11,311	11,674	7,456	7,454	4,432	4,291	2,447	2,313
	2.25		13,889	13,888	20,834	21,705	10,542	10,948	8,493	8,855	6,117	6,285	3,922	3,909	10,669	11,058	7,169	7,211	4,329	4,213	2,417	2,291

Calculations using client's point to point method

Calculations using EasyPower software

Residential Service Fault Currents w/1/0 AWG

Transformer KVA - Single Phase 240/120 Volts	Transformer Impedance	Full Load Current @ 240 Volts Single Phase	Available Fault Current Phase to Phase		Available Fault Current Phase to Neutral		Available Fault Current Phase to Phase, 200 Amp Service, 1/0 Aluminum Service Conductor length (feet)								Available Fault Current Phase to Neutral, 200 Amp Service, 1/0 Aluminum Service Conductor length (feet)								240 Volt Line to Line Service: Maximum Length 1/0 Aluminum Service Conductor for 3000 Amps (feet)	120 Volt Line to Neutral Service: Maximum Length 1/0 Aluminum Service Conductor for 3000 Amps (feet)
							25		50		100		200		25		50		100		200		(Isca-Iscb)*C*n*Ell/(2*Isca*Iscb)	(Isca-Iscb)*C*n*Eln/(2*Isca*Iscb)
	1.00		10,420	10,416	15,630	16,116	7,596	7,963	5,976	6,279	4,189	4,317	2,622	2,611	7,388	7,637	4,837	4,846	2,862	2,774	1,576	1,490	166	94
	1.25		8,336	8,333	12,504	12,893	6,425	6,709	5,227	5,500	3,806	3,957	2,467	2,485	6,607	6,881	4,490	4,547	2,736	2,679	1,537	1,463	149	89
25	1.5	104	6,947	6,944	10,421	10,744	5,567	5,792	4,644	4,884	3,488	3,646	2,329	2,368	5,976	6,254	4,189	4,279	2,622	2,589	1,500	1,437	133	83
	1.75		5,954	5,952	8,931	9,209	4,910	5,093	4,179	4,389	3,219	3,375	2,205	2,259	5,454	5,726	3,926	4,037	2,516	2,504	1,465	1,402	116	78
	2.00		5,210	5,208	7,815	8,058	4,393	4,543	3,798	3,982	2,988	3,140	2,094	2,159	5,016	5,276	3,694	3,818	2,419	2,423	1,431	1,387	99	72
	2.25		4,631	4,629	6,947	7,163	3,974	4,099	3,481	3,642	2,788	2,933	1,994	2,065	4,644	4,890	3,488	3,621	2,329	2,346	1,398	1,363	82	66
	1.00		15,630	15,623	23,445	24,243	10,033	10,586	7,388	7,718	4,837	4,902	2,862	2,798	8,771	8,939	5,395	5,309	3,048	2,913	1,629	1,528	189	102
	1.25		12,504	12,499	18,756	19,395	8,647	9,108	6,607	6,943	4,490	4,601	2,736	2,705	8,020	8,260	5,100	5,077	2,952	2,845	1,602	1,510	177	98
37.5	1.5	156	10,420	10,416	15,630	16,163	7,596	7,982	5,976	6,298	4,189	4,329	2,622	2,616	7,388	7,667	4,837	4,860	2,862	2,779	1,576	1,492	166	94
	1.75		8,931	8,928	13,397	13,854	6,772	7,097	5,454	5,755	3,926	4,083	2,516	2,532	6,849	7,147	4,601	4,658	2,777	2,716	1,549	1,474	155	91
	2.00		7,815	7,812	11,723	12,122	6,111	6,386	5,016	5,293	3,694	3,859	2,419	2,451	6,383	6,688	4,386	4,470	2,697	2,655	1,524	1,457	144	87
	2.25		6,947	6,944	10,421	10,775	5,567	5,803	4,644	4,897	3,488	3,656	2,329	2,374	5,976	6,281	4,189	4,294	2,622	2,595	1,500	1,439	133	83
	1.00		20,830	20,831	31,245	32,410	11,948	12,630	8,376	8,681	5,243	5,243	3,000	2,898	9,673	9,747	5,724	5,568	3,149	2,986	1,659	1,547	200	106
	1.25		16,664	16,665	24,996	25,929	10,450	11,059	7,612	7,958	4,933	4,992	2,895	2,826	8,979	9,153	5,472	5,381	3,072	2,934	1,637	1,534	191	103
50	1.5	208	13,887	13,888	20,831	21,608	9,285	9,819	6,974	7,333	4,656	4,759	2,797	2,755	8,376	8,617	5,243	5,203	2,998	2,883	1,616	1,520	183	100
	1.75		11,903	11,904	17,855	18,521	8,355	8,820	6,436	6,790	4,410	4,542	2,707	2,687	7,851	8,134	5,032	5,034	2,928	2,833	1,594	1,506	175	97
	2.00		10,415	10,416	15,623	16,206	7,593	7,999	5,974	6,315	4,188	4,340	2,621	2,621	7,387	7,696	4,837	4,873	2,861	2,784	1,575	1,493	166	94
	2.25		9,258	9,259	13,887	14,405	6,959	7,315	5,574	5,898	3,988	4,153	2,541	2,558	6,974	7,299	4,656	4,721	2,797	2,737	1,555	1,480	158	92
	1.00		31,250	31,244	46,875	48,831	14,775	15,554	9,675	9,863	5,722	5,618	3,150	3,002	10,786	10,681	6,094	5,846	3,258	3,061	1,687	1,567	211	109
	1.25		25,000	24,996	37,500	39,066	13,213	13,993	8,980	9,264	5,473	5,435	3,073	2,953	10,200	10,222	5,903	5,714	3,203	3,026	1,673	1,558	205	107
75	1.5	313	20,833	20,831	31,250	32,556	11,950	12,691	8,377	8,720	5,242	5,260	2,998	2,904	9,675	9,763	5,722	5,585	3,150	2,991	1,659	1,549	200	106
	1.75		17,857	17,855	26,786	27,905	10,907	11,594	7,852	8,226	5,032	5,092	2,929	2,856	9,198	9,392	5,553	5,461	3,096	2,957	1,645	1,540	194	104
	2.00		15,625	15,623	23,438	24,417	10,031	10,662	7,388	7,777	4,838	4,932	2,861	2,809	8,768	9,018	5,393	5,340	3,047	2,923	1,629	1,531	189	102
	2.25		13,889	13,888	20,834	21,705	9,286	9,862	6,975	7,369	4,657	4,778	2,797	2,763	8,377	8,668	5,242	5,224	2,998	2,890	1,615	1,522	183	100

Calculations using client's point to point methoc

Calculations using EasyPower software

Isca = Line to Line Fault Current at transformer		Isca = Line to neutral Fault Current	Isca = Line to neutral Fault Current at transforme	
Iscb = final line to line fault current at service fixed at	3000	Iscb = final line to neutral fault curre	Iscb = final line to neutral fault curre	3000
n = number of conductors per phase, fixed at 1		n = number of conductors per phas	n = number of conductors per phase, fixed at 1	
Ell = Line to line voltage fixed at 240		Eln = Line to neutral voltage fixed a	Eln = Line to neutral voltage fixed at 120	
C = impedance constant for Aluminum 1/0 =	5838	C = impedance constant for Alumin	C = impedance constant for Alumin	5838

Residential Service Fault Currents w/1/0 AWG

Transformer KVA - Single Phase 240/120 Volts	Transformer Impedance	Full Load Current @ 240 Volts Single Phase	Available Fault Current Phase to Phase		Available Fault Current Phase to Neutral		Available Fault Current Phase to Phase, 200 Amp Service, 1/0 Aluminum Service Conductor length (feet)								Available Fault Current Phase to Neutral, 200 Amp Service, 1/0 Aluminum Service Conductor length (feet)							
							25		50		100		200		25		50		100		200	
25	1.00	104	10,420	10,416	15,630	16,116	7,596	7,963	5,976	6,279	4,189	4,317	2,622	2,611	7,388	7,637	4,837	4,846	2,862	2,774	1,576	1,490
	1.25		8,336	8,333	12,504	12,893	6,425	6,709	5,227	5,500	3,806	3,957	2,467	2,485	6,607	6,881	4,490	4,547	2,736	2,679	1,537	1,463
	1.5		6,947	6,944	10,421	10,744	5,567	5,792	4,644	4,884	3,488	3,646	2,329	2,368	5,976	6,254	4,189	4,279	2,622	2,589	1,500	1,437
	1.75		5,954	5,952	8,931	9,209	4,910	5,093	4,179	4,389	3,219	3,375	2,205	2,259	5,454	5,726	3,926	4,037	2,516	2,504	1,465	1,402
	2.00		5,210	5,208	7,815	8,058	4,393	4,543	3,798	3,982	2,988	3,140	2,094	2,159	5,016	5,276	3,694	3,818	2,419	2,423	1,431	1,387
	2.25		4,631	4,629	6,947	7,163	3,974	4,099	3,481	3,642	2,788	2,933	1,994	2,065	4,644	4,890	3,488	3,621	2,329	2,346	1,398	1,363
37.5	1.00	156	15,630	15,623	23,445	24,243	10,033	10,586	7,388	7,718	4,837	4,902	2,862	2,798	8,771	8,939	5,395	5,309	3,048	2,913	1,629	1,528
	1.25		12,504	12,499	18,756	19,395	8,647	9,108	6,607	6,943	4,490	4,601	2,736	2,705	8,020	8,260	5,100	5,077	2,952	2,845	1,602	1,510
	1.5		10,420	10,416	15,630	16,163	7,596	7,982	5,976	6,298	4,189	4,329	2,622	2,616	7,388	7,667	4,837	4,860	2,862	2,779	1,576	1,492
	1.75		8,931	8,928	13,397	13,854	6,772	7,097	5,454	5,755	3,926	4,083	2,516	2,532	6,849	7,147	4,601	4,658	2,777	2,716	1,549	1,474
	2.00		7,815	7,812	11,723	12,122	6,111	6,386	5,016	5,293	3,694	3,859	2,419	2,451	6,383	6,688	4,386	4,470	2,697	2,655	1,524	1,457
	2.25		6,947	6,944	10,421	10,775	5,567	5,803	4,644	4,897	3,488	3,656	2,329	2,374	5,976	6,281	4,189	4,294	2,622	2,595	1,500	1,439
50	1.00	208	20,830	20,831	31,245	32,410	11,948	12,630	8,376	8,681	5,243	5,243	3,000	2,898	9,673	9,747	5,724	5,568	3,149	2,986	1,659	1,547
	1.25		16,664	16,665	24,996	25,929	10,450	11,059	7,612	7,958	4,933	4,992	2,895	2,826	8,979	9,153	5,472	5,381	3,072	2,934	1,637	1,534
	1.5		13,887	13,888	20,831	21,608	9,285	9,819	6,974	7,333	4,656	4,759	2,797	2,755	8,376	8,617	5,243	5,203	2,998	2,883	1,616	1,520
	1.75		11,903	11,904	17,855	18,521	8,355	8,820	6,436	6,790	4,410	4,542	2,707	2,687	7,851	8,134	5,032	5,034	2,928	2,833	1,594	1,506
	2.00		10,415	10,416	15,623	16,206	7,593	7,999	5,974	6,315	4,188	4,340	2,621	2,621	7,387	7,696	4,837	4,873	2,861	2,784	1,575	1,493
	2.25		9,258	9,259	13,887	14,405	6,959	7,315	5,574	5,898	3,988	4,153	2,541	2,558	6,974	7,299	4,656	4,721	2,797	2,737	1,555	1,480
75	1.00	313	31,250	31,244	46,875	48,831	14,775	15,554	9,675	9,863	5,722	5,618	3,150	3,002	10,786	10,681	6,094	5,846	3,258	3,061	1,687	1,567
	1.25		25,000	24,996	37,500	39,066	13,213	13,993	8,980	9,264	5,473	5,435	3,073	2,953	10,200	10,222	5,903	5,714	3,203	3,026	1,673	1,558
	1.5		20,833	20,831	31,250	32,556	11,950	12,691	8,377	8,720	5,242	5,260	2,998	2,904	9,675	9,763	5,722	5,585	3,150	2,991	1,659	1,549
	1.75		17,857	17,855	26,786	27,905	10,907	11,594	7,852	8,226	5,032	5,092	2,929	2,856	9,198	9,392	5,553	5,461	3,096	2,957	1,645	1,540
	2.00		15,625	15,623	23,438	24,417	10,031	10,662	7,388	7,777	4,838	4,932	2,861	2,809	8,768	9,018	5,393	5,340	3,047	2,923	1,629	1,531
	2.25		13,889	13,888	20,834	21,705	9,286	9,862	6,975	7,369	4,657	4,778	2,797	2,763	8,377	8,668	5,242	5,224	2,998	2,890	1,615	1,522

Calculations using client's point to point method

Calculations using EasyPower software

Public Input No. 1229-NFPA 70-2023 [Section No. 210.12(B)]

(B) Dwelling Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Kitchens

(2) Family rooms

(3) Dining rooms

(4) Living rooms

(5) Parlors

(6) Libraries

(7) Dens

(8) Bedrooms

(9) Sunrooms

(10) Recreation rooms

(11) Closets

(12) Hallways

(13) Laundry areas

(14) Similar areas

(15) Garages

Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

Informational Note No. 1: See *NFPA 72*-2022, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

Garages at dwelling units are commonly used for many purposes other than to garage automobiles. These often large areas are frequently used as recreation rooms and the like and should have the same branch circuit protections that section 210.12 affords other rooms in the dwelling. We now require that garages be counted the same as habital rooms for the purposes of load calculations thus recognizing the other uses that may occur as previously described. Additionally when these garage areas are primarily used to garage automobiles these areas often are relied upon for all manner of storage and racking. Affixing racks, hooks and various other storage hardware to the walls and ceiling of the garage poses a risk of damaging cables within the wall. It is very common for branch circuits supplying other rooms in the dwelling to pass through the garage and these branch circuits are required to comply with section 210.12. Safety should dictate that branch cicuits serving the garage outlets, devices etc. be afforded the same level of protection as elsewhere in the home.

Submitter Information Verification

Submitter Full Name:	David Humphrey
Organization:	County of Henrico, Virginia
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Wed Jun 28 09:02:07 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: Incompatibility continues to be a concern. Expansion of AFCI protection into garages should not take place until incompatibility with welders and garage door openers is addressed.

Public Input No. 1438-NFPA 70-2023 [Section No. 210.12(B)]

(B) Dwelling Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or ~~devices installed in the following locations shall~~ devices shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

- ~~Kitchens~~
- ~~Family rooms~~
- ~~Dining rooms~~
- ~~Living rooms~~
- ~~Parlors~~
- ~~Libraries~~
- ~~Dens~~
- ~~Bedrooms~~
- ~~Sunrooms~~
- ~~Recreation rooms~~
- ~~Closets~~
- ~~Hallways~~
- ~~Laundry areas~~
- ~~Similar areas~~

~~Exception No. 1~~ Exception No. 1 AFCI protection shall not be required in Bathrooms or Garages.

Exception No. 2 : AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

Exception No. ~~2~~ 3 : AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

Informational Note No. 1: See *NFPA 72-2022*, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

Removed the laundry list of areas that AFCI are required and made it required through out the dwelling.
Added exception to encompass the two areas not included in the laundry list or to address any areas not needing AFCI.
Renumbered exceptions

Submitter Information Verification

Submitter Full Name:	IEC National
Organization:	IEC
Affiliation:	Jon Coulimore
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sun Jul 16 11:35:53 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: FR-8195-NFPA 70-2024

Statement: The section has been revised to make the NEC more user-friendly. Expansion to the remaining circuits of dwelling units, except for garages, continues the incremental steps to protect the entire dwelling as electrical fires can occur on these 10-A, 15-A, and 20-A circuits regardless of the area or room they serve. The entire length of conductors presents opportunities for causing an electrical fire. This Arc-fault protection expansion to all dwelling unit 10-A, 15-A, and 20-A branch circuits increases safety by reducing the likelihood of electrical fires.

Electrical fire statistics demonstrate that electrical fires exist in dwelling units that might have been prevented by AFCI protection.

Kitchens, Laundry areas, and Listed HVAC equipment have been excepted from AFCI protection due to incompatibility concerns.

Public Input No. 1773-NFPA 70-2023 [Section No. 210.12(B)]

(B) Dwelling Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Kitchens

(2) Family rooms

(3) Dining rooms

(4) Living rooms

(5) Parlors

(6) Libraries

(7) Dens

(8) Bedrooms

(9) Sunrooms

(10) Recreation rooms

(11) Closets

(12) Hallways

(13) Laundry areas

(14) Similar areas

(15) Garages

Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

Informational Note No. 1: See *NFPA 72*-2022, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

Garages at dwelling units are commonly used for many purposes other than to garage automobiles. These often large areas are frequently used as recreation rooms and the like and should have the same branch circuit protections that section 210.12 affords other rooms in the dwelling. We now require that garages be counted the same as habitable rooms for the purposes of load calculations thus recognizing the other uses that may occur as previously described.

Additionally when these garage areas are primarily used to garage automobiles these areas often are relied upon for all manner of storage and racking. Affixing racks, hooks and various other storage hardware to the walls and ceiling of the garage poses a risk of damaging cables within the wall. It is very common for branch circuits supplying other rooms in the dwelling to pass through the garage and these branch circuits are required to comply with section 210.12.

Safety should dictate that branch circuits serving the garage outlets, devices etc. be afforded the same level of protection as elsewhere in the home.

Submitter Information Verification

Submitter Full Name: Rudy Garza

Organization: IAEI

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 01 15:13:07 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: Incompatibility continues to be a concern. Expansion of AFCI protection into garages should not take place until incompatibility with welders and garage door openers is addressed.

Public Input No. 1903-NFPA 70-2023 [Section No. 210.12(B)]

(B) Dwelling Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

210.12 (B) - Require all branch circuit conductors which pass through a AFCI protected zone/area to have AFCI protection.

(1) Kitchens

(2) Family rooms

(3) Dining rooms

(4) Living rooms

(5) Parlors

(6) Libraries

(7) Dens

(8) Bedrooms

(9) Sunrooms

(10) Recreation rooms

(11) Closets

(12) Hallways

(13) Laundry areas

(14) Similar areas

Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

Informational Note No. 1: See *NFPA 72*-2022, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

It is very common for example to have for example one branch circuit in a wall cavity that is AFCI protected while other branch circuits in the same wall cavity are not AFCI protected simply because the unprotected branch circuit it is not supplying a device or equipment in a AFCI protected area.

When someone is hanging a picture on the wall in a bedroom for example, the nail that is driven into the wall is just as likely to damage conductors that are not required to be AFCI protected as it is to damage AFCI protected conductors.

Submitter Information Verification

Submitter Full Name:	Gary Hein
Organization:	[Not Specified]
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Aug 07 14:26:00 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The submitter did not provide specific text to consider. The submitted language would be difficult to enforce, as determining the installation of branch circuits through a structure is difficult to follow. 210.12(B) addresses locations, and the proposed change does not describe a location.

Public Input No. 3155-NFPA 70-2023 [Section No. 210.12(B)]

(B) Dwelling Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) ~~Kitchens~~

(2)

(3) Family rooms

(4) Dining rooms

(5) Living rooms

(6) Parlors

(7) Libraries

(8) Dens

(9) Bedrooms

(10) Sunrooms

(11) Recreation rooms

(12) Closets

(13) Hallways

(14) ~~Laundry areas~~

(15) ~~Similar areas~~

(16)

Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

Informational Note No. 1: See *NFPA 72*-2022, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

Additional Proposed Changes

File Name	Description	Approved
PI_3155_Attachment.pdf		

Statement of Problem and Substantiation for Public Input

This Public Input proposes deletion of kitchens, laundry, and similar areas from the requirements of 210.12(B)(1), 210.12(B)(13), and 210.12(B)(14) from the 2023 edition of the NEC.

A LACK OF EVIDENCE TO SUPPORT AFCI

As noted in proposals made during the 2023 NEC cycle, a review of comments when kitchen and laundry areas were first added, Panel 2 did not have clear substantiation of fires located in these specific areas from data used to justify that expansion. Even though fire data never supported this expansion of AFCIs, these locations were nevertheless added to the 2014 NEC. Nine years later, there is still no evidence that expanding AFCI into kitchens and laundry areas has proven to increase safety in those locations. In addition, there is still no practical data collection method to demonstrate that AFCI expansion reduces residential fires due to electrical malfunctions. Without fire data usable for analytics as the Research Foundation pointed out, claims that “there have been no documented cases of an electrical fire on an AFCI-protected circuit" are in fact innately “unprovable”.

Previously reported Research Foundation conclusions in part state that due to fire statistics not measuring effectiveness of prevention devices, there is no credible data to confirm AFCIs have been effective in reducing electrical fires. However, an updated chart provides data from seven NFPA reports that drill down to best available statistics speaking most directly to the problem of home fires involving Wiring and Related Equipment. These NFPA electrical fires statistics from 2003 (as AFCI implementation was just beginning) to 2019 show a 76% increase in the level of home fires involving wiring and related equipment. Please see Attachment #1.

In alignment with NFPA findings, the most recent USFA Residential Building Electrical Malfunction Fire estimates reveal an increasing trend of fire levels due to electrical malfunctions. In fact, for the ten-year period between 2012 and 2021, residential electrical malfunction fires have increased 11%. Please see Attachment #2.
According to the most recent NFPA data [2015 – 2019], there were 2,410 fires associated with electrical branch circuits, which resulted in 20 deaths, 50 injuries and an estimated $108 Million property damage.

The NFPA data for fires involving electrical branch circuits are as follows:
- Between 2003 and 2006 there were 1,600 reported branch-circuit fires
- Between 2007 and 2011 there were 2,200 reported branch-circuit fires
- Between 2015 and 2019 there were 2,410 reported branch-circuit fires

The number of branch-circuit fires increased more than 50% over the 16-year period between 2003 and 2019 despite a significant increase in AFCI use. There is no correlation between AFCI use and a reduction in the number of fires involving branch circuits.

The prevailing view is AFCIs are required because they lead to or would result in reduced residential fires that could start due to an electrical malfunction. However, the trend line from fema.gov's credible public data counters this belief. At the very least, the USFA and NFPA data sets both reveal that these presumed benefits from the requirements are not being achieved.

Those who support AFCI expansion justify the lack of data by saying that you can't prove a negative should consider incremental GFCI expansion. Consumer product electrocutions over the last 50 years have dropped by 93% with an increasing population. The widely publicized graph depicting Electrocutions Associated with Consumer Products has been acknowledged as credibly illustrating the direct correlation between the reduction in consumer product electrocutions and the expansion of GFCI protection. For an illustration of the effectiveness of GFCI in electrocution prevention, please visit https://www.esfi.org/program/ground-fault-circuit-interrupters.

Although nowhere is data captured about electrocutions that did not happen, the great success of GFCIs represents a true example of cause-and-effect, where the initiation and incremental expansion of GFCI protection is seen and can be claimed as the proven solution to address the risk of electrocutions from consumer products.

STATE AMENDMENTS SHOW A LACK OF ACCEPTANCE

As also seen in proposals made during the 2023 NEC cycle, 20 states and several municipalities have amended AFCI requirements. Please see Attachment #3. Many states and local jurisdictions have locally amended the NEC to limit the requirement to bedrooms, which is where AFCIs were originally proposed to reduce fires. Others have eliminated provisions expanding use in kitchens and laundry areas to reduce complaints due to unwanted tripping. As there is no evidence-based data to quantify safety has increased due to AFCI requirements, actions by state governing bodies to widely implement exceptions undermine and detract from the NEC's purpose of "practical safeguarding of persons and property from hazards arising from the use of electricity". State amendments show a lack of acceptance of AFCI requirements.

MANUFACTURER'S CHANGING PRODUCT STANDARDS

Individual manufacturer's proprietary AFCI trip/no-trip criteria change frequently with limited or no notice. This makes it impossible for consumer product manufacturers to design products which do not cause nuisance tripping of the AFCI device. To avoid nuisance tripping, appliance manufacturers are told to check-in with each AFCI manufacturer. This is an impossible task, requiring hundreds of companies (which are constantly designing new consumer products) to check-in with seven companies, just to obtain AFCI specs which may change again the day after they are transmitted.

Product safety requirements are typically decided by a UL Technical Committee (TC) using the UL's Collaborative Standard Development System (CSDS). Development of AFCI trip/no-trip criteria are not collaborative but rather proprietary; appliance manufacturers MIGHT only be consulted if proprietary problems in the field have arisen.

Until all AFCI trip/no-trip criteria are defined in the consensus standard, UL 1699, AFCI expansion is premature whether in the 2026 or previous Codes. The entire electrical safety community (electricians, inspectors, fire service, consumer product manufacturers) should have a clear understanding of what is changing in AFCIs and when, as is done within CSDS.

UL 1699 is not staying current with newer appliances being manufactured today. AFCI and appliance manufacturers are working to define compatibility requirements between these products. Time is needed to define these requirements and to work them through standards development process.

"NUISANCE TRIPPING"

A recent study by East Carolina University was conducted to investigate residential electricians' perceptions of arc-fault circuit interrupters (AFCIs) and "nuisance tripping", i.e., unwanted tripping. Please see Attachment #4. This study was conducted to examine a variety of issues surrounding the use of AFCIs and nuisance tripping, including the following:
- Frequency of nuisance tripping with AFCIs
- Troubleshooting and solutions
- Costs (time and money) associated with nuisance tripping
- Electricians' perceptions of AFCIs and nuisance tripping
- Customers' perceptions of nuisance tripping

The conclusions are as follows:

- Almost all respondents (93.9%) experienced problems with nuisance tripping and AFCIs on residential projects at some point in their work.
- In the past year, respondents worked on an average of 45 residential projects
- 33% of these projects (15 of 45) experienced AT LEAST ONE issue with nuisance tripping
- 87% of those projects (13 of 15) required at least one call-back
- 18% of the projects (8 of 45) experienced TWO OR MORE issues with nuisance tripping

- 88% of the projects (7 of 8) required two or more call-backs
- Most respondents (87%) have replaced AFCIs with standard circuit breakers (and/or knew someone who had done so) to resolve nuisance tripping issues. This is, by far, the most common way of resolving these issues.
- Only 23 percent of respondents believed the benefits of AFCIs outweighed the problems associated with them.

Recent nuisance tripping data from the Electro Federation Canada shows there are significant issues with nuisance tripping, particularly with clothes washers, microwave ovens, and refrigerators and from other unknown sources. Please see Attachment #5. Canadian Authorities Having Jurisdiction are permitting contractors to swap AFCI circuit breakers for standard thermo-magnetic-trip breakers where it can be demonstrated there is no other solution to the nuisance tripping.

Replacement of AFCI/GFCI protection with standard thermo-magnetic trip circuit breakers would result in the loss of GFCI protection in these moisture prone areas. This could lead to an increase in electrocutions.

UNENFORCEABLE TERMS

The term “Similar areas” in 210.12(B)(14) of the 2023 edition of the NEC is vague and unenforceable and is not permitted by the NEC Style Manual.

SUMMARY

A lack of data suggesting that AFCI protection contributes to fewer electrical fires, changing products and product standards, and nuisance tripping are all evidence that AFCI should not be used in kitchens, laundry areas, and similar areas. For these reasons, 210.12(B)(1), 210.12(B)(13) and 210.12(B)(14) in the existing 2023 NEC should be deleted.

Submitter Information Verification

Submitter Full Name:	Merton Bunker
Organization:	Merton Bunker & Associates, LLC
Affiliation:	Arc Fault Circuit Interrupter Wiring Device Joint Research and Development Consortium
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Tue Aug 29 17:56:02 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: FR-8195-NFPA 70-2024

Statement: The section has been revised to make the NEC more user-friendly. Expansion to the remaining circuits of dwelling units, except for garages, continues the incremental steps to protect the entire dwelling as electrical fires can occur on these 10-A, 15-A, and 20-A circuits regardless of the area or room they serve. The entire length of conductors presents opportunities for causing an electrical fire. This Arc-fault protection expansion to all dwelling unit 10-A, 15-A, and 20-A branch circuits increases safety by reducing the likelihood of electrical fires.

Electrical fire statistics demonstrate that electrical fires exist in dwelling units that might have been prevented by AFCI protection.

Kitchens, Laundry areas, and Listed HVAC equipment have been excepted from AFCI protection due to incompatibility concerns.

Engineering | Forensics | Litigation Support | Training

August 29, 2023
National Fire Protection Association
Attn: Standards Administration
1 Batterymarch Park
Quincy, MA 02169

Dear Standards Administration:

Please see the attached supporting material and related permission to use the material for PI 3155, which proposes changes to NEC 210.12(B).

I am submitting this PI on behalf of the AFCI Consortium.

The material in Attachment #1 is NFPA material and does not require permission to use in support of this PI.

The material in Attachment #2 is from the US Fire Administration. It is not copyrighted, is in the public domain, and does not require permission to use for this PI.

The material in Attachment #3 is a graphic from Mr. Jeff Terrey, with the accompanying permission to use as part of this PI.

The material in Attachment #4 is a study conducted by East Carolina University and permission to use this material as part of this PI is granted by its author, Mr. Steven Schmidt.

The material in Attachment #5 has permission to be used, as obtained by Todd Hamden of Hubbell Canada, who is a member of the AFCI Consortium. I am submitting this PI on behalf of the AFCI Consortium. You will also see in the e-mail where the Vice President Standards and Regulations of Electro-Federation Canada (EFC) notes that this information is also in the public domain.

Thank you in advance for your attention to this matter. If you have any questions or concerns, please contact me at the phone number below.

Very truly yours,

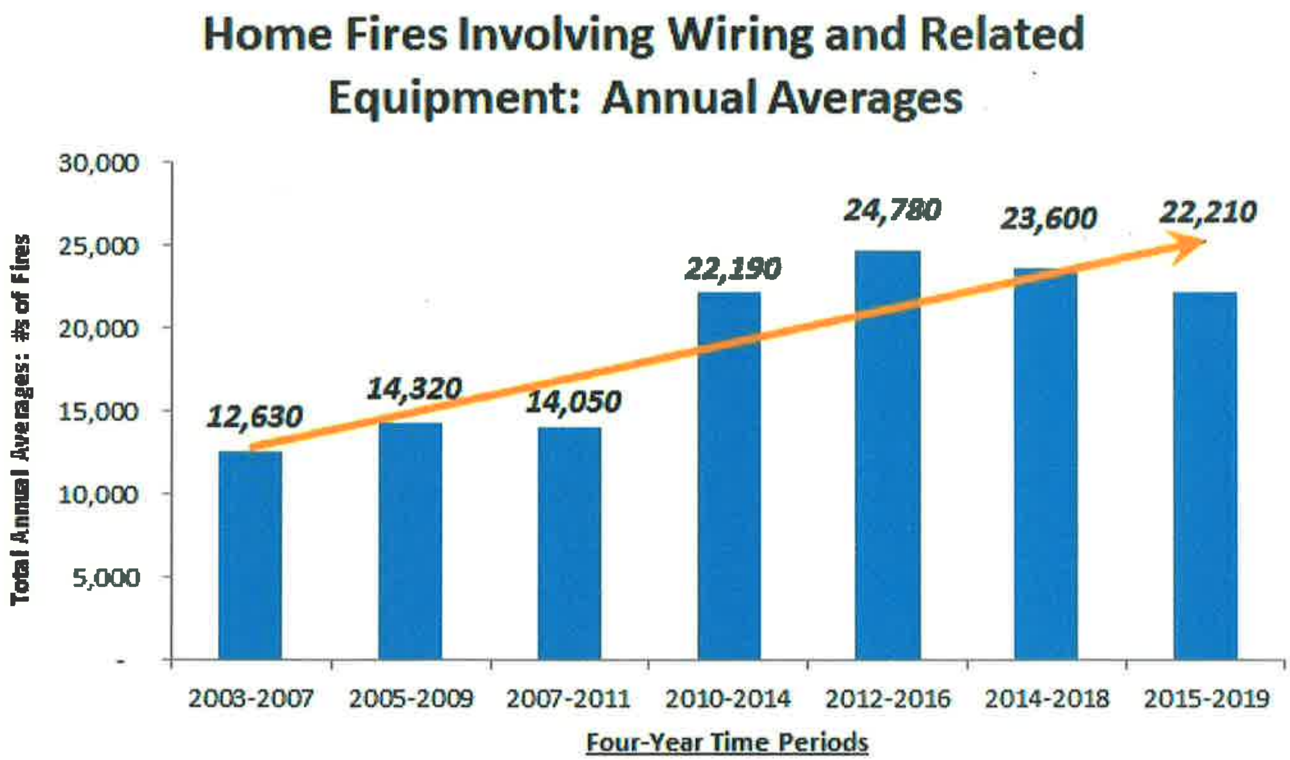
Merton Bunker, PE.

Attachment #1

NFPA Electrical Fire Data

PI 3155

NFPA Electrical Fire Data



Sources: Data from NFIRS Version 5.0, NFPA Survey, NFPA Fire Experience Survey and Fire Safety in the United States since 1980

Attachment #2

USFA residential Building Electrical Malfunction Trends (2012-2021)

PI 3155

US Fire Administration

Residential Building Electrical Malfunction Fire Trends (2012-2021)

(https://www.usfa.fema.gov/statistics/residential-fires/electrical.html)

Residential Building Electrical Malfunction Fire Trends (2012-2021)

Fires, deaths, injuries and dollar loss

Fires Deaths Injuries $ Loss

Residential building electrical malfunction fires

View data in a table Download chart

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Fires	20,200	23,100	23,900	24,500	23,500	24,100	25,700	24,200	23,400	24,200

Residential Building Electrical Malfunction Fire Trends (2012-2021)

Overall trends

Overall trends for residential building electrical malfunction fires and losses for the 10-year period of 2012 to 2021 show the following:

- An 11% increase in fires.
- A 17% decrease in deaths.
- An 8% increase in injuries.
- A 27% increase in dollar loss.*

  In 2018, there were 32 incidents with a reported dollar loss of $1,000,000 or more, 14 in 2019, 13 in 2020 and 23 in 2021. These incidents may have contributed to the continued increase in fire dollar loss. The 2019 high-dollar-loss fires included a $26,400,000 hotel fire in New Orleans, Louisiana.

*This overall constant dollar-loss trend takes inflation into account by adjusting each year's dollar loss to its equivalent 2021 value.

Attachment #3

State-By-State NEC Adoption

PI 3155

August 2023

STATE-BY-STATE NEC ADOPTION

Overview of AFCI Requirements: 20 states and 3 major municipalities have made amendments to reduce the AFCI requirements. Below is a summary of the changes that have been made:

Montana (2017 NEC) – Removed requirements to install AFCIs in kitchens.

South Dakota (2020 NEC) – Includes an exception which would not require AFCIs on life support and similar equipment.

North Dakota (2020 NEC) – AFCI protection not required for refrigeration appliances if a single receptacle on a dedicated circuit is installed.

Iowa (2020 NEC) – AFCI requirements for branch circuit extensions or modifications in dwelling or dormitory units were deleted.

Wisconsin (2017 NEC) – AFCI requirements do not apply to kitchens.

Michigan (2018 IRC) – AFCI requirements were deleted.

Indiana (2018 IRC) – AFCI requirements were deleted for modifications or renovations of homes. New construction will require AFCIs

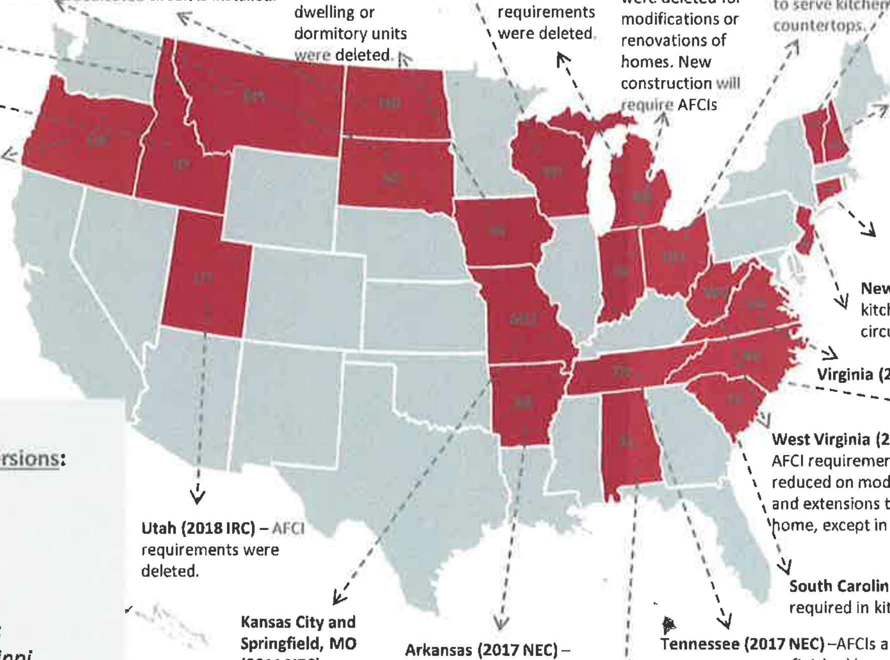
Ohio (2017 NEC) – AFCI requirements were deleted for receptacles installed to serve kitchen countertops.

Vermont (2020 NEC) – AFCI requirements for branch circuit extensions or modifications were deleted where the extension of the existing conductors is used solely to hardwire single station smoke and or CO alarms in an existing dwelling or dormitory unit.

New Hampshire (2020 NEC) – AFCI requirements for dormitory unit devices and bathrooms, guest rooms and guest suites, and branch circuit extensions or modifications for dormitory units were deleted. "Protection in excess of the requirements of the 2014 National Electrical Code shall not be enforced under the state building code".

Idaho (2017 NEC) – AFCI protection is only required in bedrooms.

Oregon (2020 NEC) – AFCI requirements deleted from branch circuits that supply hallways, kitchen or laundry areas, as well as GFCI protected receptacles installed in dining rooms. AFCI protection shall not be required for optional, dedicated outlets that supply equipment known to cause unwanted tripping of AFCI devices and for branch circuits that serve an appliance that is not easily moved or that is fastened in place.



Connecticut (2015 IRC; 2017 NEC) – AFCI protection not required for replacement receptacles.

New Jersey (2017 NEC) - AFCI requirements for kitchens and laundry areas, as well as for branch circuit extensions or modifications, were deleted.

Virginia (2017 NEC) – AFCI's only required in bedrooms.

North Carolina (2020 NEC) – AFCI requirements for kitchens and laundry areas were deleted, as well as those for dormitory unit bathrooms guest room and guest suites, and extensions or modifications.

West Virginia (2020 NEC) – AFCI requirements were reduced on modifications and extensions to any new home, except in bedrooms

<u>Overview of NEC adopted versions</u>:

- **2023 NEC – 2 States**
- **2020 NEC – 17 States**
- **2017 NEC – 17 States**
- **2014 NEC – 1 States**
- **2008 NEC – 1 States**
- **Local Adoption – 5 States:** *Alabama, Arizona, Mississippi, Missouri and Nevada.*
- **AFCI Requirements Controlled by International Residential Code – 7 States**

Utah (2018 IRC) – AFCI requirements were deleted.

South Carolina (2018 IRC) - AFCI's will not be required in kitchens and laundry areas.

Kansas City and Springfield, MO (2011 NEC) – AFCI's only required in bedrooms.

Arkansas (2017 NEC) – AFCI's are not required in kitchens and laundry areas.

Tennessee (2017 NEC) –AFCIs are optional for bathrooms, laundry areas, garages, unfinished basements, work or similar area, and for branch circuits dedicated to supplying refrigeration equipment.

Mobile, AL (2014 NEC) – AFCI's requirements were deleted for family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets and hallways

Attachment #4

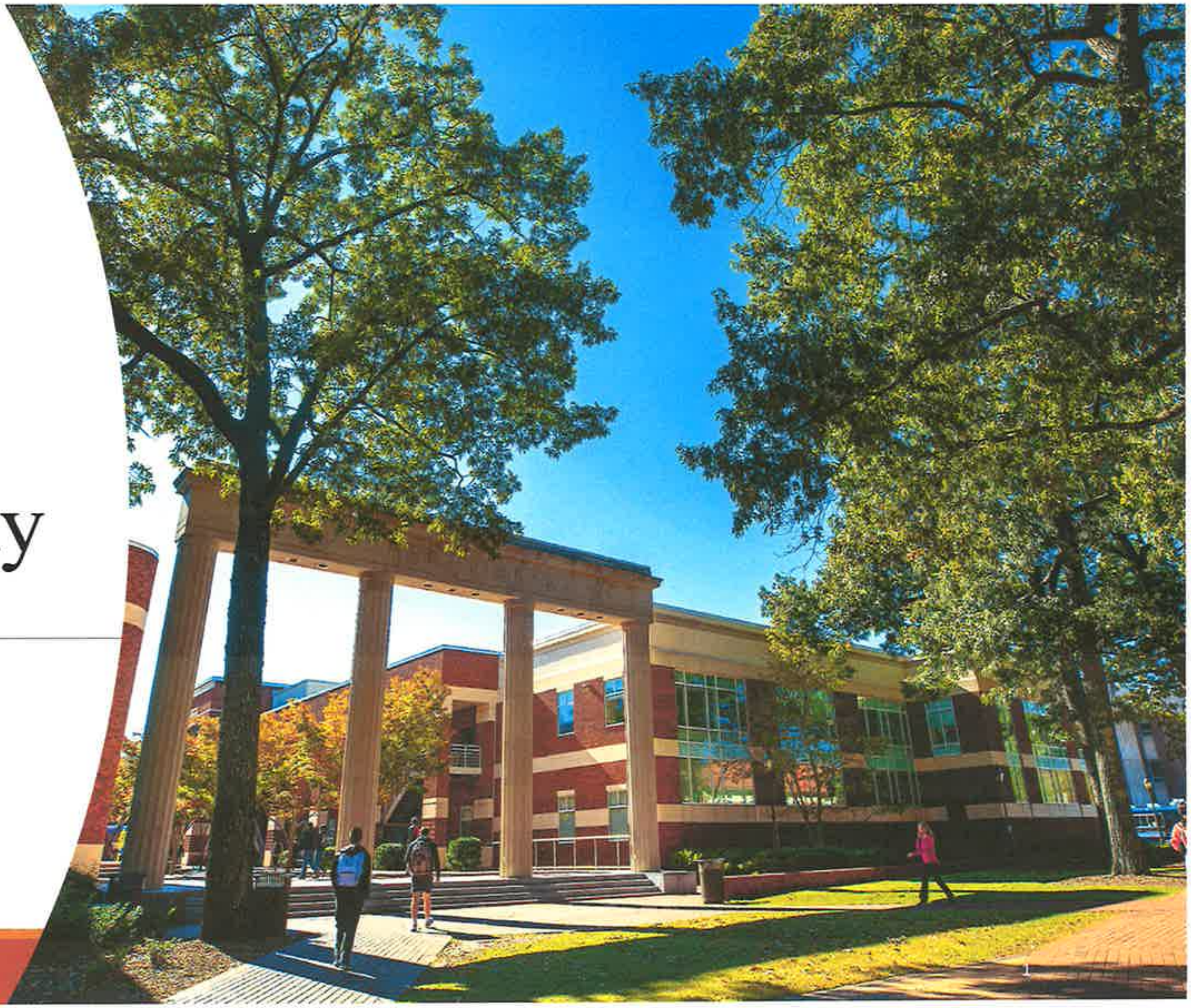
AFCI and Nuisance Tripping Research Study (ECU)

PI 3155

AFCI and Nuisance Tripping Research study

Dr. Steven W. Schmidt
Dr. Xi Lin
East Carolina University

August 15, 2023



2023 Research Study Overview

The purpose of this study was to investigate residential electricians' perceptions of arc fault circuit interrupters (AFCIs) and nuisance tripping. This study was designed to build on the 2020 AFCI study.

This study was conducted to examine a variety of issues surrounding the use of AFCIs and nuisance tripping, including the following:

- Frequency of nuisance tripping, troubleshooting, and solutions
- Costs (time and money) associated with nuisance tripping
- Electricians' perceptions of AFCIs and nuisance tripping
- Customers' perceptions of nuisance tripping
- Customer safety and protection

2023 Research Study Overview (continued)

Following is a summary of steps taken in order to address the research questions:

1. An online survey was developed and sent to residential electricians
   - The survey development process, along with information on reliability and validity checks, can be found in the report summary
   - Names and email addresses of residential electricians were provided by Electrical Contractor Magazine
   - An initial invitation was emailed to 4000 residential electricians, and a follow-up reminder was sent seven days after the initial invitation
   - Respondents who completed the survey were asked to provide their email addresses if they were interested in participating in brief (10-15 minute) phone interviews
   - As an additional incentive, all respondents who completed the survey were given the option of providing their email addresses for a chance to enter a drawing for one of five $50 Amazon gift cards

2023 Research Study Overview (continued)

2. Telephone interviews were conducted with respondents who provided their contact information
   - Nine interviews were conducted
   - Interviews were 10-15 minutes in duration
   - Each interview asked respondents to provide details on their experience dealing with AFCIs and nuisance tripping
   - Interview data was used to support and enhance data gathered in the online survey

3. Both survey and interview data were analyzed, first by each researcher individually, and then together, in order to make conclusions and recommendations

2023 Executive Summary

- Almost all respondents (93.9%) experienced problems with nuisance tripping and AFCIs on residential projects at some point in their work.

- Almost all respondents (87%) knew someone who had replaced AFCIs with standard circuit breakers to resolve a nuisance tripping issue. This percentage is about the same as that from the 2020 survey, when 83% of respondents indicated they knew someone who had done this.

2023 Executive Summary

- The major problems with nuisance tripping are as follows:
  - New construction that involves home products (appliances, lighting) that are more technologically advanced than, or do not work with, the AFCIs being installed in the home.
    - A respondent noted: "AFCI technology is not keeping up with new technology used in appliances, LED Drivers, and other loads"
  - Rewiring/rework projects on existing homes, whereby new electrical components (AFCIs) are added to existing wiring systems.
- The two major issues above may be incompatible with each other. AFCIs must be flexible enough to work with old (existing) wiring systems, but they also have to be technologically advanced to work with the latest technology found in new residential construction and new appliances.

2023 Executive Summary

- **In the past year,** respondents worked on an average of 45 residential projects
  - 34% of these projects (15 of 45) experienced AT LEAST ONE issue with nuisance tripping
  - 87% of those projects (13 of 15) required at least one call-back

  - 18% of the projects (8 of 45) experienced TWO OR MORE issues with nuisance tripping
  - 88% of those projects (7 of 8) required two or more call-backs

- Note that the 8 projects that experienced TWO OR MORE issues with nuisance tripping are counted in the 15 projects that included at least one nuisance trip.
- These percentages are virtually unchanged from the 2020 study.

2023 Executive Summary

- Most respondents (66%) address the issue of nuisance tripping by replacing the AFCI.
  - Most respondents initially replace the AFCI with a new AFCI (often a different brand of AFCI than was used originally).
  - If that doesn't work, they replace with a standard breaker
    - Many respondents know people who have replaced AFCIs with standard breakers.
  - The trying of different brands of AFCI to address nuisance tripping issues is something that is new in the 2023 study. One respondent referred to it as "AFCI roulette".
    - Respondents have preferred brands and brands they will not use. There was no consistency of preferred brand (or brand they will not use) from respondent to respondent.

- Almost all respondents agreed that safety was the main benefit of AFCIs. However, only 23% of respondents believed the benefits of AFCIs outweighed the problems associated with them.
- Overrun costs for replacing AFCIs are still a major concern for electricians.

2023 Executive Summary

- One average call back costs electricians **$200** and takes **2 hours** to complete.
  - These figures are unchanged from the 2020 survey.

- Based on data compiled from this survey on nuisance tripping frequency, and based on data from US Market Watch on the number of new homes constructed in 2022, we can estimate that call backs related to nuisance tripping in that year cost the electrical industry at least:
  - $128,174,500 (tools, materials, wages)
  - 1,281,744 hours (drive and work time)

- Note that this figure is based on new construction. Survey respondents consistently noted that the major problems with nuisance tripping happen on rewire/renovation projects, which are not included here.

2023 Executive Summary

- There was a much greater emphasis on proactivity and on education in this study than in the 2020 study. More respondents are educating their customers up front about the issue of nuisance tripping. They are also educating local/regional authorities in charge of codes with the purpose of changing AFCI requirements.
  - In some cases, exceptions are being made at these levels.
  - There may be opportunities to use education to promote optimal use of AFCIs and Dual Function AFCI/GFCIs that could address problems related to nuisance tripping.

- As in the 2020 study, there are a significant number of work arounds that electricians use to "get around" AFCI requirements. NEC code enforcement is not consistent from area to area. AFCIs are regularly replaced with standard breakers if nuisance tripping occurs after inspections.

2023 Executive Summary

- There is agreement that AFCI technology is improving, which is helping the issue of nuisance tripping, however, perceptions are that technology is not improving fast enough and is not keeping up with innovations in appliances and other home products that use electricity.

- There is still a perception that AFCI requirements in the NEC are driven by AFCI manufacturers to make money.

2023 Survey
Overview and Findings

2023 Survey Participants

The online survey was sent to **4,000** potential participants

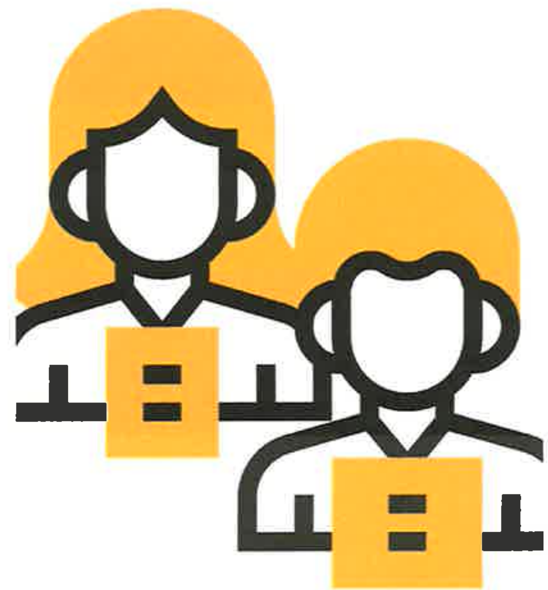
Responses received: **N = 141**

In order to complete the survey, respondents had to answer "yes" to the first two questions on the survey:

- Q1. Do you do residential project work?
- Q2. Do you use AFCIs and/or Dual Function AFCI/GFCIs in your residential wiring

Number of usable responses: **N = 131**

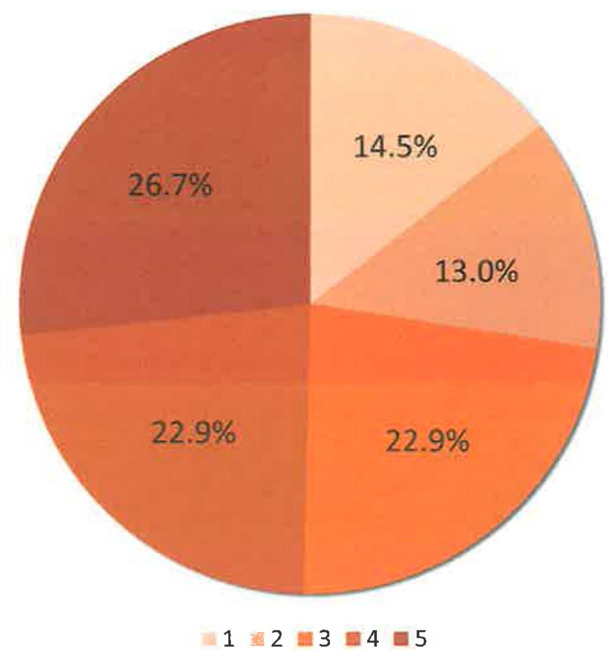
- Those who responded positively to the first two questions and completed the survey



The use of AFCIs and/or Dual Function AFCI/GFCIs is important in residential work.

Respondents were fairly evenly divided in their beliefs on this statement.

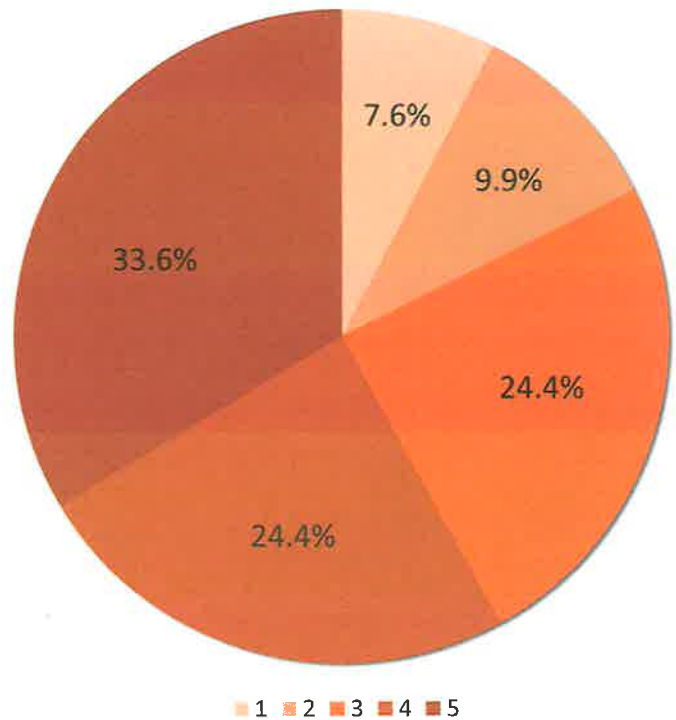
1.	Strongly disagree	14.5%
2.	Disagree	13.0%
3.	Neither agree or disagree	22.9%
4.	Agree	22.9%
5.	Strongly agree	26.7%



Installing AFCIs and/or Dual Function AFCI/GFCIs makes residences safer.

58 percent of respondents agreed with this statement and 42 percent were either neutral or disagreed with this statement.

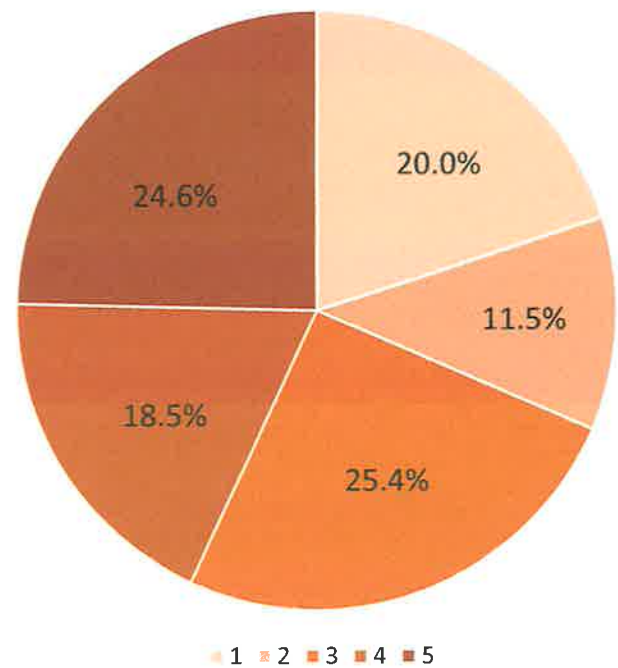
1.	Strongly disagree	7.6%
2.	Disagree	9.9%
3.	Neither agree or disagree	24.4%
4.	Agree	24.4%
5.	Strongly agree	33.6%



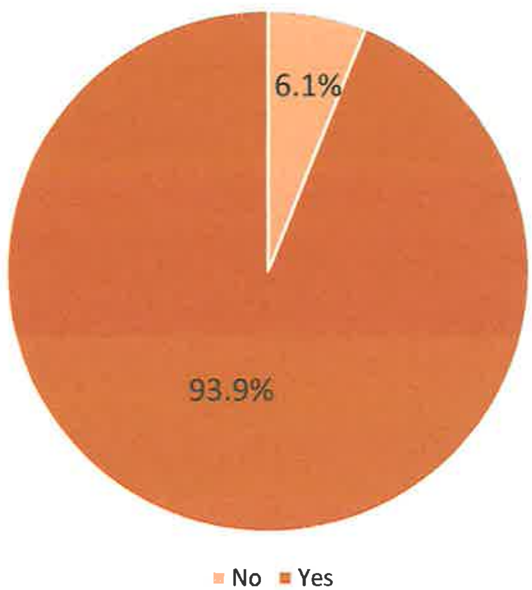
Installing AFCIs and/or Dual Function AFCI/GFCIs provides benefits to homeowners.

Respondents were fairly evenly split in their beliefs on this statement.

1.	Strongly disagree	20.0%
2.	Disagree	11.5%
3.	Neither agree or disagree	25.4%
4.	Agree	18.5%
5.	Strongly agree	24.6%



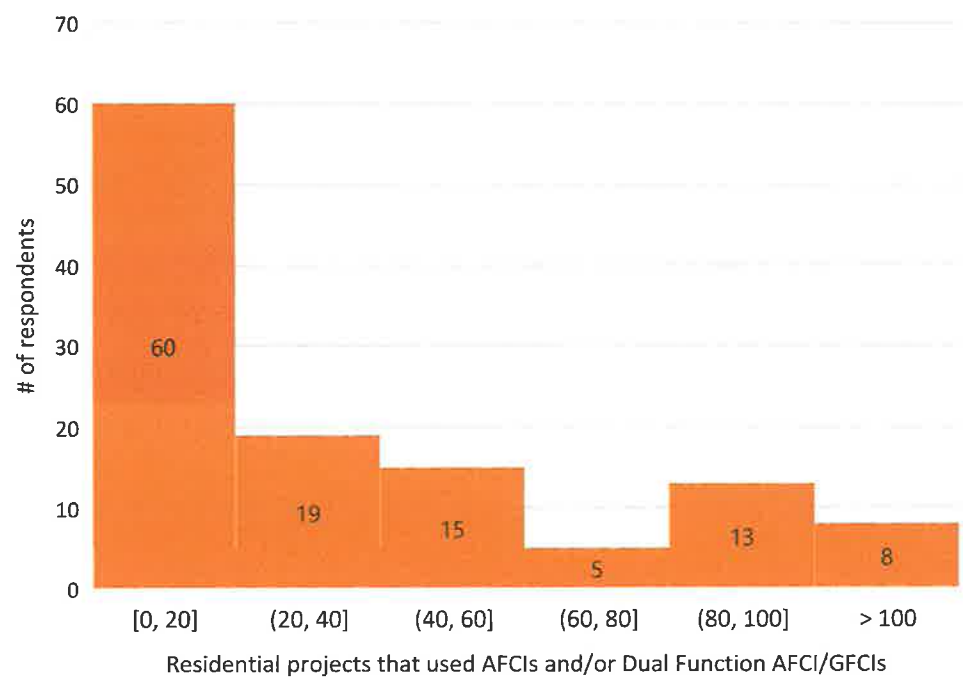
Have you ever experienced nuisance or unwanted tripping of AFCIs and/or Dual Function AFCI/GFCIs on residential projects?



Most respondents have experienced nuisance tripping.

- **Yes: 93.9%**
- No: 6.1%

Within the last year, on approximately how many separate residential projects did you use AFCIs and/or Dual Function AFCI/GFCIs?



- The average respondent used AFCIs and/or Dual Function AFCI/GFCIs on **45** separate residential projects within the past year.

Data on Nuisance Tripping and Call Backs

- Respondents worked on an average of 45 residences that used AFCIs within the past year.
- There was **AT LEAST ONE** issue with nuisance tripping in 15 of those 45 residences (34% of all residences experienced issues with nuisance tripping)
  - Of those 15 residences, 13 required a call back because of nuisance tripping (87%).
- There were **TWO OR MORE** issues with nuisance tripping in 8 of those 15 residences (or 18% of the total of 45 residences).
  - Of those 8 residences, 7 required two or more call backs (88%).

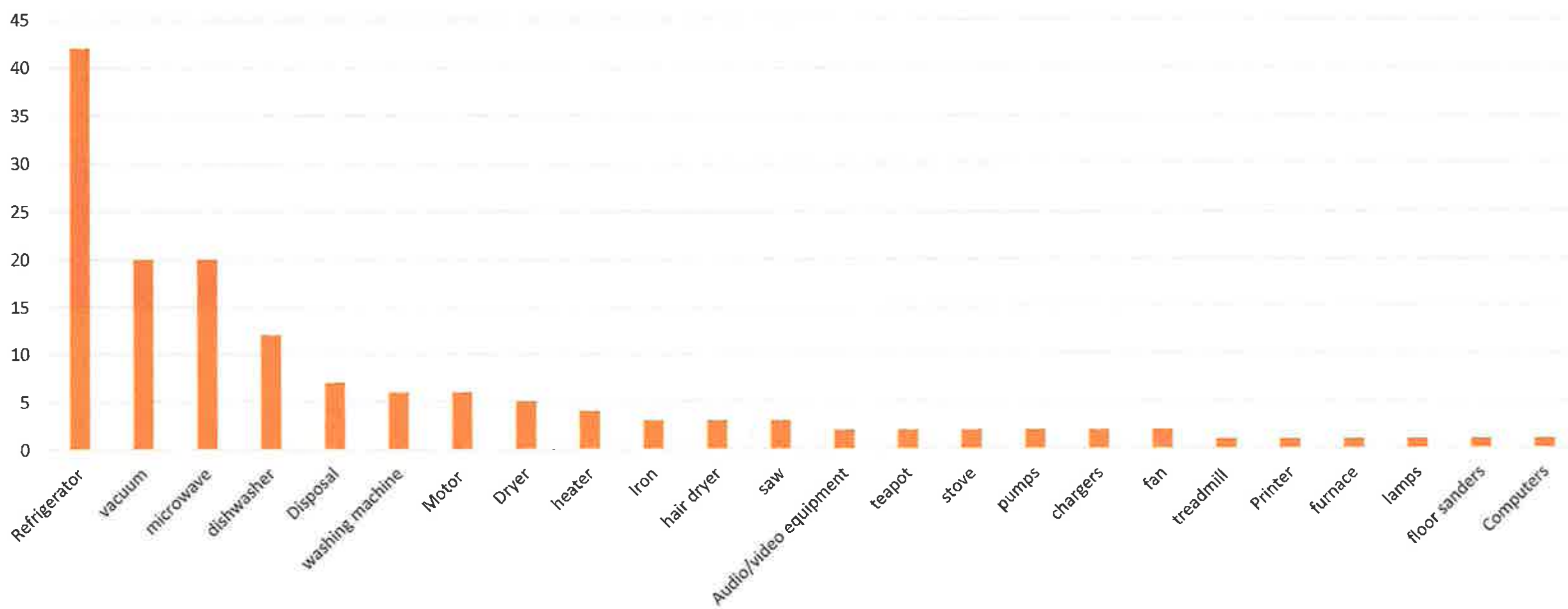
In your experience, what is the most common cause/origin of nuisance tripping in AFCIs and/or Dual Function AFCI/GFCIs?

- Respondents' most common response to this question (in order) are as follows:
  - Motor/Electrical load issues (79 mentions)
  - Breaker issues (30 mentions)
  - Neutral issues (9 mentions)
  - Existing old wiring/wiring equipment (8 mentions)

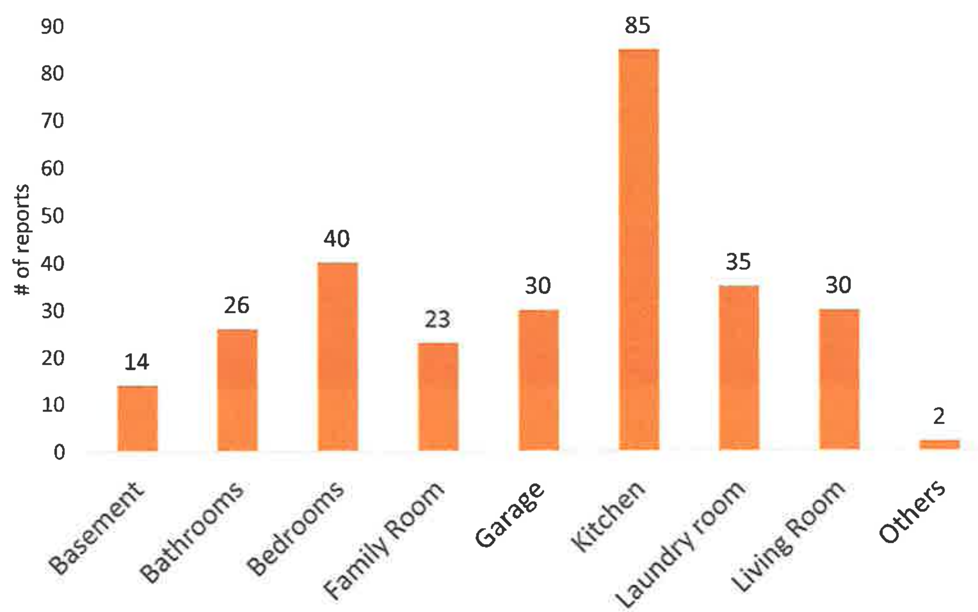
- Note that many respondents listed multiple causes/origins in their responses. In these cases, we categorized each separately (so a single person's response could be represented multiple times in the list of mentions above).

In your experience, what is the most common appliance or load that causes AFCI and/or Dual Function AFCI/GFCI nuisance tripping?

Most common appliances/loads causing nuisance tripping: Refrigerator, vacuum, microwave, dishwasher.



In your experience, what circuits or areas in the home experience the most AFCI and/or Dual Function AFCI/GFCI nuisance tripping?



14 reported Basement

26 reported Bathrooms

40 reported Bedrooms

23 reported Family room

30 reported Garage

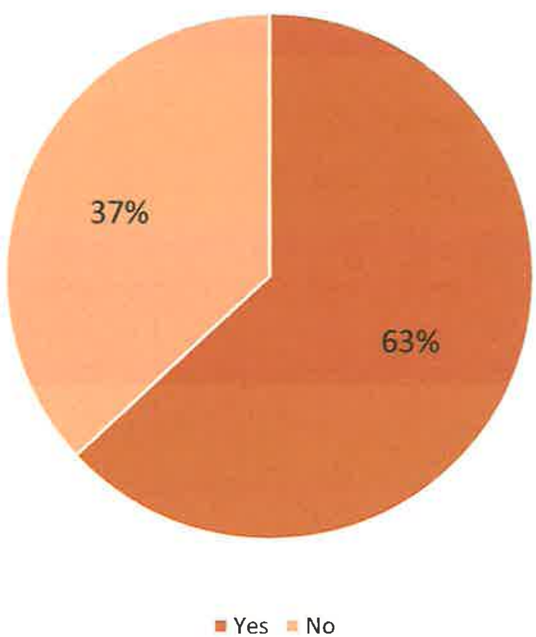
85 reported Kitchen

35 reported Laundry room

30 reported Living room

NOTE: Respondents could choose as many options as they thought applied.

Have you or your customer ever reset a tripped AFCI or Dual Function AFCI/GFCI circuit breaker that resulted in a plugged-in appliance (such as a blender, food processor, stove, toaster oven, garbage disposal or power tool) immediately starting back up again?



- **Yes: 63%**
- No: 37%

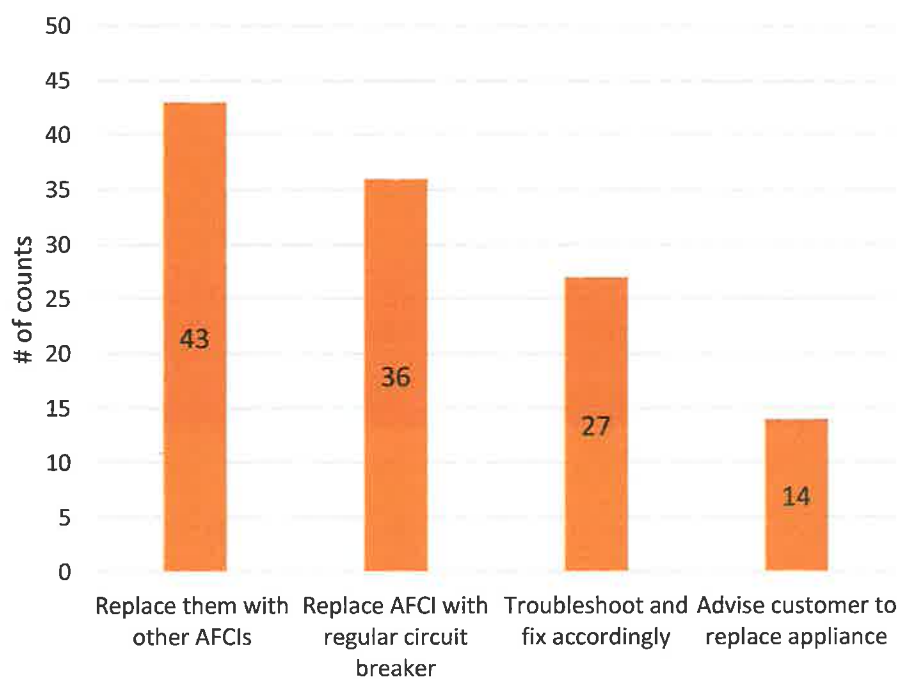
This was a fairly common occurrence among respondents, and it may be a safety issue of concern.

Homeowner Safety and Security Questions

- As noted on the previous page, most electricians have encountered situations in which an unattended appliance restarts when an AFCI or a Dual Function AFCI/GFCI breaker is reset.

- The general consensus was that consumers call electricians before attempting to fix anything on their own.

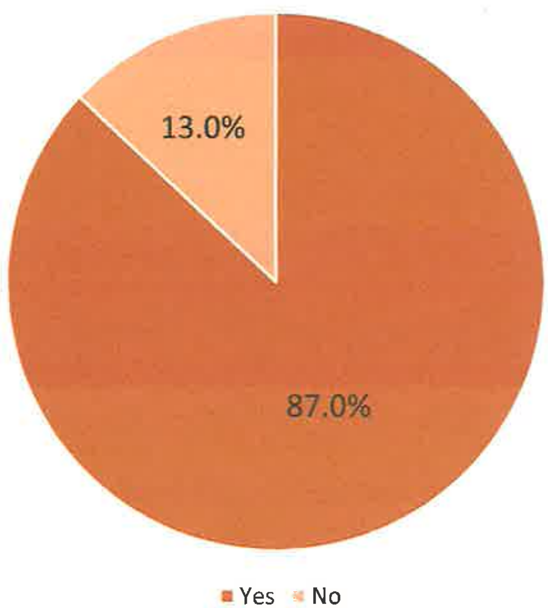
What is the most common way you resolve nuisance tripping problems?



The most common response to this question was replacing AFCIs with **other AFCIs** .

1. Replace them with other AFCIs (often a different brand)
2. Replace AFCI with regular circuit breaker
3. Troubleshoot and fix accordingly
4. Advise customer to replace appliance

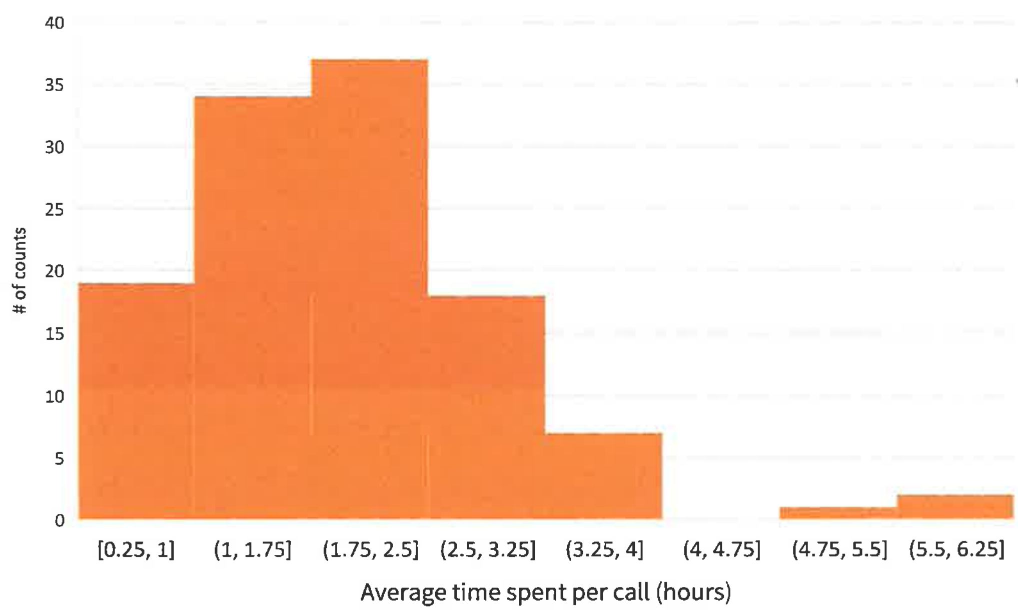
Are you aware of anyone ever replacing an AFCI or Dual Function AFCI/GFCI Breaker with a standard circuit breaker to resolve the nuisance tripping issue?



Most respondents knew someone who had replaced an AFCI breaker with a standard breaker. This percentage is consistent with that from the 2020 survey (83 percent).

- **Yes: 87%**
- No: 13%

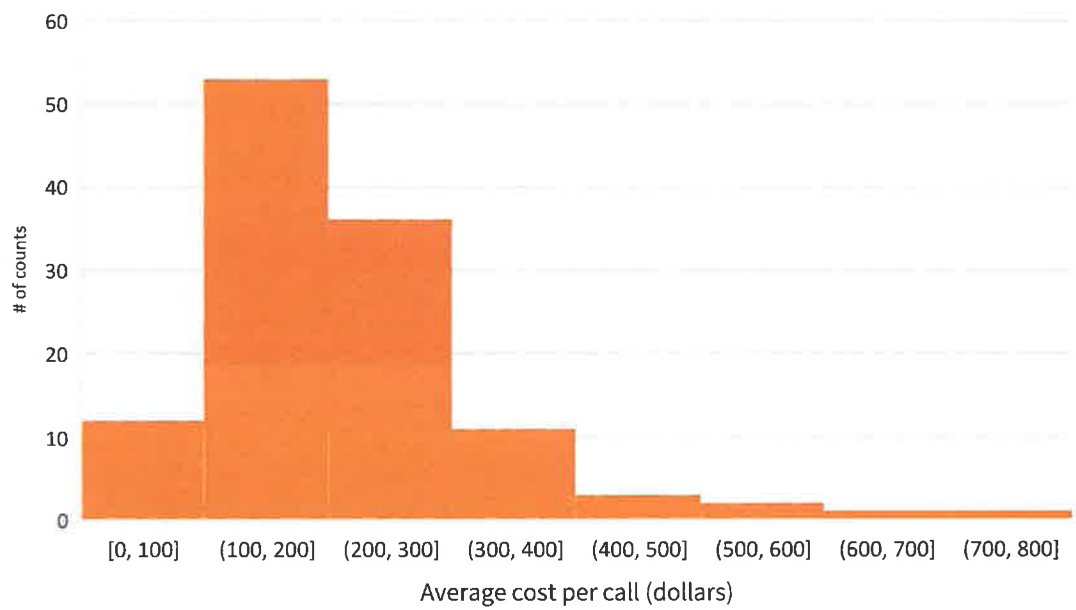
Considering drive and work time, ONE average call back takes ____ hours.



On average, respondents spent **2 hours** on a call back.

This average is the same as the 2020 average.

Considering tools, materials, supplies, and wages, ONE average call back costs ____ dollars.



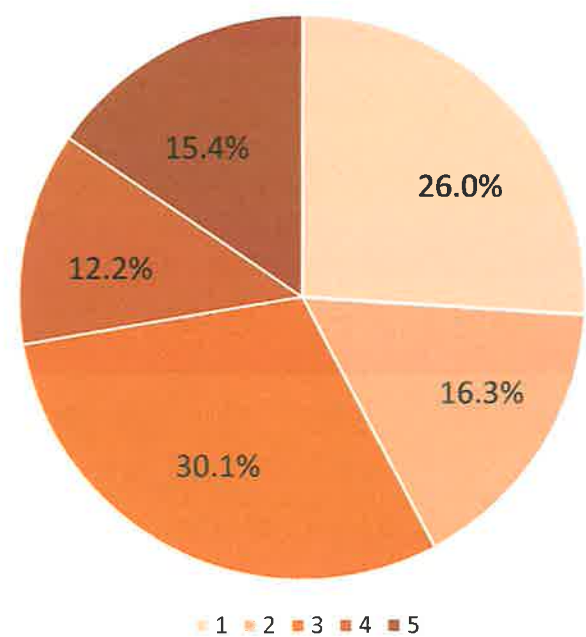
On average, respondents spent **$200** for a call back.

This average is the same as the 2020 study average.

AFCIs or Dual Function AFCI/GFCIs should be installed in the same room, or on the same floor, as the room/floor that they serve.

- Responses to this question were fairly evenly split. Some respondents noted this was ideal, but not often feasible.

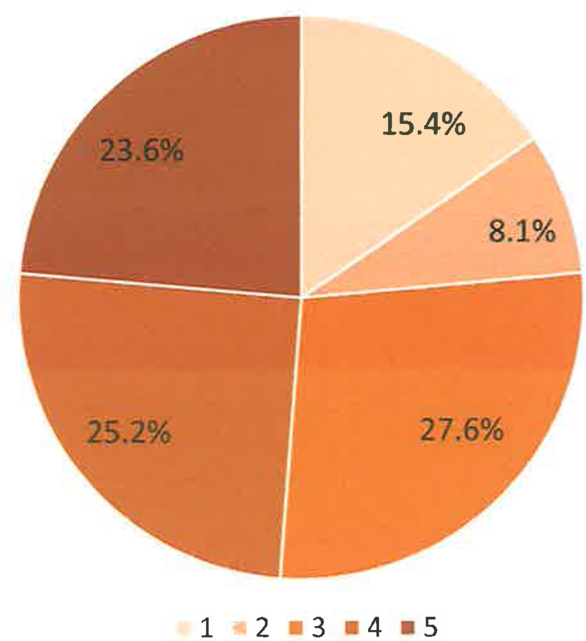
1.	Strongly disagree	26.0%
2.	Disagree	16.3%
3.	Neither agree or disagree	30.1%
4.	Agree	12.2%
5.	Strongly agree	15.4%



AFCI and/or Dual Function AFCI/GFCI nuisance tripping problems have caused a decrease in my customers' satisfaction with my work.

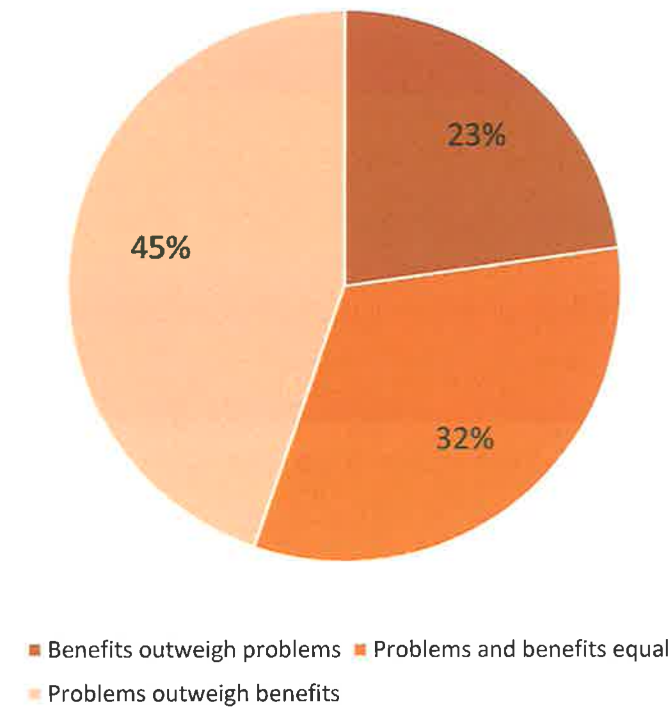
Almost half of all respondents agreed with this statement. Respondents have lost jobs/contracts because of nuisance tripping. More have started to proactively educate customers about this issue.

1. Strongly disagree	15.4%
2. Disagree	8.1%
3. Neither agree or disagree	27.6%
4. Agree	25.2%
5. Strongly agree	23.6%

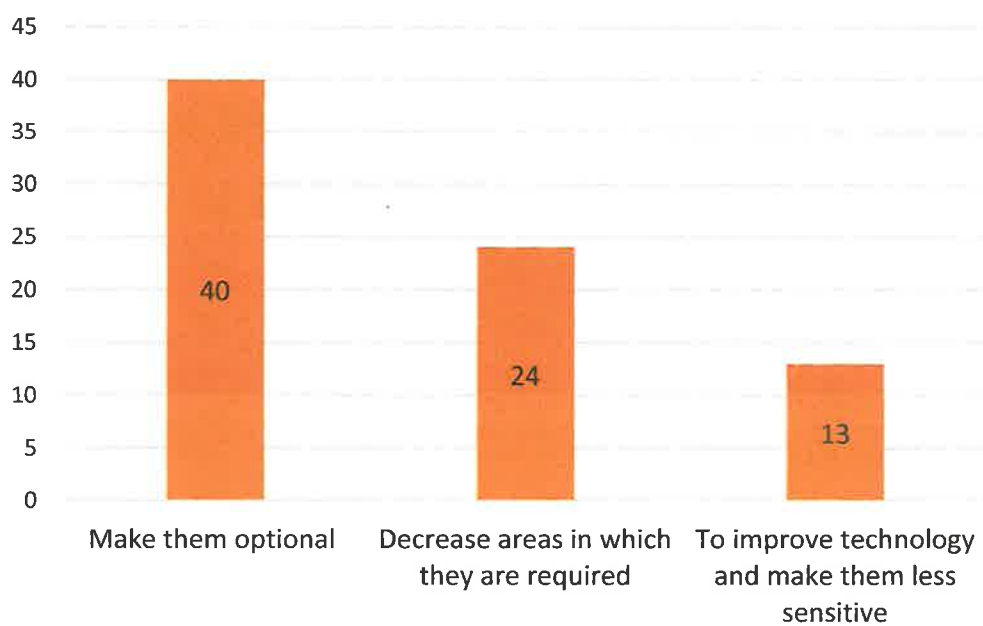


In your opinion, do the benefits of AFCIs and Dual Function AFCI/GFCIs outweigh the problems or do the problems outweigh the benefits?

- A majority of respondents (45 percent) believed that problems outweigh benefits.
- Twenty-three percent believed that benefits outweigh problems.



If you were writing the National Electrical Code (NEC), would you recommend any changes to the AFCI and/or Dual Function AFCI/GFCI requirements? If so, please note the changes you would recommend.



The most common responses to this question are as follows:

- Make them optional (top response by far)
- Decrease areas in which they are required
- Work with manufacturers to improve technology and make them less sensitive

Appendices

APPENDIX A: ABOUT THE RESEARCHERS

APPENDIX B: STUDY METHODOLOGY INFORMATION

About the Researchers

- Dr Steven W. Schmidt is Professor of Adult Education at East Carolina University. He also manages the Adult Education Program. He earned masters and doctoral degrees from the University of Wisconsin – Milwaukee. He has conducted many qualitative and quantitative research studies, and his work has been published in a variety scholarly journals. He regularly presents his research at national and international conferences, and he has authored two textbooks. In addition, he is the author of the publication "The Shift to Competency-Based Education in the Electrical Trades Industry", published by ELECTRI International.

- Dr. Xi Lin is Associate Professor of Adult Education at East Carolina University. She is a graduate of Auburn University's doctoral program in adult education. Dr. Lin has conducted a variety of quantitative research studies, and also focuses on using technology in the research process. Her work has been published in many different journals and she has presented at conferences around the world.

Study Methodology Information

Steps taken to ensure study validity included the following:

- Subject-matter experts were employed to review the survey and interview questions to ensure content validity. The use of a standard interview guide and the pilot testing of the survey were also used to ensure overall validity.
- The use of multiple methods of data collection, along with data triangulation, was also used to ensure validity and reliability

Survey Protocol

- The survey was distributed to 4000 electricians randomly selected from a list of electricians owned by Electrical Contractor Magazine. After pilot testing, survey invitations were sent to 4000 electricians on July 6, 2023. A follow-up, or reminder message was sent to the same list on July 11, 2023. The deadline for responses was July 13, 2023.

Survey Sample Size

- In order to ensure a 90 percent confidence level and a 10 percent margin of error in our study, the number of respondents had to be over 100. That was achieved with a total usable number of responses of 131. The 90 percent confidence level aligns with the confidence level for the 2020 study. The number of responses means we can generalize results for the population of residential electricians (with a 10 percent margin of error).

Attachment #5

EFC Collected Data on AFCI Nuisance Tripping

PI 3155

From: Gurvinder Chopra
Sent: Thursday, July 6, 2023 10:21 AM
To: Hamden, Todd
Subject: RE: AFCI Tripping

P1 3155
EFC DATA

Hi Todd, I don't see a reason for not being able to share on a public Domain as there is no mention of any names of the manufacturers which would make it confidential. We have shared this data with CACES and some regulators as well.

Gurvinder Chopra | VP, Standards & Regulations

Electro-Federation Canada

From: Hamden, Todd <>
Sent: Thursday, July 6, 2023 10:19 AM

To: Karen Ewing
Cc: Gurvinder Chopra
Subject: RE: AFCI Tripping

Hi Karen/Gurvinder

I am wondering if the below information can be shared in a public domain (General public). Has this information been in the public domain.

Regards,

HUBBELL CANADA

Todd Hamden

Manager, Certification and Standards

www.hubbell.ca

From: Karen Ewing
Sent: Wednesday, July 5, 2023 9:14 AM
To: Hamden, Todd
Cc: Gurvinder Chopra
Subject: FW: AFCI Tripping

Hi Todd,

Below is a report on appliances that have tripped with AFCIs and the # of occurrences per year. We have some unknowns due to the submitter not sending in the details but we know there was a trip.

Hope this helps

Count of Equipment Causing Tripping **Years**

Row Labels	**2018**	2019	2020	2021	2022	2023	(blank)	**Grand Total**
Microwave		2	10	28	18	17	9	84
Unknown	2	20	6	12	32	1	3	76

Washing Machine		2	5	25	26	8	4	70
Television		1	5	6	6	2	3	23
Vacuum		2	8	3	5		3	21
Refrigerator		1	1	4	5	1		12
Saw		4	2	4				10
Dishwasher			1	3	4	1		9
Freezer		2		1	1	2	1	7
Dryer			1	4			1	6
Mitre saw				1	2	2		5
Lawn mower				2	1	1		4
Pump			1				2	3
Stove					3			3
Oven				1	2			3
Hair Dryer				1			2	3
Washer/Dryer						3		3
Vacuum						2		2
Printer			2					2
Blender			1				1	2
Treadmill				2				2
Pot Lights			1		1			2
Printer			1		1			2
LED Tree					2			2
Hot Water Tank		1						1
Generator			1					1
Snow blower starter engine					1			1
Inverter Charger				1				1

Vent Hood		1						1
Computer					1			1
Sewage pump						1		1
Air Compressor				1				1
Garage Door Opener							1	1
CPAP Machine or electric foot rest					1			1
Heat Gun					1			1
Dehumidifier					1			1
Hot water heater				1				1
OTR					1			1
Car Charger				1				1
Battery				1				1
Sewerage pump				1				1
Playstation						1		1
Freezer & Refrigerator				1				1
Drill Press		1						1
Gas Range							1	1
Breville Espresso Machine, Vacuum, Tea Kettle, Bar Fridge				1				1
Christmas lights					1			1
Electric fireplace					1			1
Various						1		1
Projector						1		1
Heat pad							1	1
Propane boiler				1				1
Power sofa						1		1

Electronics			1					1
Exhaust fan					1			1
(blank)								
Grand Total	**2**	**37**	**47**	**106**	**118**	**45**	**32**	**387**

Kindest regards,

Karen Ewing | Business Sections Administrator

Electro-Federation Canada

190 Attwell Drive, Suite 560,

Toronto, ON M9W 6H8

Direct: (647) 250-8341

From: Hamden, Todd <THamden@hubbell.ca>
Sent: Tuesday, July 4, 2023 4:00 PM
To: Gurvinder Chopra <gchopra@electrofed.com>; Karen Ewing <kewing@electrofed.com>
Subject: AFCI Tripping

Hi Gurvinder / Karen,

I hope this e mail reaches both of you well and you are enjoying our warm weather. I have a need for a bit of information as there are some proposals at NEMA to the NEC with respect to AFCI's and I would like to know what the reported incidents we have been tracking.

I would welcome any data you can disclose with me on the number of AFCI trips reported, what type of appliance and possibly manufacture (if you can). The manufacture info may be too much but anything you can provide would be of interest.

Regards,

Todd Hamden

Manager, Certification and Standards

T: 905 837-6058

T: 416.302.6004

Email: thamden@hubbell.ca

www.hubbell.ca

EFC collected data on AFCI nuisance tripping:

Count of Equipment Causing Tripping	Years							
Row Labels	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**(blank)**	**Grand Total**
Microwave		2	10	28	18	17	9	84
Unknown	2	20	6	12	32	1	3	76
Washing Machine		2	5	25	26	8	4	70
Television		1	5	6	6	2	3	23
Vacuum		2	8	3	5		3	21
Refrigerator		1	1	4	5	1		12
Saw		4	2	4				10
Dishwasher			1	3	4	1		9
Freezer		2		1	1	2	1	7
Dryer			1	4			1	6
Mitre saw				1	2	2		5
Lawn mower				2	1	1		4
Pump			1				2	3
Stove					3			3
Oven				1	2			3
Hair Dryer				1			2	3
Washer/Dryer						3		3
Vacuum						2		2
Printer			2					2
Blender			1				1	2
Treadmill				2				2
Pot Lights			1		1			2
Printer			1		1			2
LED Tree					2			2

Hot Water Tank		1						1
Generator			1					1
Snow blower starter engine					1			1
Inverter Charger				1				1
Vent Hood		1						1
Computer					1			1
Sewage pump						1		1
Air Compressor				1				1
Garage Door Opener							1	1
CPAP Machine or electric foot rest					1			1
Heat Gun					1			1
Dehumidifier					1			1
Hot water heater				1				1
OTR					1			1
Car Charger				1				1
Battery				1				1
Sewerage pump				1				1
Playstation						1		1
Freezer & Refrigerator				1				1
Drill Press		1						1
Gas Range							1	1
Breville Espresso Machine, Vacuum, Tea Kettle, Bar Fridge				1				1
Christmas lights					1			1
Electric fireplace					1			1
Various						1		1
Projector						1		1
Heat pad							1	1
Propane boiler				1				1

Power sofa						1		1
Electronics			1					1
Exhaust fan					1			1
(blank)								
Grand Total	**2**	**37**	**47**	**106**	**118**	**45**	**32**	**387**

Public Input No. 3372-NFPA 70-2023 [Section No. 210.12(B)]

(B) Dwelling Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Kitchens

(2) Family rooms

(3) Dining rooms

(4) Living rooms

(5) Parlors

(6) Libraries

(7) Dens

(8) Bedrooms

(9) Sunrooms

(10) Recreation rooms

(11) Closets

(12) Hallways

(13) Laundry areas

(14) Similar areas

(15) Attics

Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

Informational Note No. 1: See *NFPA 72*-2022, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

The Commonwealth of Massachusetts has required AFCI protection on all circuits since their adoption of the 2020 NEC w/ this amendment on January 1, 2020. There has not been any reports of unwanted tripping or other issues related to the use of AFCI's across all 15-20A circuits. ESFi conducted a survey of electrical contractors during 2022 and found that there were no specified issues related to AFCI's causing tripping issues. The vast majority of tripping issues found were related to overloads/short circuits.

Housing start data from Massachusetts (source: NAHB):
2020 data: 8,507 single family permits and 3,376 multi-family permits
2021 data: 7,231 single family permits and 12,622 multi-family permits
2022 data: 6,094 single family permits and 12,102 multi-family permits

Concerns related to interoperability lead to additional testing of attic fans in a humidity chamber. There testing covered 5 different fans from 5 different manufacturers utilizing Conditions of 120Vac, and +54C (+130F). Three different manufacturers of current dual function circuit breakers were used and none of the devices tripped.

Submitter Information Verification

Submitter Full Name: Randy Dollar
Organization: Siemens Industry
Affiliation: American Circuit Breaker Manufacturers Association (ACBMA)
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 01 15:20:41 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: FR-8195-NFPA 70-2024

Statement: The section has been revised to make the NEC more user-friendly. Expansion to the remaining circuits of dwelling units, except for garages, continues the incremental steps to protect the entire dwelling as electrical fires can occur on these 10-A, 15-A, and 20-A circuits regardless of the area or room they serve. The entire length of conductors presents opportunities for causing an electrical fire. This Arc-fault protection expansion to all dwelling unit 10-A, 15-A, and 20-A branch circuits increases safety by reducing the likelihood of electrical fires.

Electrical fire statistics demonstrate that electrical fires exist in dwelling units that might have been prevented by AFCI protection.

Kitchens, Laundry areas, and Listed HVAC equipment have been excepted from AFCI protection due to incompatibility concerns.

Public Input No. 3379-NFPA 70-2023 [Section No. 210.12(B)]

(B) Dwelling Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Kitchens

(2) Family rooms

(3) Dining rooms

(4) Living rooms

(5) Parlors

(6) Libraries

(7) Dens

(8) Bedrooms

(9) Sunrooms

(10) Recreation rooms

(11) Closets

(12) Hallways

(13) Laundry areas

(14) Similar areas

(15) Circuits supplying Garage door openers

Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

Informational Note No. 1: See *NFPA 72*-2022, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

AFCIs have been required in the Code since 1999. The initial requirement covered only bedroom receptacle outlets, giving installers an opportunity to gain experience with what was at that time a new product, and for manufacturers to address any unforeseen problems with their designs. In the 2002 edition the requirement was expanded to include all bedroom outlets. In the 2008 edition the requirement was expanded once again to include bedrooms, family rooms, living rooms, parlors, libraries, dens, sun rooms, recreation rooms or similar rooms. Kitchens, laundry areas and devices located in the specified areas were added to the requirement in the 2014
edition. When the 2023 edition was published, the industry has over 21 years of experience with the manufacture and installation of AFCIs and over 15years of experience with combination type AFCIs. All along CMP2 has wisely chosen to take incremental steps in the expansion of the AFCI requirement. Per the U.S. Fire Administration, each year there are over 6600 garage fires resulting in an average of 30 deaths, 400 injuries, and $457M in property loss. Electrical malfunction is a major contributor to the number with an annual average of 1590/yr. and 10 deaths per NFPA 2021 Home Electrical Fires Table 8. NFPA's documentation explains that the majority of electrical malfunctions are arcing faults. The industry still has questions on specific loads, but none of the concerns are around the garage door opener. This load uses typical motors seen utilized without issue in other parts of the AFCI protected branch circuits. The addition of this protection would help in reducing garage fires and be another incremental step by CMP 2 to improve electrical safety.

The following garage fires are what this PI is designed to prevent when an issue arises with the garage door opener:

Garage Fire caused by Garage Door Opener in Nahant, MA
https://itemlive.com/2021/07/15/garage-door-opener-sparks-fire-in-nahant/

CPSC Recall of Genie Garage Door Openers from a national issue.
https://www.cpsc.gov/Recalls/2014/Genie-Recalls-Garage-Door-Openers

Garage Fire caused by Garage Door Opener in Mitchell, SD
https://www.mitchellrepublic.com/news/faulty-garage-door-opener-likely-caused-fire-to-start

Interoperability testing has been done with various manufacturers of garage door openers based on requests from home builders and electrical contractors without any tripping issues.

The Commonwealth of Massachusetts has required AFCI protection on all circuits since their adoption of the 2020 NEC w/ this amendment on January 1, 2020. There has not been any reports of unwanted tripping or other issues related to the use of AFCI's across all 15-20A circuits. ESFI conducted a survey of electrical contractors during 2022 and found that there were no specified issues related to AFCI's causing tripping issues. A large majority of tripping issues found were related to overloads/short circuits. These results would include any unwanted tripping issues within garages but there have not been any reports to date after 3 ½ years. A link to this survey is below:

https://www.esfi.org/esfi-afci-and-gfci-performance-survey/

Submitter Information Verification

Submitter Full Name:	Randy Dollar
Organization:	Siemens Industry
Affiliation:	American Circuit Breaker Manufacturers Association (ACBMA)
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Fri Sep 01 16:09:24 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: Incompatibility continues to be a concern. Expansion of AFCI protection into garages should not take place until incompatibility with welders and garage door openers is addressed.

Public Input No. 3380-NFPA 70-2023 [Section No. 210.12(B)]

(B) Dwelling Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Kitchens

(2) Family rooms

(3) Dining rooms

(4) Living rooms

(5) Parlors

(6) Libraries

(7) Dens

(8) Bedrooms

(9) Sunrooms

(10) Recreation rooms

(11) Closets

(12) Hallways

(13) Laundry areas

(14) Similar areas

(15) Bathrooms

Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

Informational Note No. 1: See *NFPA 72*-2022, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

Additional Proposed Changes

File Name	Description	Approved
bathroom_fan_testing_-_AFCI.jpg	Bathroom fan testing - AFCI	

Statement of Problem and Substantiation for Public Input

The branch circuit that feeds bathrooms is routed with other conductors throughout the structure that are afforded AFCI protection as conductor damage can occur along the entire length of the branch circuit.

The Commonwealth of Massachusetts has required AFCI protection on all circuits since their adoption of the 2020 NEC w/ this amendment on January 1, 2020. There has not been any reports of unwanted tripping or other issues related to the use of AFCI's across all 15-20A circuits. ESFI conducted a survey of electrical contractors during 2022 and found that there were no specified issues related to AFCI's causing tripping issues. The vast majority of tripping issues found were related to overloads/short circuits.

Housing start data from Massachusetts (source: NAHB):
2020 data: 8,507 single family permits and 3,376 multi-family permits
2021 data: 7,231 single family permits and 12,622 multi-family permits
2022 data: 6,094 single family permits and 12,102 multi-family permits

Additionally, concerns related to interoperability lead to additional testing of bathroom fans in a humidity chamber. There testing covered 11 different fans from 6 different manufacturers utilizing Conditions of 120Vac, +32C (+90F), and Relative Humidity 20% - 93%. Three different manufacturers of current dual function circuit breakers were used and none of the devices tripped. Similar tests were run on other fans without any tripping of the dual function circuit breakers.

(see attached photo for example of bathroom fan testing)

"How Dangerous is a Bathroom Exhaust Fan?" by The Forst Consulting Group (May 2020) - "The three most common causes of a bathroom exhaust fan fire are: faulty wiring, running the fan for extended periods of time and overheating the motor, and failing to clean the fan. Most fans have a shaded pole motor which has a very low starting torque. Any additional resistance in the bearing can lead to a locked rotor, thus overheating the motor to temperatures in excess of 340 °F. The typical NEMA Class B motor corresponds to a maximum insulation temperature of 266 °F. When overheated, the wire insulation will fail and cause a fire."

ESFi reports the following (https://www.esfi.org/home-electrical-fires/):
• Home electrical fires account for an estimated 51,000 fires each year, nearly than 500 deaths, more than 1,400 injuries, and $1.3 billion in property damage.
• Electrical distribution systems are the third leading cause of home structure fires.
• Each year in the United States, arcing faults are responsible for starting more than 28,000 home fires, killing and injuring hundreds of people, and causing over $700 million in property damage.
• The U.S. Consumer Product Safety Commission (CPSC) reports that electrical receptacles are involved in 5,300 fires every year, causing forty deaths and more than 100 consumer injuries.
• Sixty-five percent of home fire deaths result from fires in homes with no working smoke detectors.

Submitter Information Verification

Submitter Full Name: Randy Dollar
Organization: Siemens Industry
Affiliation: American Circuit Breaker Manufacturers Association (ACBMA)
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 01 16:14:55 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8195-NFPA 70-2024

Statement: The section has been revised to make the NEC more user-friendly. Expansion to the remaining circuits of dwelling units, except for garages, continues the incremental steps to protect the entire dwelling as electrical fires can occur on these 10-A, 15-A, and 20-A circuits regardless of the area or room they serve. The entire length of conductors presents opportunities for causing an electrical fire. This Arc-fault protection expansion to all dwelling unit 10-A, 15-A, and 20-A branch circuits increases safety by reducing the likelihood of electrical fires.

Electrical fire statistics demonstrate that electrical fires exist in dwelling units that might have been prevented by AFCI protection.

Kitchens, Laundry areas, and Listed HVAC equipment have been excepted from AFCI protection due to incompatibility concerns.

Public Input No. 3407-NFPA 70-2023 [Section No. 210.12(B)]

(B) Dwelling Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Kitchens

(2) Family rooms

(3) Dining rooms

(4) Living rooms

(5) Parlors

(6) Libraries

(7) Dens

(8) Bedrooms

(9) Sunrooms

(10) Recreation rooms

(11) Closets

(12) Hallways

(13) Laundry areas

(14) Similar areas

(15) Attics

Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

Informational Note No. 1: See *NFPA 72*-2022, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

Electrical malfunction (Per NFPA, home fires due to electrical failure or malfunction primarily involve some form of arcing, which results from an unintentional discharge of electrical current between conductors.) is a major contributor to fires starting in attics with an annual average of 4600/yr. with 10 deaths, 70 injuries, & $194M in damage per NFPA 2021 Home Electrical Fires Table 8. While some of these fires are caused by circuits running through the attic, the branch circuits feeding the attic are subject to the same damage and other causes of arcing. The dangers that these unprotected circuits could create should not be ignored. Some recent attic fires are given below and what this PI will prevent.

May 2022: Gardnerville, NV (East Fork FD) / https://www.recordcourier.com/news/2022/may/13/firefighters-douse-main-street-attic-blaze/
October 2022: Rockton, IL (Rockton FD) / https://roscoenews.com/g/rockton-il/n/127798/attic-fire-rockton-was-put-out-quickly
February 2023: Monona, WI (Monona FD) / https://www.nbc15.com/2023/02/10/attic-fire-causes-estimated-50k-damage-monona-home/
March 2023: Lakewood, CO (West Metro FD) / https://5280fire.com/2023-incidents/lakewood-west-5th-ave-attic-fire/

The Commonwealth of Massachusetts has required AFCI protection on all circuits since their adoption of the 2020 NEC with this amendment on January 1, 2020. There has not been any reports of unwanted tripping or other issues related to the use of AFCI's across all 15-20A circuits. ESFI conducted a survey of electrical contractors during 2022 and found that there were no specified issues related to AFCI's causing tripping issues. The vast majority of tripping issues found were related to overloads/short circuits.

Concerns related to interoperability lead to additional testing of attic fans in a humidity chamber. There testing covered 5 different fans from 5 different manufacturers utilizing Conditions of 120Vac, and +54C (+130F). Three different manufacturers of current dual function circuit breakers were used and none of the devices tripped.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3408-NFPA 70-2023 [Section No. 210.12(B)]	

Public Input No. 3408-NFPA 70-2023 [Section No. 210.12(B)]

Submitter Information Verification

Submitter Full Name: Megan Hayes
Organization: NEMA
Street Address:
City:
State:
Zip:
Submittal Date: Sat Sep 02 16:16:41 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8195-NFPA 70-2024

Statement: The section has been revised to make the NEC more user-friendly. Expansion to the remaining circuits of dwelling units, except for garages, continues the incremental steps to protect the entire dwelling as electrical fires can occur on these 10-A, 15-A, and 20-A circuits regardless of the area or room they serve. The entire length of conductors presents opportunities for causing an electrical fire. This Arc-fault protection expansion to all dwelling unit 10-A, 15-A, and 20-A branch circuits increases safety by reducing the likelihood of electrical fires.

Electrical fire statistics demonstrate that electrical fires exist in dwelling units that might have been prevented by AFCI protection.

Kitchens, Laundry areas, and Listed HVAC equipment have been excepted from AFCI protection due to incompatibility concerns.

Public Input No. 3408-NFPA 70-2023 [Section No. 210.12(B)]

(B) Dwelling Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Kitchens

(2) Family rooms

(3) Dining rooms

(4) Living rooms

(5) Parlors

(6) Libraries

(7) Dens

(8) Bedrooms

(9) Sunrooms

(10) Recreation rooms

(11) Closets

(12) Hallways

(13) Laundry areas

(14) Similar areas

(15) Bathrooms

Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

Informational Note No. 1: See *NFPA 72*-2022, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

Additional Proposed Changes

File Name	Description	Approved
Images_210.12_B_Dwelling_Units_Bathrooms.docx	Supporting images for 210.12B_Bathrooms	

Statement of Problem and Substantiation for Public Input

Electrical malfunction (Per NFPA, home fires due to electrical failure or malfunction primarily involve some form of arcing, which results from an unintentional discharge of electrical current between conductors.) caused bathroom fires at an annual average of 2300/yr. and 10 deaths, 50 injuries, & $48M per NFPA 2021 Home Electrical Fires Table 8. A reduction of these fires, deaths, injuries, and financial impact is the focus of this public input. There have been significant AFCI testing done on bathroom cord/plug appliances as well as the major manufacturers of bathroom fans including humidity level testing in order to prevent unwanted tripping. This testing covers over 100,000 test cases, over 1,000 use cases, and over 300 appliance brands.

Some examples of fires that have started in bathrooms include

March 2017 - Zionsville, IN / https://fox59.com/news/family-loses-everything-after-fire-started-by-bathroom-exhaust-fan/
October 2019 - Troy, MI (2 separate fires) / https://www.theoaklandpress.com/news/two-fires-start-from-faulty-bathroom-exhaust-fans/article_35d3003c-ef71-11e9-aea7-63cc0011aca1.html
May 2021 - Spokane Valley, WA / https://www.khq.com/news/bathroom-ceiling-fan-causing-electrical-fire-at-spokane-valley-home/article_4f2baa5e-add7-11eb-90b0-ff1f3e70dfea.html

The Commonwealth of Massachusetts has required AFCI protection on all circuits since their adoption of the 2020 NEC w/ this amendment on January 1, 2020. There has not been any reports of unwanted tripping or other issues related to the use of AFCI’s across all 15-20A circuits. ESFI conducted a survey of electrical contractors during 2022 and found that there were no specified issues related to AFCI’s causing tripping issues. The vast majority of tripping issues found were related to overloads/short circuits.

Additionally, concerns related to interoperability lead to additional testing of bathroom fans in a humidity chamber. There testing covered 11 different fans from 6 different manufacturers utilizing Conditions of 120Vac, +32C (+90F), and Relative Humidity 20% - 93%. Three different manufacturers of current dual function circuit breakers were used and none of the devices tripped. Similar tests were run on 5 Radon Fans without any tripping of the dual function circuit breakers.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3407-NFPA 70-2023 [Section No. 210.12(B)]	
Public Input No. 3407-NFPA 70-2023 [Section No. 210.12(B)]	

Submitter Information Verification

Submitter Full Name: Megan Hayes
Organization: NEMA
Street Address:
City:
State:
Zip:
Submittal Date: Sat Sep 02 16:35:24 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8195-NFPA 70-2024

Statement: The section has been revised to make the NEC more user-friendly. Expansion to the remaining circuits of dwelling units, except for garages, continues the incremental steps to protect the entire dwelling as electrical fires can occur on these 10-A, 15-A, and 20-A circuits regardless of the area or room they serve. The entire length of conductors presents opportunities for causing an electrical fire. This Arc-fault protection expansion to all dwelling unit 10-A, 15-A, and 20-A branch circuits increases safety by reducing the likelihood of electrical fires.

Electrical fire statistics demonstrate that electrical fires exist in dwelling units that might have been prevented by AFCI protection.

Kitchens, Laundry areas, and Listed HVAC equipment have been excepted from AFCI protection due to incompatibility concerns.

Bathroom fans tested at cycling humidity and temp

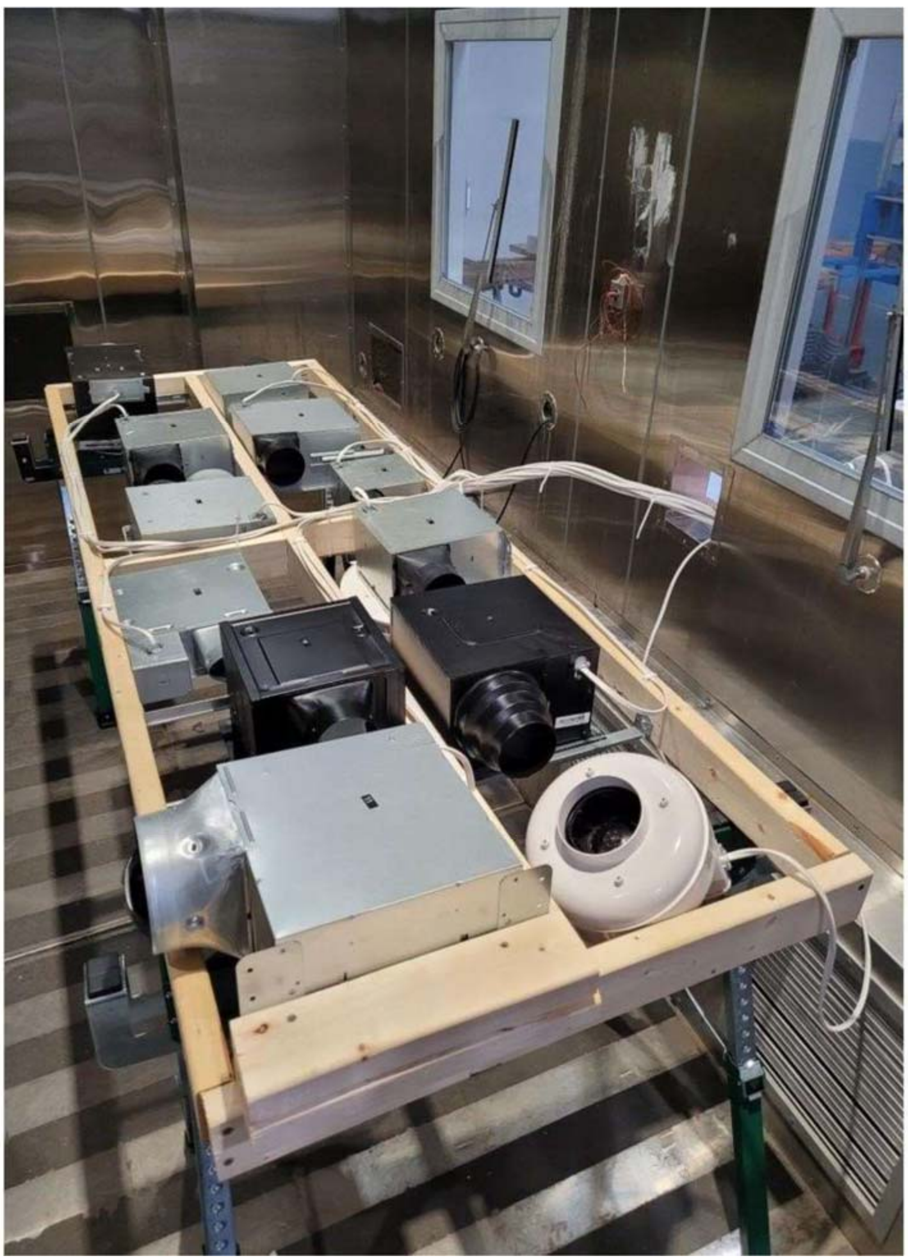
No nuisance tripping registered

[redacted]

The test included fan samples with and without Humidity sensors.

Test setup is was done using 1P AFCI CB and 1P DF (AFCI/GFCI) CB.

Humidity was cycled 90/40 RH



Public Input No. 3635-NFPA 70-2023 [Section No. 210.12(B)]

(B) Dwelling Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Kitchens

(2) Family rooms

(3) Dining rooms

(4) Living rooms

(5) Parlors

(6) Libraries

(7) Dens

(8) Bedrooms

(9) Sunrooms

(10) Recreation rooms

(11) Closets

(12) Hallways

(13) Laundry areas

(14) Similar areas

Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

~~*Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.*~~

Informational Note No. 1: See *NFPA 72*-2022, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

The date of this exception will have passed at the publishing of the 2026 edition of the National Electrical Code.

Submitter Information Verification

Submitter Full Name:	Thomas Domitrovich
Organization:	Eaton Corporation
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Tue Sep 05 10:53:16 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: Exception No. 2 is retained to address incompatibility concerns. Welding equipment could be used in areas, other than garages, that require AFCI protection.

Public Input No. 3926-NFPA 70-2023 [Section No. 210.12(B)]

(B) Dwelling Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Kitchens

(2) Family rooms

(3) Dining rooms

(4) Living rooms

(5) Parlors

(6) Libraries

(7) Dens

(8) Bedrooms

(9) Sunrooms

(10) Recreation rooms

(11) Closets

(12) Hallways

(13) Laundry areas

(14) Similar areas

(15) <u>All Branch circuits ran in non-metallic cable unless protected from damage by rigid metal conduit, intermediate metal conduit, or electrical metallic tubing.</u>

Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

Informational Note No. 1: See *NFPA 72*-2022, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

NM and NMC cable do not provide physical protection and once concealed behind walls in a home or building the owner has no idea where the cable is located. This can cause damage to the cable when making modifications or penetrating the wall. Also staples when installing these cables can be applied to tight compromising the sheath of the cable leading to early breakdown of the outer jacket and sheath allowing arcing between the conductors. NM Cable is a popular and reliable wiring method, but we do need to take some steps to protect it and the residents of homes and building where it is used. Below you will see some residential fire statistics from 2015 - 2019 provided by the NFPA in two different reports:https://www.nfpa.org/News-and-Research/Data-research-and-tools/Electrical/ElectricalElectrical Failures or malfunctions caused an estimated 390 civilian deaths and 1330 injuries a year. The fires also caused an estimated 1.5 billion dollars in direct property damage a year. It was the second leading cause of home structure fires accounting for 13% percent of all fires. Arcing was estimated to cause three in five residential home fires from 2015-2019.Electrical Distribution and lighting equipment was the cause of an estimated 32,160 home fires a year from 2015-2019. These fires caused an estimated 430 civilian deaths and 1070 civilian injuries each year. Wiring and related equipment caused an estimated 68% of these fires. By protecting our most common residential wiring either physically with conduit or with an Arc fault interrupter increases fire safety in our residential buildings. If this increased safety results in saving one

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3931-NFPA 70-2023 [Sections 210.12(C), 210.12(D)]	

Submitter Information Verification

Submitter Full Name: Raymond Horner
Organization: Atkore
Affiliation: Atkore

Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 06 10:37:57 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The charging language of 210.12(B) is for locations required to be protected by one of the AFCI means of protections in 210.12(A). The proposed language addresses a wiring method and not a location.

Public Input No. 3966-NFPA 70-2023 [Section No. 210.12(B)]

(B) Dwelling Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) ~~Kitchens~~

(2) Family rooms

(3) Dining rooms

(4) Living rooms

(5) Parlors

(6) Libraries

(7) Dens

(8) Bedrooms

(9) Sunrooms

(10) Recreation rooms

(11) Closets

(12) Hallways

(13) ~~Laundry areas~~

(14) Similar areas

Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

Informational Note No. 1: See *NFPA 72-2022*, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

Additional Proposed Changes

File Name	Description	Approved
PI_3966_-_Reason_Statement.pdf		

Statement of Problem and Substantiation for Public Input

Please see attached reason statement.

Submitter Information Verification

Submitter Full Name: Daniel Buuck
Organization: National Association of Home Builders
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 06 11:30:46 EDT 2023
Committee: NEC-P02

Committee Statement

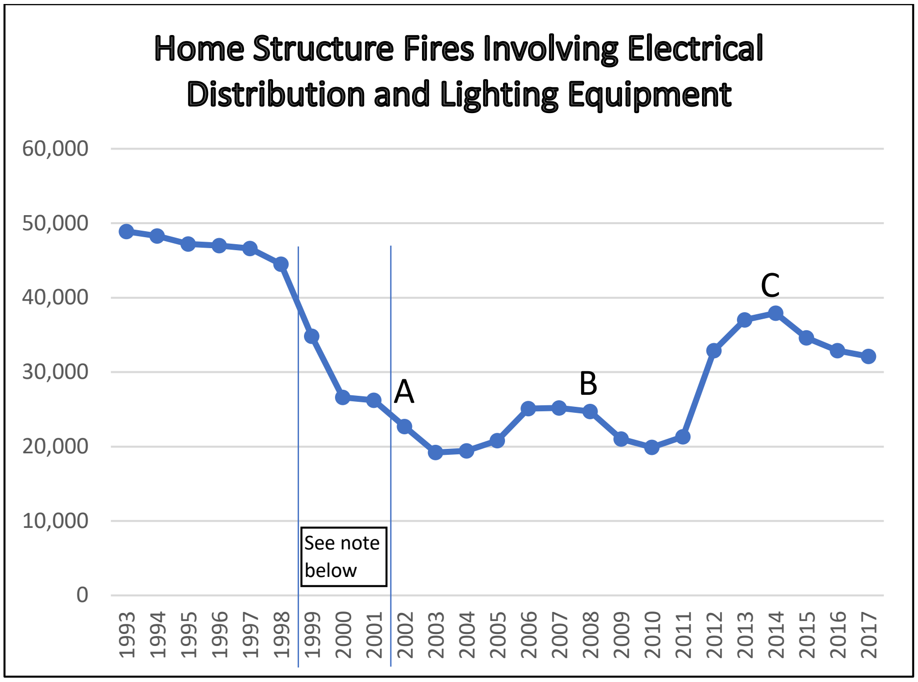
Resolution: FR-8195-NFPA 70-2024

Statement: The section has been revised to make the NEC more user-friendly. Expansion to the remaining circuits of dwelling units, except for garages, continues the incremental steps to protect the entire dwelling as electrical fires can occur on these 10-A, 15-A, and 20-A circuits regardless of the area or room they serve. The entire length of conductors presents opportunities for causing an electrical fire. This Arc-fault protection expansion to all dwelling unit 10-A, 15-A, and 20-A branch circuits increases safety by reducing the likelihood of electrical fires.

Electrical fire statistics demonstrate that electrical fires exist in dwelling units that might have been prevented by AFCI protection.

Kitchens, Laundry areas, and Listed HVAC equipment have been excepted from AFCI protection due to incompatibility concerns.

The current fire data coming from NFPA should give us pause. There is no empirical, real-world data we can point to supporting the expansion of AFCI requirements. Quite the opposite—we now see that the installation of tens of millions of AFCI devices has not had a noticeable effect on fire data. As millions of AFCI devices were being installed, home fires involving electrical distribution and lighting equipment experienced a dramatic increase between 2010 and 2014 (see Figure 1)—the numbers of fires jumped from 19,900 to 37,900 in that period.



Required Locations

A – Bedrooms

B – Family rooms, dining rooms, living rooms, parlors, libraries, dens, sunrooms, recreation rooms, closets, hallways and similar rooms or areas

C – Kitchens and laundry areas

Figure 1

Source: [Home Fires Caused by Electrical Distribution and Lighting Equipment: Supporting Tables](), Feb. 2022, NFPA

Note: Because of low participation in NFIRS Version 5.0 during 1999-2001, data from these years is not considered reliable.

In contrast to the data surrounding AFCIs, there is a clear relationship between the early adoption of GFCIs and the reduction in electrocutions (see Figure 2). This is the effect we should be expecting from AFCIs as well, but we are not seeing anything similar to the benefit GFCIs have provided.

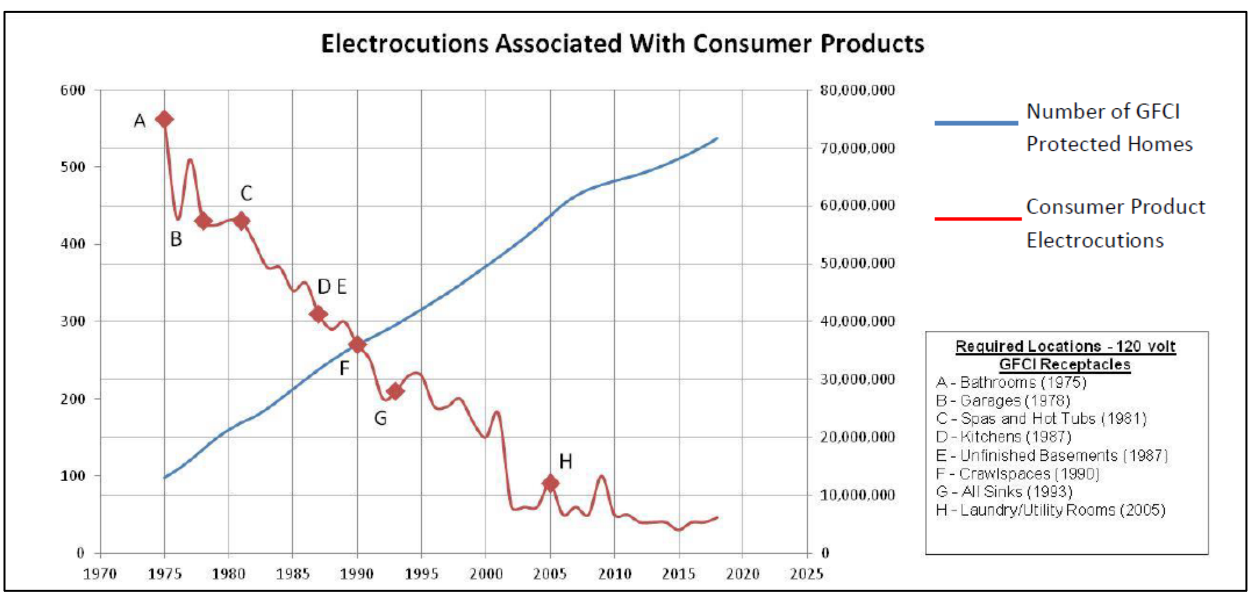
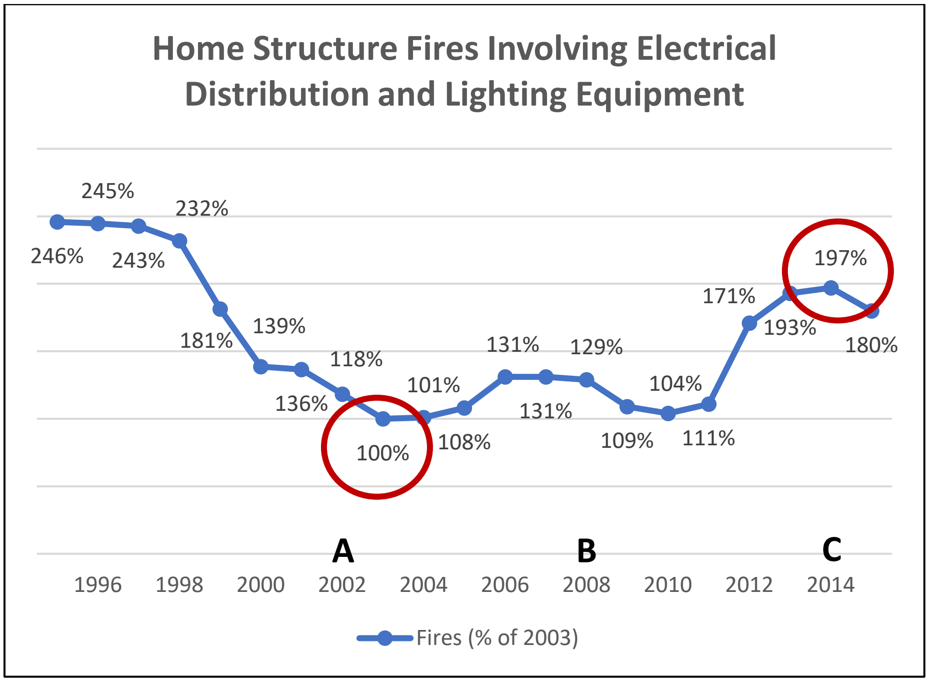


Figure 2: GFCI Protection in Homes Versus Electrocutions 1975 to 2018 (Source: A NEMA Ground Fault Personnel Protection Section Article entitled “GFCI Receptacles: Consumer Protection Personified” June 2020, Revision 2).

Another way to look at the AFCI data is to show the increase in fires as a percent of the low water mark of 2003. After 2008, when the bulk of circuits in a home were required to be covered by an AFCI device, fires incidents reached their highest number since 1998—a nearly 100% increase over 2003.



Required Locations
A – Bedrooms
B – Family rooms, dining rooms, living rooms, parlors, libraries, dens, sunrooms, recreation rooms, closets, hallways and similar rooms or areas
C – Kitchens and laundry areas

Figure 3
Source: Home Fires Caused by Electrical Distribution and Lighting Equipment: Supporting Tables, Feb. 2022, NFPA
Note: Because of low participation in NFIRS Version 5.0 during 1999-2001, data from these years is not considered reliable.

Kitchens and laundry areas are being deleted from the list because they are the primary locations for appliances that experience incompatibility issues causing unnecessary tripping. And they were the last areas to be added to the list. Since then, there has been mounting evidence that these devices do not offer the benefits they were designed for.

Similar amendments have been adopted in Arkansas, North Carolina, Oregon and Wisconsin. Idaho and Tennessee limit AFCIs to bedroom circuits. Montana, Virginia and Wisconsin have exempted kitchens or kitchen countertops from requiring AFCIs. And Indiana, Michigan and Utah have completely removed the requirement for AFCIs for single-family homes. In all, nineteen states have amended the code to remove or reduce AFCI requirements.

Public Input No. 4450-NFPA 70-2023 [Section No. 210.12(B)]

(B) Dwelling Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) ~~Kitchens~~

(2)

(3) Family rooms

(4) Dining rooms

(5) Living rooms

(6) Parlors

(7) Libraries

(8) Dens

(9) Bedrooms

(10) Sunrooms

(11) Recreation rooms

(12) Closets

(13) Hallways

(14) ~~Laundry areas~~

(15)

(16) Similar areas

Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

Informational Note No. 1: See *NFPA 72*-2022, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

Energy efficient appliances utilize power supplies and other components that generate high frequency noise that may be incorrectly interpreted as an arc. Other devices in the household also contribute conducted noise onto the branch circuits, resulting in frequent nuisance tripping. AFCI manufacturers have not been able to establish operating conditions that manufacturers can design to ensure products can operate reliably. The loss of refrigeration in particular can expose the consumer to a high degree of loss if the failure is not noticed before food spoilage occurs. Laundry is also impacted by extensive energy restrictions and nuisance tripping is a significant annoyance.
The requirement for AFCI devices to be on these circuits should be removed or delayed until AFCI manufacturers can define appropriate operating limits that consider FCC and other limits.

Submitter Information Verification

Submitter Full Name: Stephen Gatz
Organization: Whirlpool
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 15:35:05 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8195-NFPA 70-2024

Statement: The section has been revised to make the NEC more user-friendly. Expansion to the remaining circuits of dwelling units, except for garages, continues the incremental steps to protect the entire dwelling as electrical fires can occur on these 10-A, 15-A, and 20-A circuits regardless of the area or room they serve. The entire length of conductors presents opportunities for causing an electrical fire. This Arc-fault protection expansion to all dwelling unit 10-A, 15-A, and 20-A branch circuits increases safety by reducing the likelihood of electrical fires.

Electrical fire statistics demonstrate that electrical fires exist in dwelling units that might have been prevented by AFCI protection.

Kitchens, Laundry areas, and Listed HVAC equipment have been excepted from AFCI protection due to incompatibility concerns.

Public Input No. 482-NFPA 70-2023 [Section No. 210.12(B)]

(B) Dwelling Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices or utilization equipment installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Kitchens

(2) Family rooms

(3) Dining rooms

(4) Living rooms

(5) Parlors

(6) Libraries

(7) Dens

(8) Bedrooms

(9) Sunrooms

(10) Recreation rooms

(11) Closets

(12) Hallways

(13) Laundry areas

(14) Similar areas

Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

Informational Note No. 1: See *NFPA 72*-2022, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

If a piece of utilization equipment is direct wired by a Chapter 3 wiring method with no device or box an argument can be made as to the presence of an "outlet". By adding "utilization" equipment to the wording AFCI protection is required regardless of the presence of an outlet point.

Submitter Information Verification

Submitter Full Name: a Bryan
Organization: State Of Tennessee Inspector (Retired)
Street Address:
City:
State:
Zip:
Submittal Date: Fri Mar 17 14:22:35 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The term “outlet” encompasses the utilization equipment. Outlets serve utilization equipment.

Public Input No. 534-NFPA 70-2023 [Section No. 210.12(B)]

(B) Dwelling Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Kitchens

(2) Family rooms

(3) Dining rooms

(4) Living rooms

(5) Parlors

(6) Libraries

(7) Dens

(8) Bedrooms

(9) Sunrooms

(10) Recreation rooms

(11) Closets

(12) Hallways

(13) Laundry areas

(14) Similar areas

Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit ~~until January 1, 2025~~ , its garages, and its accessory buildings .

Informational Note No. 1: See *NFPA 72*-2022, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

2023 NEC® 210.12(B) Exception No. 2, with its January 1, 2025 "sunset", was newly added by First Revision No. 9628-NFPA 70-2021 [Global Input], largely in anticipation by some of AFCI protection being added to branch circuits serving outlets and devices in dwelling unit basements and garages. The addition of dwelling unit basements via Committee Input No. 9006-NFPA 70-2021 [Detail], however, FAILED CMP-2 BALLOT; branch circuits serving dwelling unit basement outlets and devices were NOT ADDED to 2023 NEC® 210.12(B). Likewise, the addition of dwelling unit garages via Committee Input No. 9003-NFPA 70-2021 [Detail] also FAILED CMP-2 BALLOT; branch circuits serving dwelling unit garage outlets and devices were also NOT ADDED . During the Second Draft stage, the addition of dwelling unit garages via Committee Comment No. 8019-NFPA 70-2021 [Detail] once again FAILED CMP-2 BALLOT; again branch circuits serving dwelling unit garage outlets and devices were NOT ADDED 2023 NEC® 210.12(B).

.

The whole present concept of allowing this Exception to expire by any given date, thereby requiring arc-fault circuit-interrupter protection to be mandated after that given date, makes absolutely no common sense. ARC welding inherently results in ARCING. To impose ARC-FAULT protection mandates on an ARC-PRODUCING equipment makes about as much sense as addressing ventilation problems on a submarine by installing screen doors. To date, no AFCI solution and no arc welding solution are forthcoming that address inherent interoperability issues and allow this January 1, 2025 or any "sunset" date to proceed.

.

Consequently, delete the "sunset" date and make Exception No. 2 permanent.

Submitter Information Verification

Submitter Full Name: Brian Rock

Organization: Hubbell Incorporated

Street Address:

City:

State:

Zip:

Submittal Date: Wed Apr 05 09:42:12 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: FR-8197-NFPA 70-2024

Statement: The date in Exception No. 2 was deleted and the exemption of arc welding equipment from AFCI protection was extended to dwelling unit garages and accessory buildings.

Public Input No. 889-NFPA 70-2023 [Section No. 210.12(B)]

(B) Dwelling Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Kitchens

(2) Family rooms

(3) Dining rooms

(4) Living rooms

(5) Parlors

(6) Libraries

(7) Dens

(8) Bedrooms

(9) Sunrooms

(10) Recreation rooms

(11) Closets

(12) Hallways

(13) Laundry areas

(14) ~~Similar areas~~

Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

Informational Note No. 1: See *NFPA 72*-2022, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Input

"Similar" (i.e., "Similar areas") is a vague and unenforceable term per NEC® Style Manual 3.2.1 and Table 3.2.1, and "(14) Similar areas" must be eliminated. Arbitrary inspection interpretations have resulted in inconsistency as to what exactly constitutes a "similar area". NEC® Correlation Committee [NEC-AAC] take note.

Submitter Information Verification

Submitter Full Name: Brian Rock
Organization: Hubbell Incorporated
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 24 16:00:54 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8195-NFPA 70-2024

Statement: The section has been revised to make the NEC more user-friendly. Expansion to the remaining circuits of dwelling units, except for garages, continues the incremental steps to protect the entire dwelling as electrical fires can occur on these 10-A, 15-A, and 20-A circuits regardless of the area or room they serve. The entire length of conductors presents opportunities for causing an electrical fire. This Arc-fault protection expansion to all dwelling unit 10-A, 15-A, and 20-A branch circuits increases safety by reducing the likelihood of electrical fires.

Electrical fire statistics demonstrate that electrical fires exist in dwelling units that might have been prevented by AFCI protection.

Kitchens, Laundry areas, and Listed HVAC equipment have been excepted from AFCI protection due to incompatibility concerns.

Public Input No. 16-NFPA 70-2023 [Sections 210.12(B), 210.12(C), 210.12(D)]

Sections 210.12(B), 210.12(C), 210.12(D)

(B) Dwelling Units.

All 120-volt nominal , single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Kitchens

(2) Family rooms

(3) Dining rooms

(4) Living rooms

(5) Parlors

(6) Libraries

(7) Dens

(8) Bedrooms

(9) Sunrooms

(10) Recreation rooms

(11) Closets

(12) Hallways

(13) Laundry areas

(14) Similar areas

Exception No. 1: AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

Exception No. 2: AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

Informational Note No. 1: See *NFPA 72*-2022, *National Fire Alarm and Signaling Code*, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

Informational Note No. 2: See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

(C) Dormitory Units.

All 120-volt nominal , single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Bedrooms

(2) Living rooms

(3) Hallways

(4) Closets

(5) Bathrooms

(6) Similar rooms

(D) Other Occupancies.

All 120-volt nominal , ~~single~~ single -phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Guest rooms and guest suites of hotels and motels

(2) Areas used exclusively as patient sleeping rooms in nursing homes and limited-care facilities

(3) Areas designed for use exclusively as sleeping quarters in fire stations, police stations, ambulance stations, rescue stations, ranger stations, and similar locations

Statement of Problem and Substantiation for Public Input

Since 210.12(B), (C), and (D) do not presently specify whether the 120V circuit is the "nominal voltage" or "circuit voltage", but 110.4 says the voltage considered shall be that at which the CIRCUIT operates, does this literally mean AFCI protection is NOT required for branch circuits operating at 119V, 118V, 122V or any voltage than 120V? Yes, apparently it does.
So, I guess we've all been installing AFCI protection on circuits that may not have needed it! I certainly don't think that is the intent of

these requirements. This revision is needed to clarify that "120-volt" is referring to the nominal voltage rather than the circuit operating voltage.
There are several other sections in the Code where this language needs clarification too. I will be submitting PI for those sections and as many other sections as I can where this conundrum seems to exists.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 23-NFPA 70-2023 [Sections 210.11(C)(3), 210.11(C)(4)]	
Public Input No. 92-NFPA 70-2023 [Section No. 210.8(C)]	
Public Input No. 96-NFPA 70-2023 [Section No. 525.23(A)]	

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 10:40:20 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8196-NFPA 70-2024
Statement: This revision is made to add clarity regarding the voltage of AFCI-protected branch circuits relative to "nominal voltage" cited in 110.4.

Public Input No. 800-NFPA 70-2023 [Section No. 210.12(C)]

(C) ~~Dormitory Units~~ Dormitories .

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Bedrooms

(2) Living rooms

(3) Hallways

(4) Closets

(5) ~~Bathrooms~~

(6) ~~Similar rooms~~

Statement of Problem and Substantiation for Public Input

OBJECTIVE:
• USABILITY of NEC® and consistent CORRELATION with the defined term's EXTRACT source NFPA 101® Life Safety Code® regarding INDIVIDUAL guest rooms and INDIVIDUAL guest suites within dormitories versus the ENTIRE dormitory occupancy. NEC® Correlation Committee [NEC-AAC] take note.
.
BACKGROUND: Users of NEC® have encountered interpretational discrepancies with the present confusing wording. Presently, interpretation confusion exists to readers of NEC® regarding the use of the term "dormitory UNIT" versus the present definition's ambiguous clause " ... group SLEEPING ACCOMMODATIONS are provided for more than 16 persons who are not members of the same family IN ONE ROOM, OR A SERIES OF CLOSELY ASSOCIATED ROOMS, ...". Because of misinterpretation, it has been interpreted by some AHJs that the "UNIT" itself MUST accommodate "more than 16 persons".
.
Misuse of the term "dormitory UNIT" has effectively DIMINISHED SAFETY for what are colloquially called "dormitory rooms" that are now wrongly NOT treated as guest rooms or guest suites WITHIN a DORMITORY OCCUPANY. These so-called dormitory UNITS (INDIVIDUAL ROOMS) are being misinterpreted such that intended GFCI, AFCI, SPD and other protection requirements do NOT APPLY for DORMITORY bedrooms, for DORMITORY living rooms, and for closets and hallways INSIDE the so-called dormitory UNIT if that "UNIT" accommodates FEWER THAN 17 OCCUPANTS.
.
The phrase "IN ONE ROOM, OR A SERIES OF CLOSELY ASSOCIATED ROOMS" refers to "who are NOT MEMBERS of the SAME FAMILY", and does NOT refer to the "group SLEEPING ACCOMMODATIONS" having to be within in ONE room or ONE suite of rooms. Consequently, "dormitory" refers to the ENTIRE building or the ENTIRE space within that building AS AN OCCUPANCY that must accommodate MORE THAN 16 persons, and NOT to EACH specific sleeping room accommodating more than 16 persons.
.
NFPA 101® Informational Annex A has long ago addressed this misinterpretation: "A.3.3.68 Dormitory. Rooms within dormitories intended for the use of individuals for combined living and sleeping purposes are guest rooms or guest suites. Examples of dormitories are college dormitories, fraternity and sorority houses, and military barracks.". Further, "Guest Room" and "Guest Suite" are ALREADY explicitly defined terms in both NFPA 70® and NFPA 101 [3.3.136 for "Guest Room"; 3.3.285.1 for "Guest Suite"].
.
It is essential therefore that the terminology and usage for dormitories and for guest rooms and guest suites of dormitories in NFPA 70® be clarified at this time, CONSISTENT with NFPA 101, to avoid enforcement confusion between Codes.
.
Related Public Inputs address the corresponding changes elsewhere in NFPA 70® that must be revised accordingly.

Further, for 210.12(C) list item 5, 2017 NEC® added "bathrooms" in dormitories with ABSOLUTELY NO SUBSTANTIATING DATA WHATSOEVER. Indeed, the sole rationale that Public Input No. 482-NFPA 70-2014 offered was that "adding bathrooms is a step in making Dormitories on the same protection level as observed in standard dwelling units. A COMPANION PROPOSAL was submitted to add Bathrooms to 210.12(A) as well." Companion proposals however, [Public Input No. 467-NFPA 70-2014, Public Input No. 1035-NFPA 70-2014, et al] to add AFCI protection to DWELLING-UNIT bathrooms ALL FAILED AT CMP-2 TO BE INCLUDED with First Revision No. 329-NFPA 70-2015.
.
210.12(A) Second Revision/Committee Comment No. 319-NFPA 70-2015 FAILED at CMP-2's Second Draft BALLOT, and AFCI protection for DWELLING-UNIT bathrooms was indeed REJECTED by CMP-2. Therefore, the very rationale for adding AFCI protection to DORMITORY bathrooms NEVER ACTUALLY HAPPENED. Indeed, in all subsequent Code cycles, during Public Inputs, Public Comments, and Certified Amending Motions (CAMs), AFCI protection of DWELLING-UNIT bathrooms have never been included in 210.12. Consequently, DORMITORY bathrooms should be consistent with DWELLING-UNIT bathrooms regarding AFCI protection.
.
For 210.12(C) list item 6, "Similar" (i.e., "Similar rooms") is a vague and unenforceable term per NEC® Style Manual 3.2.1 and Table 3.2.1, and accordingly "(6) Similar rooms" must be eliminated. Arbitrary inspection interpretations have resulted in inconsistency as to what exactly constitutes a "similar room". NEC® Correlation Committee [NEC-AAC] take note.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 798-NFPA 70-2023 [Definition: Dormitory Unit.]	Clarification of NEC ambiguity in the definition extracted from NFPA 101
Public Input No. 798-NFPA 70-2023 [Definition: Dormitory Unit.]	

Submitter Information Verification

Submitter Full Name: Brian Rock
Organization: Hubbell Incorporated
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 12 17:17:48 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7917-NFPA 70-2024. Bathrooms in dormitories have been AFCI-protected in the NEC since 2017. Insufficient substantiation has been provided to delete this requirement. CMP-2 is not aware of any incompatibility issues related to this requirement. The phrase “similar rooms” refers to all other locations listed in 210.12(C) to ensure that AFCI protection is provided despite a different name that may be similar to the list items.

Statement: Changing the title of 210.12(C) from “Dormitory Units” to “Dormitories” is to enhance Code usability and to better correlate with NPFA 101 and NFPA 5000.

Public Input No. 3931-NFPA 70-2023 [Sections 210.12(C), 210.12(D)]

Sections 210.12(C), 210.12(D)

(C) Dormitory Units.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Bedrooms

(2) Living rooms

(3) Hallways

(4) Closets

(5) Bathrooms

(6) Similar rooms

(7) All branch circuits ran in non-metallic cable unless protected from damage by rigid metal conduit, intermediate metal conduit, or electrical metallic tubing.

(D) Other Occupancies.

All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

(1) Guest rooms and guest suites of hotels and motels

(2) Areas used exclusively as patient sleeping rooms in nursing homes and limited-care facilities

(3) Areas designed for use exclusively as sleeping quarters in fire stations, police stations, ambulance stations, rescue stations, ranger stations, and similar locations

(4) All branch circuits ran in non-metallic cable unless protected from damage by rigid metal conduit, intermediate metal conduit, or electrical metallic tubing.

Statement of Problem and Substantiation for Public Input

NM and NMC cable do not provide physical protection and once concealed behind walls in a home or building the owner has no idea where the cable is located. This can cause damage to the cable when making modifications or penetrating the wall. Also staples when installing these cables can be applied to tight compromising the sheath of the cable leading to early breakdown of the outer jacket and sheath allowing arcing between the conductors. NM Cable is a popular and reliable wiring method, but we do need to take some steps to protect it and the residents of homes and building where it is used. Below you will see some residential fire statistics from 2015 - 2019 provided by the NFPA in two different reports:https://www.nfpa.org/News-and-Research/Data-research-and-tools/Electrical/ElectricalElectrical Failures or malfunctions caused an estimated 390 civilian deaths and 1330 injuries a year. The fires also caused an estimated 1.5 billion dollars in direct property damage a year. It was the second leading cause of home structure fires accounting for 13% percent of all fires. Arcing was estimated to cause three in five residential home fires from 2015-2019.Electrical Distribution and lighting equipment was the cause of an estimated 32,160 home fires a year from 2015-2019. These fires caused an estimated 430 civilian deaths and 1070 civilian injuries each year. Wiring and related equipment caused an estimated 68% of these fires. By protecting our most common residential wiring either physically with conduit or with an Arc fault interrupter increases fire safety in our residential buildings. If this increased safety results in saving one

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3926-NFPA 70-2023 [Section No. 210.12(B)]	

Submitter Information Verification

Submitter Full Name:	Raymond Horner
Organization:	Atkore
Affiliation:	Atkore
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Wed Sep 06 10:47:20 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The charging language of 210.12(C) and (D) is for locations required to be protected by one of the AFCI means of protections in 210.12(A). The proposed language addresses a wiring method and not a location.

Public Input No. 1445-NFPA 70-2023 [New Section after 210.12(D)]

TITLE OF NEW CONTENT

Type your content 210.12 (D) (4): In all other areas covered in section 406.12 (1 through 10) and not covered in subsections (B), (C) (D) (1 through 3 above).

Statement of Problem and Substantiation for Public Input

Same level of protection must be provided in all other areas for life safety of occupants in these areas also to avoid any fatal injuries.

Submitter Information Verification

Submitter Full Name: Mohinder Sood
Organization: Core Engineers
Street Address:
City:
State:
Zip:

Submittal Date: Mon Jul 17 11:10:25 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The hazard being addressed by location of tamper-resistant receptacles differs from the hazard being addressed by AFCI protection and insufficient substantiation has been provided to support the inclusion of the locations in 406.12.

Public Input No. 2341-NFPA 70-2023 [Section No. 210.12(E)]

(E) Branch Circuit Wiring Extensions, Modifications, or Replacements.

If branch-circuit wiring for any of the areas specified in 210.12(B), (C), or (D) is modified, replaced, or extended, the branch circuit shall be protected by one of the following:

(1) By any of the means described in 210.12(A)(1) through (A)(6)

(2) A listed outlet branch-circuit-type AFCI located at the first receptacle <u>or switch</u> outlet of the existing branch circuit

Exception: AFCI protection shall not be required where the extension of the existing branch-circuit conductors is not more than 1.8 m (6 ft) and does not include any additional outlets or devices, other than splicing devices. This measurement shall not include the conductors inside an enclosure, cabinet, or junction box.

Statement of Problem and Substantiation for Public Input

Adding ‘or switch’ gives installers the option to provide AFCI protection via a AFCI switch device if the circuit is extended, modified, or replaced. Limiting the outlet branch circuit type AFCI to just receptacle outlets is excluding the possibility of providing AFCI protection with a listed AFCI switch device.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 16 13:39:00 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7921-NFPA 70-2024

Statement: Adding ‘or switch’ gives installers the option to provide AFCI protection via an AFCI switch device if the circuit is extended, modified, or replaced.

Public Input No. 2594-NFPA 70-2023 [Section No. 210.12(E)]

(E) Branch Circuit Wiring Extensions, Modifications, or Replacements.

If branch-circuit wiring for any of the areas specified in 210.12(B), (C), or (D) is modified, replaced, or extended, the branch circuit shall be protected by one of the following:

(1) By any of the means described in 210.12(A)(1) through (A)(6)

(2) A listed outlet branch-circuit-type AFCI located at the first receptacle outlet of the existing branch circuit

Exception 1 : AFCI protection shall not be required where the extension of the existing branch-circuit conductors is not more than 1.8 m (6 ft) and does not include any additional outlets or devices, other than splicing devices. This measurement shall not include the conductors inside an enclosure, cabinet, or junction box.

Exception 2: AFCI protection shall not be required where the extension of the branch circuit is done using MC Cable, AC Cable, electrical metallic tubing, intermediate metal conduit, or rigie metal conduit.

Statement of Problem and Substantiation for Public Input

Metal conduit or MC Cable will mitigate the arcing and any damage that could occur to the wiring. Therefor if installed in metal conduit there really is not a need for AFCI protection.

Submitter Information Verification

Submitter Full Name: Raymond Horner
Organization: Atkore
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 23 17:25:39 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The proposed language only affords AFCI protection to branch circuits and eliminates AFCI protection of outlets, devices, and appliance supply cords.

Public Input No. 3492-NFPA 70-2023 [Section No. 210.12 [Excluding any Sub-Sections]]

Arc-fault circuit-interrupter (AFCI) protection shall be installed in accordance with 210.12(B) through (E) by any of the means described in 210.12(A)~~(1) through (A)(6)~~ . The AFCI shall be listed and installed in a readily accessible location.

Statement of Problem and Substantiation for Public Input

It is unnecessary to reference all the list items when all are optional means of compliance. Referencing only 210.12(A) includes list items (A)(1) through the end of the list.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2794-NFPA 70-2023 [Section No. 210.12(A)]	The related PI proposes revisions to 210.12(A) which follow the proposed revision to the titled section 210.12.
Public Input No. 2794-NFPA 70-2023 [Section No. 210.12(A)]	

Submitter Information Verification

Submitter Full Name:	John Kovacik
Organization:	Trusted Safety Solutions LLC
Affiliation:	Arc Fault Circuit Interrupter Wiring Device Joint Research and Development Consortium
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Sep 04 15:14:21 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: FR-8227-NFPA 70-2024

Statement: The reference to list items (1) through (6) of 210.12(A) in the parent text, 210.12(B), (C), (D) and (E) is deleted. It is unnecessary to reference all the list items when all are optional means of compliance.

Public Input No. 1633-NFPA 70-2023 [Section No. 210.13]

210.13 Ground-Fault Protection of Equipment.

Each branch-circuit disconnecting means rated 1000 amperes or more and installed on solidly grounded wye electrical systems of more than 150 volts to ground, but not exceeding 1000 volts phase-to-phase, shall be provided with ground-fault protection of equipment in accordance with 230.95.

Informational Note: See 517.17 for requirements on buildings that contain health care occupancies.

Exception No. 1: This section shall not apply to a disconnecting means for a continuous industrial process where a nonorderly shutdown will introduce additional or increased hazards.

Exception No. 2: This section shall not apply if ground-fault protection of equipment is provided on the supply side of the branch circuit and on the load side of any transformer supplying the branch circuit.

Exception No. 3: For fused disconnects, where the available fault current, at the fused disconnect, is 10,000 amperes or greater, the ground-fault protection provisions of this section shall not apply if the fuses have a clearing time of 0.07 seconds or less at the lower of the calculated minimum available arcing current or 38% of the available fault current , or if the disconnect switch complies with Section 240.67(B)(1), 240.67(B)(3), or 240.67(B)(4) and is set to operate at the lower of the calculated minimum arcing current or 38% of the available fault current.

Exception No. 4: For circuit breakers, where the available fault current, at the fused disconnect, is 10,000 amperes or greater, the ground-fault protection provisions of this section shall not apply if the circuit breaker complies with Section 240.87(B)(2), 240.87(B)(4), 240.87(B)(5), or 240.87(B)(6). and is set to operate at the lower of the calculated minimum arcing current or 38% of the available fault current.

Additional Proposed Changes

File Name	Description	Approved
210.13.docx	210.13	

Statement of Problem and Substantiation for Public Input

Executive Summary:

We can now accurately predict the minimum three-phase arcing current, along with the minimum sustainable line-to-ground arcing current, for an arcing ground fault. Knowing these currents, we can determine whether or not the arc energy reduction methods in proposed Exceptions 3 and 4 will operate at, or below, those levels. If they do operate at or below those levels, the equipment damage will be just a small percentage of that allowed by the GFPE requirements of 230.95. This applies to all available fault currents of 10,000 amperes or greater.

Background:

A requirement (230.95) for ground fault protection of equipment (GFPE) was added to the 1971 NEC® because 480/277 volt, solidly grounded wye services, protected by 1000 ampere and larger overcurrent protective devices, were burning down due to arcing ground faults. 208/120 volt services and those services protected by smaller overcurrent protective devices were not burning down, so they weren't included in the new GFPE requirement. Over many Code cycles, GFPE requirements were also added for branch circuits (210.13), feeders (215.10), and equipment (240.13). In all cases, the intent was to limit, not eliminate, damage to the switchboard, switchgear, panelboard or equipment being supplied by the 1000 ampere and larger overcurrent protective device.

Present Day:

The electrical industry has evolved considerably since those early GFPE requirements were introduced. In those years, J. R. Dunki-Jacobs, Harris I. Stanback, and R. H. Kaufman authored numerous ground-breaking papers on arcing ground faults and the need for ground fault protection. They accomplished a great deal and their determination that the minimum sustainable line-to-ground arcing fault on a 480/277 volt system was 38% of the available bolted fault current is very close to the values predicted today by IEEE1584-2019. In recent editions of the NEC®, Sections were added to require the protection of an employee that is exposed to dangerous levels of incident energy while working on energized equipment. To avoid serious injuries, employees, working on or near energized equipment, can only withstand a small fraction of the incident energy to which equipment may be subjected by the allowances of 230.95(A). This substantiation compares the levels of equipment damage allowed by existing 230.95(A) with the levels allowed by the employee arc-flash protection requirements of 240.67 and 240.87. It shows that the equipment damage allowed by the employee arc-flash protection requirements of 240.67 and 240.87 is just a small fraction of that allowed by 230.95(A).

The following examples utilize IEEE 1584-2018 for a 480 volt arcing fault with 32mm equipment spacing, in a 20"x20"x20" box and an HCB (horizontal conductors in a metal enclosure) configuration. Equipment damage is described in terms of kW-cycles which is a product of arcing current (kA) X number of arcing cycles (cycles) X arc voltage (100 volts on a 480 system).

Worst Case Equipment Damage with 10 kA Available Fault Current

As allowed by 230.95(A). The IEEE 1584-2018 minimum arcing current is 6.09kA. Using the maximum 230.95(A) opening time of 60 cycles, the equipment damage is (6.09 kA X 60 cycles X 100 arcing volts) = 36,540 kW-cycles. See Figure 1.

As allowed by Proposed Exception No. 3. The IEEE 1584-2018 minimum arcing current is 6.09kA. Assuming the maximum opening time of 4.2 cycles (0.07 seconds) for 240.67(B), the equipment damage is 6.09 kA X 4.2 cycles X 100 arcing volts) = 2,558 kW-cycles. Assuming an opening time of 7 cycles for 240.67(B)(1) and (B)(3), the equipment damage is (6.09 kA X 7 cycles X 100 arcing volts = 4,263 kW-cycles. Assuming an opening time of 1/2 cycle for 240.67(B)(4), the equipment damage is (6.09 kA X 0.5 cycles X 100 arcing volts) = 305 kW-cycles. Worst-case damage for the minimum arcing current with this proposed exception for fusible switches (4,263 kW-cycles) is less than 12% of the worst-case damage allowed by 230.95(A) (36,540 kW-cycles). See Figure 1.

As allowed by Proposed Exception No. 4. The IEEE 1584-2018 minimum arcing current is 6.09kA. Assuming an opening time of 4 cycles for 240.87(B)(1), (B)(2), or (B)(4), the equipment damage is (6.09 kA X 4.0 cycles X 100 arcing volts) = 2,436 kW-cycles. Assuming an opening time of 3 cycles for 240.87(B)(5) or (B)(6), the equipment damage is (6.09 kA X 3 cycles X 100 arcing volts) = 1,827 kW-cycles. Worst-case damage for the minimum arcing current with this proposed exception for circuit breakers (2,426 KW-Cycles) is less than 7% of the worst-case damage allowed by 230.95(A) (36,540 kW-cycles). See Figure 1.

Worst Case Equipment Damage with 25 kA Available Fault Current

As allowed by 230.95(A). The IEEE 1584-2018 minimum arcing current is 15.21kA. Using the maximum 230.95(A) opening time of 60 cycles, the equipment damage is (15.21 kA X 60 cycles X 100 arcing volts) = 91,260 kW-cycles. See Figure 1.

As allowed by Proposed Exception No. 3. The IEEE 1584-2018 minimum arcing current is 15.21kA. Assuming the maximum opening time of 4.2 cycles for 240.67(B), the equipment damage is (15.21 kA X 4.2 cycles X 100 arcing volts) = 6,388 kW-cycles. Assuming an opening time of 7 cycles for 240.67(B)(1) and (B)(3), the equipment damage is (15.21 kA X 7 cycles X 100 arcing volts) = 10,647 kW-cycles. Assuming an opening time of 1/2 cycle for 240.67(B)(4), the equipment damage is (15.21 kA X 0.5 cycles X 100 arcing volts) = 761 kW-cycles. Worst-case damage for the minimum arcing current with this proposed exception for fusible switches (10,647 kW-cycles) is less than 12% of the worst-case damage allowed by 230.95(A) (91,260 kW-cycles). See Figure 1.

As allowed by Proposed Exception No. 4. The IEEE 1584-2018 minimum arcing current is 15.21kA. Assuming an opening time of 4 cycles for 240.87(B)(1), (B)(2), or (B)(4), the equipment damage is (15.21 kA X 4 cycles X 100 arcing volts) = 6,084 kW-cycles. Assuming an opening time of 3 cycles for 240.87(B)(5) or (B)(6), the equipment damage is (15,21 kA X 3 cycles X 100 arcing volts) = 4,563 kW-cycles. Worst-case damage for the minimum arcing current with this proposed exception for circuit breakers (6,084 kW-Cycles) is less than 7% of the worst-case damage allowed by 230.95(A) (91,260 kW-cycles). See Figure 1.

Worst Case Equipment Damage with 50 kA Available Fault Current

As allowed by 230.95(A). The IEEE 1584-2018 minimum arcing current is 25.98kA. Using the maximum 230.95(A) opening time of 60 cycles, the equipment damage is (25.98 kA X 60 cycles X 100 arcing volts) = 155,880 kW- cycles. See Figure 1.

As allowed by Proposed Exception No. 3. The IEEE 1584-2018 minimum arcing current is 25.98kA. Assuming an opening time of 4.2 cycles for 240.67(B), the equipment damage is (25.98 kA X 4.2 cycles X 100 arcing volts) = 10,912 kW-cycles. Assuming an opening time of 7 cycles for 240.67(B)(1) and (B)(3), the equipment damage is (25.98 kA X 7 cycles X 100 arcing volts) = 18,186 kW-cycles. Assuming an opening time of 1/2 cycle for 240.67(B)(4), the equipment damage is (25.98 kA X 0.5 cycles X 100 arcing volts) = 1,299 kW-cycles. Worst-case damage for the minimum arcing current with this proposed exception for fusible switches (18,186 kW-cycles) is less than 12% of the worst-case damage allowed by 230.95(A) (155,880 kW-cycles). See Figure 1.

As allowed by Proposed Exception No. 4. The IEEE 1584-2018 minimum arcing current is 25.98kA. Assuming an opening time of 4 cycles for 240.87(B)(1), (B)(2), or (B)(4), the equipment damage is (25.98 kA X 4 cycles X 100 arcing volts) = 10,392 kW-cycles. Assuming an opening time of 3 cycles for 240.87(B)(5) or (B)(6), the equipment damage is (25.98 kA X 3 cycles X 100 arcing volts) = 7,794 kW-cycles. Worst-case damage for the minimum arcing current with this proposed exception for circuit breakers (10,392 KW-Cycles) is less than 7% of the worst-case damage allowed by 230.95(A) (155,880 kW-cycles). See Figure 1.

Worst Case Equipment Damage with 100 kA Available Fault Current

As allowed by 230.95(A). For an available fault current of 100kA, the IEEE 1584-2018 three phase minimum arcing current is 33.75 kA. Using the maximum 230.95(A) opening time of 60 cycles, the equipment damage is (33.75 kA X 60 cycles X 100 arcing volts) = 202,500 kW-cycles. See Figure 1.

As allowed by Proposed Exception No. 3. The IEEE 1584-2018 minimum arcing current is 33.75 kA. Assuming the maximum opening time of 4.2 cycles (0.07 seconds) for 240.67(B), the equipment damage is 33.75 kA X 4.2 cycles X 100 arcing volts) = 14,175 kW-cycles. Assuming an opening time of 7 cycles for 240.67(B)(1) and (B)(3), the equipment damage is (33.75 kA X 7 cycles X 100 arcing volts = 23625 kW-cycles. Assuming an opening time of 1/2 cycle for 240.67(B)(4), the equipment damage is (33.75 kA X 0.5 cycles X 100 arcing volts) = 1688 kW-cycles. Worst-case damage for the minimum arcing current with this proposed exception for fusible switches (23625 kW-cycles) is less than 12% of the worst-case damage allowed by 230.95(A) (202,500 kW-cycles). See Figure 1.

As allowed by Proposed Exception No. 4. For an available fault current of 100kA, the IEEE 1584-2018 minimum arcing current is 33.75 kA. Assuming an opening time of 4 cycles for 240.87(B)(1), (B)(2), or (B)(4), the equipment damage is (33.75 kA X 4.0 cycles X 100 arcing volts) = 13,500 kW-cycles. Assuming an opening time of 3 cycles for 240.87(B)(5) or (B)(6), the equipment damage is (33.75 kA X 3 cycles X 100 arcing volts) = 10,125 kW-cycles. Worst-case damage for the minimum arcing current with this proposed exception for circuit breakers (13,500 KW-Cycles) is less than 7% of the worst-case damage allowed by 230.95(A) (202,500 kW-cycles). See Figure 1.

Figure 1 (See attached file)
Figures 1 shows that equipment damage allowed by this Public Input is always, from 10,000 amperes available through 100,000 amperes available, just a small fraction of the equipment damage allowed by 230.95(A).

One might ask whether it is possible that the alternate systems proposed by this Public Input could be set such that they might provide arc energy reduction, but not operate during a lower level ground fault where traditional GFPE will provide protection. That question is answered by the very last lines of the proposed new language for both fusible switches and circuit breakers, as both the fusible switches and circuit breakers must be "set to operate at the lower of the calculated minimum arcing current or 38% of the available fault current." Since we know the minimum three phase arcing current from IEEE 1584-2018 and the minimum sustainable phase to ground arcing current of 38% of the available fault current, we know whether or not the fusible switch or circuit breaker is set to operate at those values. So, there is no minimum value of actual arcing current that could be so small as to be picked up by 230.95(A) requirements that would not also be sensed by the requirements of Exceptions 3 and 4.

Let's look at an example with 10,000 available short-circuit amperes (lowest available fault current for which Exceptions 3 and 4 could apply). In this case the minimum 1584-2018 three-phase arcing current is 6.09 kA and the minimum sustainable phase-to-ground current is 38% of 10,000 amps = 3.8 kA. Per the requirements of the proposed exceptions the fusible switch or circuit breaker must be set to operate at the lower of either 6.09 kA or 3.8 kA, so the fusible switch or circuit breaker must operate for arcing currents of 3.8 kA or greater. If a three phase arcing fault occurs it is calculated to be 6.09 kA with the possibility that a single phase to ground arcing fault could be as low as 3.8 kA. In either case, the requirements of Exceptions 3 and 4 assure that the arcing fault is taken off-line in no more than 7 cycles for Exception 3 and no more than 4 cycles for Exception 4, while 230.95(A) would allow a full 60 cycles. What happens if the available fault current is less than or even significantly less than 10,000 amperes? Then the proposed Exceptions 3 and 4 do not apply and GFPE would be required.

Energy reducing maintenance switches (240.67(B)(2) and 240.87(B)(3)) are not included in the exceptions because energy-reducing maintenance switches are typically turned off when a worker is not working on energized equipment, whereas ground fault protection is constantly protecting the equipment, whether or not a worker is working on the energized equipment.

The Approved Equivalent Means (240.67(B)(5) and 240.87(B)(7)) are excluded because the opening times for these methods are unclear.

Conclusion:

This Public Input takes advantage of the arc-energy reduction requirements found in 240.67 and 240.87. It provides an exception for GFPE requirements whenever specific 240.67 and 240.87 methods to reduce clearing time are utilized. Arc energy reduction methods, as detailed in Exceptions 3 and 4, must open for "all" actual arcing ground faults and in a much faster time than allowed by 230.95(A). Reviewing Figure 1, it becomes obvious that Exceptions 3 and 4 will limit the arcing fault damage to the equipment to a level that is considerably less than that currently allowed by the requirements found in 230.95(A).

Submitter Information Verification

Submitter Full Name:	Vincent Saporita
Organization:	Saporita Consulting
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Thu Jul 27 15:15:10 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: FR-7565-NFPA 70-2024

Statement: This FR revision correlates with changes to 215.10 (PI 1641) and 230.95 (PI 1645) which eliminate the need for a second level of GFPE to achieve selective coordination, greatly simplifying selective coordination. The FR revision does not prohibit GFPE, but rather makes it optional when very specific arc-flash energy reduction methods are utilized. Equipment damage is reduced because arc-flash energy reduction, used for personnel protection, is much faster than GFPE that is used for equipment protection.

210.13 Ground-Fault Protection of Equipment.

Each branch-circuit disconnect rated 1000 amperes or more and installed on solidly grounded wye electrical systems of more than 150 volts to ground, but not exceeding 1000 volts phase- to-phase, shall be provided with ground-fault protection of equipment in accordance with 230.95.

Informational Note: See 517.17 for requirements on buildings that contain health care occupancies.

Exception No. 1: This section shall not apply to a disconnecting means for a continuous industrial process where a nonorderly shutdown will introduce additional or increased hazards.

Exception No. 2: This section shall not apply if ground-fault protection of equipment is provided on the supply side of the branch circuit and on the load side of any transformer supplying the branch circuit.

Exception No. 3: For fused disconnects, where the available fault current, at the fused disconnect, is 10,000 amperes or greater, the ground-fault protection provisions of this section shall not apply if the fuses have a clearing time of 0.07 seconds or less at the lower of the calculated minimum available arcing current or 38% of the available fault current , or if the disconnect switch complies with Section 240.67(B)(1), 240.67(B)(3), or 240.67(B)(4) and is set to operate at the lower of the calculated minimum arcing current or 38% of the available fault current.

Exception No. 4: For circuit breakers, where the available fault current, at the fused disconnect, is 10,000 amperes or greater, the ground-fault protection provisions of this section shall not apply if the circuit breaker complies with Section 240.87(B)(2), 240.87(B)(4), 240.87(B)(5), or 240.87(B)(6). and is set to operate at the lower of the calculated minimum arcing current or 38% of the available fault current.

Substantiation

Executive Summary: We can now accurately predict the minimum three-phase arcing current, along with the minimum sustainable line-to-ground arcing current, for an arcing ground fault. Knowing these currents, we can determine whether or not the arc energy reduction methods in proposed Exceptions 3 and 4 will operate at, or below, those levels. If they do operate at or below those levels, the equipment damage will be just a small percentage of that allowed by the GFPE requirements of 230.95. This applies to all available fault currents of 10,000 amperes or greater.

Background: A requirement (230.95) for ground fault protection of equipment (GFPE) was added to the 1971 NEC® because 480/277 volt, solidly grounded wye services, protected by 1000 ampere and larger overcurrent protective devices, were burning down due to arcing ground faults. 208/120 volt services and those services protected by smaller overcurrent protective devices were not burning down, so they weren't included in the new GFPE requirement. Over many Code cycles, GFPE requirements were also added for branch circuits (210.13), feeders (215.10), and equipment (240.13). In all cases, the intent was to limit, not eliminate, damage to the switchboard, switchgear, panelboard or equipment being supplied by the 1000 ampere and larger overcurrent protective device.

Present Day: The electrical industry has evolved considerably since those early GFPE requirements were introduced. In those years, J. R. Dunki-Jacobs, Harris I. Stanback, and R. H. Kaufman authored numerous ground-breaking papers on arcing ground faults and the need for ground fault protection. They accomplished a great deal and their determination that the minimum sustainable line-to-ground arcing fault on a 480/277 volt system was 38% of the available bolted fault current is very close to the values predicted today by IEEE1584-2019. In recent editions of the NEC®, Sections were added to require the protection of an employee that is exposed to dangerous levels of incident energy while working on energized equipment. To avoid serious injuries, employees, working on or near energized equipment, can only withstand a small fraction of the incident energy to which equipment may be subjected by the allowances of 230.95(A). This substantiation compares the levels of equipment damage allowed by existing 230.95(A) with the levels allowed by the employee arc-flash protection requirements of 240.67 and 240.87. It shows that the equipment damage allowed by the employee arc-flash protection requirements of 240.67 and 240.87 is just a small fraction of that allowed by 230.95(A). The following examples utilize IEEE 1584-2018 for a 480 volt arcing fault with 32mm equipment spacing, in a 20"x20"x20" box and an HCB (horizontal conductors in a metal enclosure) configuration. Equipment damage is described in terms of kW-cycles which is a product of arcing current (kA) X number of arcing cycles (cycles) X arc voltage (100 volts on a 480 system).

Worst Case Equipment Damage with 10 kA Available Fault Current

As allowed by 230.95(A). The IEEE 1584-2018 minimum arcing current is 6.09kA. Using the maximum 230.95(A) opening time of 60 cycles, the equipment damage is (6.09 kA X 60 cycles X 100 arcing volts) = 36,540 kW-cycles. See Figure 1.

As allowed by Proposed Exception No. 3. The IEEE 1584-2018 minimum arcing current is 6.09kA. Assuming the maximum opening time of 4.2 cycles (0.07 seconds) for 240.67(B), the equipment damage is 6.09 kA X 4.2 cycles X 100 arcing volts) = 2,558 kW-cycles. Assuming an opening time of 7 cycles for 240.67(B)(1) and (B)(3), the equipment damage is (6.09 kA X 7 cycles X 100 arcing volts = 4,263 kW-cycles. Assuming an opening time of 1/2 cycle for 240.67(B)(4), the equipment damage is (6.09 kA X 0.5 cycles X 100 arcing volts) = 305 kW-cycles. Worst-case damage for the minimum arcing current with this proposed exception for fusible switches (4,263 kW-cycles) is less than 12% of the worst-case damage allowed by 230.95(A) (36,540 kW-cycles). See Figure 1.

As allowed by Proposed Exception No. 4. The IEEE 1584-2018 minimum arcing current is 6.09kA. Assuming an opening time of 4 cycles for 240.87(B)(1), (B)(2), or (B)(4), the equipment damage is (6.09 kA X 4.0 cycles X 100 arcing volts) = 2,436 kW-cycles. Assuming an opening time of 3 cycles for 240.87(B)(5) or (B)(6), the equipment damage is (6.09 kA X 3 cycles X 100 arcing volts) = 1,827 kW-cycles. Worst-case damage for the minimum arcing current with this proposed exception for circuit breakers (2,426 KW-Cycles) is less than 7% of the worst-case damage allowed by 230.95(A) (36,540 kW-cycles). See Figure 1.

Worst Case Equipment Damage with 25 kA Available Fault Current

As allowed by 230.95(A). The IEEE 1584-2018 minimum arcing current is 15.21kA. Using the maximum 230.95(A) opening time of 60 cycles, the equipment damage is (15.21 kA X 60 cycles X 100 arcing volts) = 91,260 kW-cycles. See Figure 1.

As allowed by Proposed Exception No. 3. The IEEE 1584-2018 minimum arcing current is 15.21kA. Assuming the maximum opening time of 4.2 cycles for 240.67(B), the equipment damage is (15.21 kA X 4.2 cycles X 100 arcing volts) = 6,388 kW-cycles. Assuming an opening time of 7 cycles for 240.67(B)(1) and (B)(3), the equipment damage is (15.21 kA X 7 cycles X 100 arcing volts) = 10,647 kW-cycles. Assuming an opening time of 1/2 cycle for 240.67(B)(4), the equipment damage is (15.21 kA X 0.5 cycles X 100 arcing volts) = 761 kW-cycles. Worst-case damage for the minimum arcing current with this proposed exception for fusible switches (10,647 kW-cycles) is less than 12% of the worst-case damage allowed by 230.95(A) (91,260 kW-cycles). See Figure 1.

As allowed by Proposed Exception No. 4. The IEEE 1584-2018 minimum arcing current is 15.21kA. Assuming an opening time of 4 cycles for 240.87(B)(1), (B)(2), or (B)(4), the equipment damage is (15.21 kA X 4 cycles X 100 arcing volts) = 6,084 kW-cycles. Assuming an opening time of 3 cycles for 240.87(B)(5) or (B)(6), the equipment damage is (15,21 kA X 3 cycles X 100 arcing volts) = 4,563 kW-cycles. Worst-case damage for the minimum arcing current with this proposed exception for circuit breakers (6,084 kW-Cycles) is less than 7% of the worst-case damage allowed by 230.95(A) (91,260 kW-cycles). See Figure 1.

Worst Case Equipment Damage with 50 kA Available Fault Current

As allowed by 230.95(A). The IEEE 1584-2018 minimum arcing current is 25.98kA. Using the maximum 230.95(A) opening time of 60 cycles, the equipment damage is (25.98 kA X 60 cycles X 100 arcing volts) = 155,880 kW- cycles. See Figure 1.

As allowed by Proposed Exception No. 3. The IEEE 1584-2018 minimum arcing current is 25.98kA. Assuming an opening time of 4.2 cycles for 240.67(B), the equipment damage is (25.98 kA X 4.2 cycles X 100 arcing volts) = 10,912 kW-cycles. Assuming an opening time of 7 cycles for 240.67(B)(1) and (B)(3), the equipment damage is (25.98 kA X 7 cycles X 100 arcing volts) = 18,186 kW-cycles. Assuming an opening time of 1/2 cycle for 240.67(B)(4), the equipment damage is (25.98 kA X 0.5 cycles X 100 arcing volts) = 1,299 kW-cycles. Worst-case damage for the minimum arcing current with this proposed exception for fusible switches (18,186 kW-cycles) is less than 12% of the worst-case damage allowed by 230.95(A) (155,880 kW-cycles). See Figure 1.

As allowed by Proposed Exception No. 4. The IEEE 1584-2018 minimum arcing current is 25.98kA. Assuming an opening time of 4 cycles for 240.87(B)(1), (B)(2), or (B)(4), the equipment damage is (25.98 kA X 4 cycles X 100 arcing volts) = 10,392 kW-cycles. Assuming an opening time of 3 cycles for 240.87(B)(5) or (B)(6), the equipment damage is (25.98 kA X 3 cycles X 100 arcing volts) = 7,794 kW-cycles. Worst-case damage for the minimum arcing current with this proposed exception for circuit breakers (10,392 KW-Cycles) is less than 7% of the worst-case damage allowed by 230.95(A) (155,880 kW-cycles). See Figure 1.

Worst Case Equipment Damage with 100 kA Available Fault Current

As allowed by 230.95(A). For an available fault current of 100kA, the IEEE 1584-2018 three phase minimum arcing current is 33.75 kA. Using the maximum 230.95(A) opening time of 60 cycles, the equipment damage is (33.75 kA X 60 cycles X 100 arcing volts) = 202,500 kW-cycles. See Figure 1.

As allowed by Proposed Exception No. 3. The IEEE 1584-2018 minimum arcing current is 33.75 kA. Assuming the maximum opening time of 4.2 cycles (0.07 seconds) for 240.67(B), the equipment damage is 33.75 kA X 4.2 cycles X 100 arcing volts) = 14,175 kW-cycles. Assuming an opening time of 7 cycles for 240.67(B)(1) and (B)(3), the equipment damage is (33.75 kA X 7 cycles X 100 arcing volts = 23625 kW-cycles. Assuming an opening time of 1/2 cycle for 240.67(B)(4), the equipment damage is (33.75 kA X 0.5 cycles X 100 arcing volts) = 1688 kW-cycles. Worst-case damage for the minimum arcing current with this proposed exception for fusible switches (23625 kW-cycles) is less than 12% of the worst-case damage allowed by 230.95(A) (202,500 kW-cycles). See Figure 1.

As allowed by Proposed Exception No. 4. For an available fault current of 100kA, the IEEE 1584-2018 minimum arcing current is 33.75 kA. Assuming an opening time of 4 cycles for 240.87(B)(1), (B)(2), or (B)(4), the equipment damage is (33.75 kA X 4.0 cycles X 100 arcing volts) = 13,500 kW-cycles. Assuming an opening time of 3 cycles for 240.87(B)(5) or (B)(6), the equipment damage is (33.75 kA X 3 cycles X 100 arcing volts) = 10,125 kW-cycles. Worst-case damage for the minimum arcing current with this proposed exception for circuit breakers (13,500 KW-Cycles) is less than 7% of the worst-case damage allowed by 230.95(A) (202,500 kW-cycles). See Figure 1.

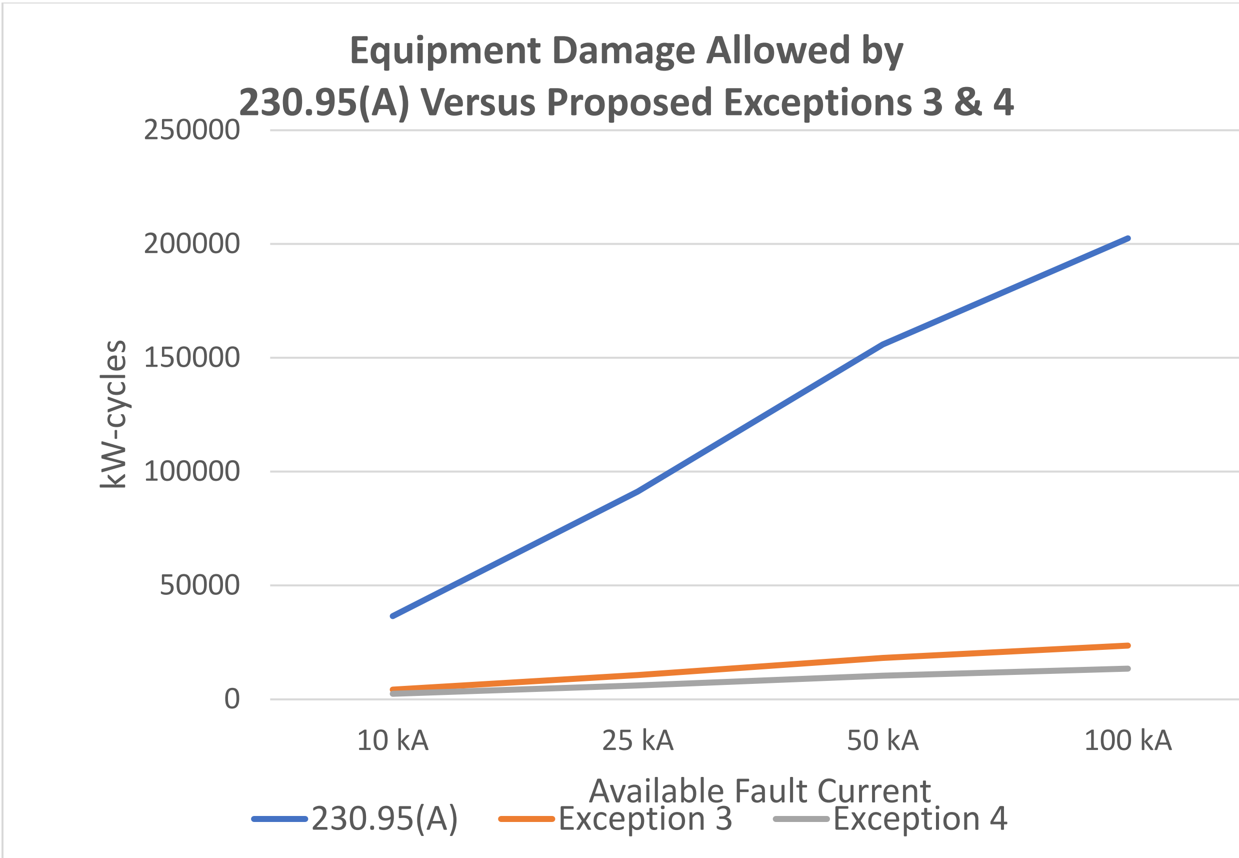


Figure 1

Figures 1 shows that equipment damage allowed by this Public Input is always, from 10,000 amperes available through 100,000 amperes available, just a small fraction of the equipment damage allowed by 230.95(A).

One might ask whether it is possible that the alternate systems proposed by this Public Input could be set such that they might provide arc energy reduction, but not operate during a lower level ground fault where traditional GFPE will provide protection. That question is answered by the very last lines of the proposed new language for both fusible switches and circuit breakers, as both the fusible switches and circuit breakers must be ***"set to operate at the lower of the calculated minimum arcing current or 38% of the available fault current."*** Since we know the minimum three phase arcing current from IEEE 1584-2018 and the minimum sustainable phase to ground arcing current of 38% of the available fault current, we know whether or not the fusible switch or circuit breaker is set to operate at those values. So, there is no minimum value of actual arcing current that could be so small as to be picked up by 230.95(A) requirements that would not also be sensed by the requirements of Exceptions 3 and 4.

Let's look at an example with 10,000 available short-circuit amperes (lowest available fault current for which Exceptions 3 and 4 could apply). In this case the minimum 1584-2018 three-phase arcing current is 6.09 kA and the minimum sustainable phase-to-ground current is 38% of 10,000 amps = 3.8 kA. Per the requirements of the proposed exceptions the fusible switch or circuit breaker must be set to operate at the lower of either 6.09 kA or 3.8 kA, so the fusible switch or circuit breaker must operate for arcing currents of 3.8 kA or greater. If a three phase arcing fault occurs it is calculated to be 6.09 kA with the possibility that a single phase to ground arcing fault could be as low as 3.8 kA. In either case, the requirements of Exceptions 3 and 4 assure that the arcing fault is taken off-line in no more than 7 cycles for Exception 3 and no more than 4 cycles for Exception 4, while 230.95(A) would allow a full 60 cycles.

What happens if the available fault current is less than or even significantly less than 10,000 amperes? Then the proposed Exceptions 3 and 4 do not apply and GFPE would be required.

Energy reducing maintenance switches (240.67(B)(2) and 240.87(B)(3)) are not included in the exceptions because energy-reducing maintenance switches are typically turned off when a worker is not working on energized equipment, whereas ground fault protection is constantly protecting the equipment, whether or not a worker is working on the energized equipment.

The Approved Equivalent Means (240.67(B)(5) and 240.87(B)(7)) are excluded because the opening times for these methods are unclear.

Conclusion: This Public Input takes advantage of the arc-energy reduction requirements found in 240.67 and 240.87. It provides an exception for GFPE requirements whenever specific 240.67 and 240.87 methods to reduce clearing time are utilized. Arc energy reduction methods, as detailed in Exceptions 3 and 4, must open for **"all"** actual arcing ground faults and in a much faster time than allowed by 230.95(A). Reviewing Figure 1, it becomes obvious that Exceptions 3 and 4 will limit the arcing fault damage to the equipment to a level that is considerably less than that currently allowed by the requirements found in 230.95(A).

Public Input No. 799-NFPA 70-2023 [Section No. 210.17]

210.17 Guest Rooms and Guest Suites.

Guest rooms and guest suites in the following occupancies that are provided with permanent provisions for cooking shall have branch circuits installed to meet the rules for dwelling units:

(1) Hotels

(2) Motels

(3) Assisted living facilities

(4) Dormitories

Informational Note No. 1: See 210.11(C)(2) and 210.52(F), Exception No. 2, for information on laundry branch circuits and receptacle outlets.

Informational Note No. 2: See NFPA *101*-~~2021~~ 2024 , *Life Safety Code*, 3.3.~~198~~ 205 .12 and A.3.3.~~198~~ 205 .12(5), for the definition of *assisted living facilities*.

Statement of Problem and Substantiation for Public Input

OBJECTIVE:
• USABILITY of NEC® and consistent CORRELATION with the defined term's EXTRACTION source NFPA 101® Life Safety Code® regarding INDIVIDUAL guest rooms and individual guest suites of dormitories versus the ENTIRE dormitory occupancy. NEC® Correlation Committee [NEC-AAC] take note.

.
BACKGROUND: Users of NEC® have encountered interpretational discrepancies with the present confusing wording. Presently, interpretation confusion exists to readers of NEC® regarding the use of the term "dormitory UNIT" versus the present definition's ambiguous clause " ... group SLEEPING ACCOMMODATIONS are provided for more than 16 persons who are not members of the same family IN ONE ROOM, OR A SERIES OF CLOSELY ASSOCIATED ROOMS, ...". Because of misinterpretation that the "UNIT" MUST accommodate "more than 16 persons", specific dormitory rooms intended for an individual student or a few individual students have been deemed wrongly to NOT constitute a dormitory UNIT because those individual rooms cannot accommodate "MORE THAN 16 PERSONS".

.
The phrase "IN ONE ROOM, OR A SERIES OF CLOSELY ASSOCIATED ROOMS" refers to "who are NOT MEMBERS of the SAME FAMILY", and does NOT refer to the "group SLEEPING ACCOMMODATIONS" having to be within in ONE room or ONE suite of rooms. Consequently, "dormitory" refers to the ENTIRE building or the ENTIRE space within that building AS AN OCCUPANCY that must accommodate MORE THAN 16 persons, and NOT to EACH specific sleeping room accommodating more than 16 persons.

.
Misuse of the term "dormitory UNIT" has effectively DIMINISHED SAFETY for what are colloquially called "dormitory rooms" that are now wrongly NOT treated as guest rooms or guest suites WITHIN a DORMITORY OCCUPANCY. These so-called dormitory UNITS (INDIVIDUAL ROOMS) are being misinterpreted such that intended GFCI, AFCI, SPD and other protection requirements do NOT APPLY for DORMITORY bedrooms, for DORMITORY living rooms, and for closets and hallways INSIDE the so-called dormitory UNIT if that "UNIT" accommodates FEWER THAN 17 OCCUPANTS.

.
It is essential therefore that the terminology and usage for dormitories and for guest rooms and guest suites of dormitories in NFPA 70® be clarified at this time, CONSISTENT with NFPA 101, to avoid enforcement confusion between Codes.

.
Related Public Inputs address the corresponding changes elsewhere in NFPA 70 that must be revised accordingly.

.
For NEC® 210.17 Informational Note No. 2, references to 3.3.198.12 and A.3.3.198.12(5) in the 2021 edition of NFPA 101® Life Safety Code® has been editorially relocated to 3.3.205.12 and A.3.3.205.12(5), respectively, in the 2024 edition of NFPA 101® Life Safety Code®.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 798-NFPA 70-2023 [Definition: Dormitory Unit.]	Clarification of NEC ambiguity in the definition extracted from NFPA 101
Public Input No. 802-NFPA 70-2023 [Section No. 240.24(B)(2)]	Addition of INDIVIDUAL guest rooms and INDIVIDUAL guest suites of dormitories
Public Input No. 798-NFPA 70-2023 [Definition: Dormitory Unit.]	
Public Input No. 802-NFPA 70-2023 [Section No. 240.24(B)(2)]	

Submitter Information Verification

Submitter Full Name: Brian Rock

Organization: Hubbell Incorporated
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 12 17:06:29 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7568-NFPA 70-2024

Statement: “Dormitories” was included in the occupancies listed to improve usability of the NEC® and to correlate consistently with the defined term's cited extraction sources NFPA 101® Life Safety Code®, revised since being included originally in NEC®, 3.3.205 (2024) and A.3.3.205 (2024), regarding individual guest rooms and individual guest suites of dormitories versus the entire dormitory occupancy. This revision, together with the revised definition of “Dormitory” in place of “Dormitory Unit”, will bring the treatment of this occupancy in the NEC® into correlation with its usage in NFPA 101®, NFPA 5000 Building Construction and Safety Code, and other codes.

Public Input No. 966-NFPA 70-2023 [Section No. 210.18]

210.18 Rating.

Branch circuits recognized by this article shall be rated in accordance with the maximum permitted ampere rating or setting of the overcurrent device. The rating for other than individual branch circuits shall be 10, 15, 20, 30, 40, and 50 amperes. Where conductors of higher ampacity are used for any reason, the ampere rating or setting of the specified overcurrent device shall determine the circuit rating.

Exception No. 1: Multioutlet branch circuits greater than 50 amperes shall be permitted to supply nonlighting outlet loads in locations where conditions of maintenance and supervision ensure that only qualified persons service the equipment.

Exception No. 2: Branch circuits rated 10 amperes shall not supply receptacle outlets.

<u>*Exception No. 3: Multioutlet branch circuits greater than 50 amperes shall be permitted where a label is permanently affixed to every outlet and visible after installation, without opening any covers, that identifies every outlet on the branch circuit and states that the sum of the load among all of them, excluding inrush current, must not exceed the branch-circuit ampere rating at any given time. The label should read the following or similar:*</u>

<u>*10G*</u>

<u>*CAUTION: sum of 10A to 10H = 60 A max.*</u>

Statement of Problem and Substantiation for Public Input

A warning/caution label is a suitable alternative to lower currents for preventing/mitigating overload. An example of Exception number 3 has the labels for the respective outlets reading, with 10G being a hardwired outlet and 10B being a NEMA 14-60, 15-60, or 18-60 receptacle:

10G
CAUTION: sum of 10A to 10H = 60 A max.

10B
CAUTION: sum of 10A to 10H = 60 A max.

Submitter Information Verification

Submitter Full Name: Conrad Ko
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 07 14:04:46 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: There is no substantiation provided for allowing higher voltages in these occupancies. A sign or marking does not remove the electrical hazard.

Public Input No. 1823-NFPA 70-2023 [Section No. 210.19(A)]

~~(A) General.~~

~~Branch-circuit conductors shall have an ampacity not less than the larger of the following and comply with 110.14(C) for equipment terminations:~~

(1) ~~Where a branch circuit supplies continuous loads or any combination of continuous and noncontinuous loads, the minimum branch-circuit conductor size shall have an ampacity not less than the noncontinuous load plus 125 percent of the continuous load in accordance with 310.14 .~~

~~Exception to (1): If the assembly, including the overcurrent devices protecting the branch circuits, is listed for operation at 100 percent of its rating, the ampacity of the branch-circuit conductors shall be permitted to be not less than the sum of the continuous load plus the noncontinuous load in accordance with 110.14(C) .~~

(2) ~~The minimum branch-circuit conductor size shall have an ampacity not less than the maximum load to be served after the application of any adjustment or correction factors in accordance with 310.15 .~~

~~Exception to (1) and (2): Where a portion of a branch circuit is connected at both its supply and load ends to separately installed pressure connections as covered in 110.14(C)(2) , an allowable ampacity in accordance with 310.15 not less than the sum of the continuous load plus the noncontinuous load shall be permitted. No portion of a branch circuit installed under this exception shall extend into an enclosure containing either the branch-circuit supply or the branch-circuit load terminations.~~

Statement of Problem and Substantiation for Public Input

Sizing conductors to 125% of the continuous load is only required when the conductor is connected to an overcurrent device. The same rules exist in Article 210 and Article 215. Since these rules deal with overcurrent devices, this PI suggests consolidating the rules, deleting them from 210 and 215, and moving them into Article 240.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1822-NFPA 70-2023 [New Section after 240.16]	New section in 240
Public Input No. 1824-NFPA 70-2023 [Section No. 215.2(A)]	Delete 215
Public Input No. 1822-NFPA 70-2023 [New Section after 240.16]	
Public Input No. 1824-NFPA 70-2023 [Section No. 215.2(A)]	

Submitter Information Verification

Submitter Full Name: Eric Stromberg
Organization: Los Alamos National Laboratory
Affiliation: Self
Street Address:
City:
State:
Zip:
Submittal Date: Sat Aug 05 14:45:52 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: This section covers the general requirements for branch circuits and is appropriately located in Article 210. Article 240 covers overcurrent protection and not the ampacity of branch circuit conductors. Moving this section to Article 240 could create confusion to Code users.

Public Input No. 471-NFPA 70-2023 [Section No. 210.19(A)]

(A) General.

Branch-circuit conductors shall have an ampacity not less than the larger of the following and comply with 110.14(C) for equipment terminations:

(1) **Without Adjustment and Correction Factors.** Where a branch circuit supplies continuous loads or any combination of continuous and noncontinuous loads, the minimum branch-circuit conductor size shall have an ampacity not less than the noncontinuous load plus 125 percent of the continuous load in accordance with 310.14.

Exception to (1): If the assembly, including the overcurrent devices protecting the branch circuits, is listed for operation at 100 percent of its rating, the ampacity of the branch-circuit conductors shall be permitted to be not less than the sum of the continuous load plus the noncontinuous load in accordance with 110.14(C).

(2) **With Adjustment and Correction Factors.** The minimum branch-circuit conductor size shall have an ampacity not less than the maximum load to be served after the application of any adjustment or correction factors in accordance with 310.15.

Exception to (1) and (2): Where a portion of a branch circuit is connected at both its supply and load ends to separately installed pressure connections as covered in 110.14(C)(2), an allowable ampacity in accordance with 310.15 not less than the sum of the continuous load plus the noncontinuous load shall be permitted. No portion of a branch circuit installed under this exception shall extend into an enclosure containing either the branch-circuit supply or the branch-circuit load terminations.

Statement of Problem and Substantiation for Public Input

The proposed section headings are borrowed from 690.8(B) and clarify the two different uses of the word "ampacity" in this section. As currently written, the use of the word "ampacity" in section 1 is confusing, because the definition of ampacity and section 310.15 lead to an interpretation that the term "ampacity" always includes the application of adjustment and correction factors.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 472-NFPA 70-2023 [Section No. 215.2(A)]	Identical change for feeders
Public Input No. 473-NFPA 70-2023 [Section No. 230.42(A)]	Identical change for service entrance conductors
Public Input No. 472-NFPA 70-2023 [Section No. 215.2(A)]	
Public Input No. 473-NFPA 70-2023 [Section No. 230.42(A)]	

Submitter Information Verification

Submitter Full Name: Wayne Whitney
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Mar 15 14:51:36 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: These are list items that do not use a title as per Section 2.1.8.2 of the NEC Style Manual. Section 690.8(B) uses a subsection structure, and titles are appropriate in that case.

Public Input No. 494-NFPA 70-2023 [Section No. 210.19(A)]

(A) General.

Branch-circuit conductors shall have an ampacity not less than the larger of the following and comply with 110.14(C) for equipment terminations:

(1) Where a branch circuit supplies continuous loads or any combination of continuous and noncontinuous loads, the minimum branch-circuit conductor size shall have an ampacity not less than the noncontinuous load plus 125 percent of the continuous load in accordance with 310.14.

~~Exception to~~ Exception No. 1 to (1): If the assembly, including the overcurrent devices protecting the branch circuits, is listed for operation at 100 percent of its rating, the ampacity of the branch-circuit conductors shall be permitted to be not less than the sum of the continuous load plus the noncontinuous load in accordance with 110.14(C).

Exception No. 2 to (1): Where the overcurrent device is sized per 210.20(A) and does not exceed 800A, the ampacity of the branch-circuit conductors shall be permitted to be not less than the sum of the continuous load plus the noncontinuous load, provided the ampacity is more than the next lower standard rating of overcurrent device in accordance with 240.4(B).

(2) The minimum branch-circuit conductor size shall have an ampacity not less than the maximum load to be served after the application of any adjustment or correction factors in accordance with 310.15.

Exception to (1) and (2): Where a portion of a branch circuit is connected at both its supply and load ends to separately installed pressure connections as covered in 110.14(C)(2), an allowable ampacity in accordance with 310.15 not less than the sum of the continuous load plus the noncontinuous load shall be permitted. No portion of a branch circuit installed under this exception shall extend into an enclosure containing either the branch-circuit supply or the branch-circuit load terminations.

Statement of Problem and Substantiation for Public Input

Recall that the 125% continuous use factor exists in the NEC solely due to the limitation of an overcurrent device installed in an enclosure which may allow heat buildup greater than would occur in the free air testing conditions of the applicable UL standard, possibly resulting in nuisance tripping when the overcurrent device is loaded continuously at its rating. In particular, there is no need to upsize the conductor itself based solely on the continuous loading; the ampacity is by the Article 100 definition a continuous rating. Any need to upsize the conductor derives from the need to upsize the overcurrent device and then to ensure than the conductor is still adequately protected under 240.4.

This amendment proposes to allow the use of 240.4(B) as indicated, which use would otherwise be circumvented by 210.19(A)(1). To illustrate the effect, consider a 48A continuous load (such as an EVSE, an increasingly common new installation) installed with a 60A overcurrent device and possibly supplied by 6/2 NM cable. NM cable is limited to the 60C ampacity column, so before adjustment and correction 6/2 NM has an ampacity of 55A.

Now the 55A rating is a continuous rating, and greater than the 48A continuous load, so the cable will not be overloaded during normal operating conditions. And 60A is 125% of the 48A continuous load, so the overcurrent device rating complies with 210.20(A) and should not lead to nuisance tripping. The only remaining question as far as the safety of the installation is whether a 60A overcurrent device can protect the 55A ampacity conductor with a 48A continuous load during abnormal conditions.

For the case of a non-continuous load of 55A, 240.4(B) does allow a 60A overcurrent device to protect a 55A ampacity conductor. The difference in loading conditions is not material to whether or not the 60A overcurrent device can properly protect a 55A ampacity conductor. That is, for the 55A non-continuous load case, 240.4(B) tells us that the overcurrent device's protection curve is suitably more conservative than the 55A ampacity conductor's damage curve, so that the 55A ampacity conductor is protected. The same confidence about abnormal conditions applies regardless of normal loading conditions, so the 55A ampacity conductor is protected by a 60A overcurrent device for the 48A continuous load case as well.

As such, since the non-continuous configuration discussed is allowed under 240.4(B), the continuous configuration should also be allowed. It is currently disallowed only due to the requirement in 210.19(A)(1) for the 125% continuous use factor. The new exception provides the narrowly tailored relief necessary to apply 240.4(B) to continuous loads.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 495-NFPA 70-2023 [Section No. 215.2(A)(1)]	Identical change for feeder conductors
Public Input No. 497-NFPA 70-2023 [Section No. 230.42(A)(1)]	Identical change for service-entrance conductors
Public Input No. 495-NFPA 70-2023 [Section No. 215.2(A)(1)]	
Public Input No. 497-NFPA 70-2023 [Section No. 230.42(A)(1)]	

Submitter Information Verification

Submitter Full Name: Wayne Whitney

Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Mar 21 12:46:55 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The 125% continuous use factor does not exist in the NEC solely due to the limitation of an overcurrent device installed in an enclosure. Heat rise tests performed on equipment address more than just the OCPDs located within. These tests are also addressing other components installed within the assembly. The increase in conductor size by application of 125% of continuous loads helps to provide conductor material to act as a heat sink for achieving a lower impact on temperature rise.

Public Input No. 1911-NFPA 70-2023 [New Section after 210.19(D)]

210.19 (E) Household Dryers

Establish a new article like 210.19(C) but for dryers noting 5 kW or more with a minimum branch-circuit rating of 30 amperes. The neutral shall be permitted to be derated to 70% of branch circuit rating but shall not be smaller than 12 AWG.

Statement of Problem and Substantiation for Public Input

Throughout Article 220 there is significant overlap between how ranges and dryers are calculated, derated, etc. Similar overlap is appropriate in Article 210 with regards to branch circuits, in this case the minimum sizing of a branch circuit.

Submitter Information Verification

Submitter Full Name: Gary Hein
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 07 14:54:34 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: No proposed text was provided, which is in violation of Section 4.3.4.1(c) of the Regulations Governing the Development of NFPA Standards. The submitter’s request does not include enough specificity for the code-making panel to act upon. There are new dryer systems that have lower wattage requirements. It would not allow for the requirements in 240.4(E), regarding taps.

Public Input No. 281-NFPA 70-2023 [Section No. 210.19 [Excluding any Sub-Sections]]

Branch-circuit conductors for circuits not exceeding 1000 volts ac or 1500 volts dc ~~shall~~ , nominal shall be sized in accordance with 210.19(A) through (D).

Informational Note: Conductors for branch circuits as defined in Article 100, sized to prevent a voltage drop exceeding 3 percent at the farthest outlet of power, heating, and lighting loads, or combinations of such loads, and where the maximum total voltage drop on both feeders and branch circuits to the farthest outlet does not exceed 5 percent, provide reasonable efficiency of operation. See 215.2(A)(2), Informational Note No. 2, for information on voltage drop on feeder conductors.

Statement of Problem and Substantiation for Public Input

The word "nominal" should be added here to correlate with the title and scope of Article 210 and to make the distinction between the Article 100 definitions of "voltage of a circuit" and "nominal voltage". As stated in 110.4- the voltage considered shall be that at which the circuit operates.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 282-NFPA 70-2023 [Section No. 210.20 [Excluding any Sub-Sections]]	

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:
Submittal Date: Fri Feb 03 14:50:48 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: Adding "Nominal" to the text is unnecessary as the text "for circuits exceeding 1000 volts ac or 1500 volts dc" has been deleted.

Public Input No. 282-NFPA 70-2023 [Section No. 210.20 [Excluding any Sub-Sections]]

Branch-circuit conductors and equipment for circuits not exceeding 1000 volts ac or 1500 volts dc, nominal shall be protected by overcurrent protective devices that have a rating or setting that complies with 210.20(A) through (D).

Statement of Problem and Substantiation for Public Input

The word "nominal" should be added here to correlate with the title and scope of Article 210 and to make the distinction between the Article 100 definitions of "voltage of a circuit" and "nominal voltage". As stated in 110.4- the voltage considered shall be that at which the circuit operates.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 281-NFPA 70-2023 [Section No. 210.19 [Excluding any Sub-Sections]]	nominal voltage vs circuit voltage

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:
Submittal Date: Fri Feb 03 14:58:43 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: Adding "Nominal" to the text is unnecessary as the text "for circuits exceeding 1000 volts ac or 1500 volts dc" has been deleted.

Public Input No. 748-NFPA 70-2023 [Section No. 210.21(B)]

(B) Receptacles.

(1) ~~Single~~ Receptacle ~~on an Individual Branch Circuit~~ Ratings .

~~A single receptacle installed on an individual branch circuit~~ Receptacles shall have an ampere rating not less than that of the branch circuit.

Exception No. 1: ~~A receptacle~~ R eceptacles installed in accordance with 430.81(B).

Exception No. 2: ~~A receptacle~~ Receptacles installed exclusively for the use of ~~a~~ cord-and-plug-connected arc ~~welder~~ welders shall be permitted to have ~~an~~ ampere ~~rating~~ ratings not less than the minimum branch-circuit conductor ampacity determined by 630.11(A) or (B) for arc welders.

Exception No. 3: The ampere rating of a receptacle installed for electric discharge lighting shall be permitted to be based on 410.62(C) .

Informational Note: See Article 100 for the definition of *receptacle*.

(2) Total Cord-and-Plug-Connected Load.

~~Circuit Rating~~

~~(Amperes) Receptacle Rating~~

~~(Amperes) 15 15 20 15 or 20 30 30 40 40 or 50 50 50 (4)~~

Where connected to a branch circuit supplying two or more receptacles or outlets, ~~a receptacle~~ any single receptacle shall not supply a total cord-and-plug-connected load in excess of the maximum ~~specified in Table 210.21(B)(2) .~~

~~Table 210.21(B)(2) Maximum Cord-and-Plug-Connected Load to Receptacle~~

~~Circuit Rating~~

~~(Amperes) Receptacle Rating~~

~~(Amperes) Maximum Load~~

~~(Amperes) 15 or 20 15 12 20 20 16 30 30 24~~

~~**(3)** Receptacle Ratings.~~

~~Where connected to a branch circuit supplying two or more receptacles or outlets, receptacle ratings shall not be less than the values listed in Table 210.21(B)(3) , or, where rated higher than 50 amperes, the receptacle rating shall not be less than the branch-circuit rating.~~

~~*Exception No. 1: Receptacles installed exclusively for the use of cord-and-plug-connected arc welders shall be permitted to have ampere ratings not less than the minimum branch-circuit conductor ampacity determined by 630.11(A) or (B) for arc welders.*~~

~~*Exception No. 2: The ampere rating of a receptacle installed for electric discharge lighting shall be permitted to be based on 410.62(C) .*~~

~~Table 210.21(B)(3) Receptacle Ratings for Circuits Serving More Than One Receptacle or Receptacle Outlet~~

continuous load rating of the circuit.

(3) Range Receptacle Rating.

The ampere rating of a range receptacle shall be permitted to be based on a single range demand load as specified in Table 220.55.

Statement of Problem and Substantiation for Public Input

One may argue that it is rare for any individual 15A receptacle to be overloaded on a 20A circuit with 2+ receptacles because they say that there are almost always other loads that add up to 5A (20A minus 15A). So, they think it is safe because drawing more than 15A on any single 15A receptacle will cause the total branch-circuit current to exceed 20A, which would trip the breaker. However, that is not what I have personally observed, at least in the lowlands of California (and probably also the rest of the Sun Belt), which has mild winters.

On most branch circuits that I've seen in person, they usually either have nothing plugged into any of the receptacles or have all equipment powered off or on standby even when they are plugged in. This means that they have negligible combined load, well under 1A. If we use 0.2A combined for example, then the current through any 15A receptacle would have to exceed 19.8A in order to trip the breaker, which is proportionally way in excess of the rating of the receptacle. I already know that all NEMA 5-15 receptacles are required to have a feed-through rating of at least 20A, so this is not about that. However, 15A receptacles are only required to have a prong contact rating of at least 15A. This means passing 19.8A through the contacts of a 15A receptacle for more than a few minutes or so would lead to overheating, which could cause the plastic around it to melt and ignite. As a result, allowing 15A receptacles on 20A branch circuits, even if they have more than one receptacle, is unsafe. So, that allowance should be discontinued.

On the hand, abroad in countries that follow British Standards, they are able to allow 13A receptacles on 32A ring circuits while ensuring safety because all listed (BSI in the territories that have adopted the BS 1363 socket as standard) BS 1363 plugs (including adaptors) are required to have built-in overcurrent protection (BS 1362), which effectively turns every cord into its own branch circuit and every ring circuit into a feeder. This means it is impossible from a physical science perspective (not just highly improbable) to overload a BS 1363 receptacle if all parts are in legal compliance and free of defects. So, either the UL standard should be updated to require all newly manufactured or newly refurbished NEMA 5-15P (including adaptors) from now on to have integrated overcurrent protection, or the NEC should prohibit any receptacle from having an ampere rating lower than the branch circuit that they're on.

Submitter Information Verification

Submitter Full Name:	Conrad Ko
Organization:	[Not Specified]
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Thu Apr 27 01:29:11 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The substantiation provided does not correlate with the requirements of 210.18, 210.22, and 210.24.

Public Input No. 3147-NFPA 70-2023 [Section No. 210.21(B)(2)]

(2) Total Cord-and-Plug-Connected Load.

Where connected to a branch circuit supplying two or more receptacles or outlets, a receptacle shall not supply a total cord-and-plug-connected load in excess of the ~~maximum~~ continuous load specified in Table 210.21(B)(2).

Table 210.21(B)(2) Maximum Cord-and-Plug-Connected Load to Receptacle

Circuit Rating (Amperes)	Receptacle Rating (Amperes)	~~Maximum~~ Continuous Load (Amperes)
15 or 20	15	12
20	20	16
30	30	24

Statement of Problem and Substantiation for Public Input

Use of the term maximum in section 210.21 (B) and inTable 210.21(B)(2) is confusing and inconsistent with ratings and ampacity calculations used elsewhere in the Code. The propsed changes woulld improve clarity and consistency of the Code.

Submitter Information Verification

Submitter Full Name: John Berdner
Organization: Enphase Energy, Inc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 16:46:32 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The existing requirements are applicable to the maximum of either continuous or non-continuous loads.

Public Input No. 2459-NFPA 70-2023 [Section No. 210.21(B)(3)]

(3) Receptacle Ratings.

Where connected to a branch circuit supplying two or more receptacles or outlets, receptacle ratings shall not be less than the values listed in Table 210.21(B)(3), or, where rated higher than 50 amperes, the receptacle rating shall not be less than the branch-circuit rating.

Exception No. 1: Receptacles installed exclusively for the use of cord-and-plug-connected arc welders shall be permitted to have ampere ratings not less than the minimum branch-circuit conductor ampacity determined by 630.11(A) or (B) for arc welders.

Exception No. 2: The ampere rating of a receptacle installed for electric discharge lighting shall be permitted to be based on 410.62(C).

Table 210.21(B)(3) Receptacle Ratings for Circuits Serving More Than One Receptacle or Receptacle Outlet

Circuit Rating (Amperes)	Receptacle Rating (Amperes)
15	15
20	15 or 20
30	30
40~~40~~	~~or~~ 50
50	50

Statement of Problem and Substantiation for Public Input

Removing 40A from receptacle ampere rating column of Table 210.21(B)(3) because there currently is no NEMA configuration for a 40A receptacle. If they don't exist currently there is no reason why to have them in Table 210.21(B)(3).

Submitter Information Verification

Submitter Full Name:	Mike Holt
Organization:	Mike Holt Enterprises Inc
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Thu Aug 17 13:20:40 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: NEMA configurations of NEMA Standard WD 6 do not represent the sum-total of all configurations eligible for receptacles, attachment plugs, connectors and inlets (motor plugs). Other configuration standards exist, such as UL 1681, UL 1686, and UL 1691 to name a few. Furthermore, proprietary configurations that do not violate 406.8 and 406.4(F) are not precluded. Although not common, receptacles rated at 40 amperes have been listed and produced in the past, and remain eligible to be listed and produced in the future.

Public Input No. 2497-NFPA 70-2023 [Section No. 210.23(A)(1)]

(1) Loads Permitted for 10-Ampere Branch Circuits.

A 10-ampere branch circuit shall only be permitted to supply one or more of the following:

(1) Lighting outlets

(2) Dwelling unit exhaust fans ~~on bathroom or laundry room lighting circuits~~

(3) ~~A gas fireplace unit supplied by an individual branch circuit~~

Statement of Problem and Substantiation for Public Input

There is no reason to limit an exhaust fan, which is typically less than one ampere, to only bathroom and laundry circuits. Who cares if I put them on a bedroom lighting circuit? I can have 10A of lighting on a bedroom circuit and be safe, but 9A of lighitng and 1 amp of exhaust fan is not safe?

The lanugae about the fireplace is marked for deletion because it never should have existed to begin with. If the rule requires it to be on an indivual branch circuit, why is covered in 210.23? That section is for multioutlet circuits, not individual circuits.

Submitter Information Verification

Submitter Full Name: Ryan Jackson
Organization: Self-employed
Street Address:
City:
State:
Zip:
Submittal Date: Fri Aug 18 12:34:50 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7637-NFPA 70-2024

Statement: To enhance Code usability and to add clarity, 210.23(A) was rewritten to clearly identify what loads are permitted to be supplied by 10-A multi-outlet branch circuits. The gas fireplace unit was removed because it was for an individual branch circuit. An exception was added to 210.22 to address receptacles on a 10-A individual branch circuit.

Public Input No. 1643-NFPA 70-2023 [Section No. 210.23(A)(2)]

~~(2) Loads Not Permitted for 10-Ampere Branch Circuits.~~

~~A 10-ampere branch circuit shall not supply any of the following:~~

(1) ~~Receptacle outlets~~

(2) ~~Fixed appliances, except as permitted for individual branch circuits~~

(3) ~~Garage door openers~~

(4) ~~Laundry equipment~~

Statement of Problem and Substantiation for Public Input

This PI proposes to delete list item (2) in it's entirety in an effort to clearly manage what loads are permitted for 10 ampere branch circuits. By managing only one list, what loads are permitted for 10 ampere branch circuits, there should be no confusion to users of the Code. If something is not on the list then it's not permitted. Currently list (2) is incomplete as there are many loads not mentioned, which can be confusing. Example- are smoke alarms permitted to be supplied by a 10 amp branch circuit?

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1644-NFPA 70-2023 [Section No. 210.23(A) [Excluding any Sub-Sections]]	

Submitter Information Verification

Submitter Full Name: Vincent Della Croce
Organization:
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 27 15:51:20 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7637-NFPA 70-2024
Statement: To enhance Code usability and to add clarity, 210.23(A) was rewritten to clearly identify what loads are permitted to be supplied by 10-A multi-outlet branch circuits. The gas fireplace unit was removed because it was for an individual branch circuit. An exception was added to 210.22 to address receptacles on a 10-A individual branch circuit.

Public Input No. 1644-NFPA 70-2023 [Section No. 210.23(A) [Excluding any Sub-Sections]]

A 10-ampere branch circuit shall comply with the requirements of 210.23(A)(1)~~ and (A)(2)~~ .

Statement of Problem and Substantiation for Public Input

This PI proposes to delete the reference to 210.23(A)(2). If companion PI 1643 is resolved, this PI will not apply.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1643-NFPA 70-2023 [Section No. 210.23(A)(2)]	

Submitter Information Verification

Submitter Full Name: Vincent Della Croce
Organization:
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 27 16:05:30 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7637-NFPA 70-2024

Statement: To enhance Code usability and to add clarity, 210.23(A) was rewritten to clearly identify what loads are permitted to be supplied by 10-A multi-outlet branch circuits. The gas fireplace unit was removed because it was for an individual branch circuit. An exception was added to 210.22 to address receptacles on a 10-A individual branch circuit.

Public Input No. 1467-NFPA 70-2023 [Section No. 210.23(B) [Excluding any Sub-Sections]]

A 15- or 20-ampere branch circuit shall be permitted to supply lighting outlets, lighting units, or other utilization equipment, or any combination of them, and shall comply with 210.23(B)(1) and (B)(2).

Exception: The small-appliance branch circuits, laundry branch circuits, bathroom, and ~~bathroom~~ garage branch circuits required in a dwelling unit(s) by 210.11(C)~~(1) , (C)(2), and (C)(3)~~ shall supply only the receptacle outlets specified in that section.

Statement of Problem and Substantiation for Public Input

This section needs to include the garages covered in 210.11(C)(4).

Submitter Information Verification

Submitter Full Name: Ryan Jackson
Organization: Self-employed
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 19 14:30:45 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Insufficient substantiation was provided to exempt garage branch circuits from supplying only the receptacle outlets specified in 210.11(C)(4).

Public Input No. 2390-NFPA 70-2023 [Section No. 210.23(B) [Excluding any Sub-Sections]]

A 15- or 20-ampere branch circuit shall be permitted to supply lighting outlets, lighting units, or other utilization equipment, or any combination of them, and shall comply with 210.23(B)(1) and (B)(2).

~~Exception~~ Informational Note : The small-appliance branch circuits, laundry branch circuits, and bathroom branch circuits required in a dwelling unit(s) by 210.11(C)(1), (C)(2), and (C)(3) shall supply only the receptacle outlets specified in that section.

Statement of Problem and Substantiation for Public Input

This exception is not necessary because 210.11(C)(1), (2), and (3) are requirements that must be complied with. Changing the exception to an informational note to remind Code users of these requirements.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 16 15:57:13 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Informational notes are not allowed to have a requirement as per Section 2.1.10.2 of the NEC Style Manual.

Public Input No. 968-NFPA 70-2023 [Sections 210.23(C), 210.23(D), 210.23(E)]

Sections 210.23(C), 210.23(D), 210.23(E)

(C) 30-Ampere Branch Circuits.

A 30-ampere branch circuit shall be permitted to supply fixed lighting units with heavy-duty lampholders in other than a dwelling unit(s) or utilization equipment in any occupancy. The rating of any one cord-and-plug-connected utilization equipment shall not exceed 80 percent of the branch-circuit ampere rating.

Exception: In dwelling unit (s), 30-ampere branch circuit(s) shall be permitted to supply fixed lighting units with heavy-duty lampholders where a label is permanently affixed to every outlet and visible after installation, without opening any covers, that identifies every outlet on the branch circuit and states that the sum of the load among all of them, excluding inrush current, must not exceed the branch-circuit ampere rating at any given time. The label should read the following or similar:

10G

CAUTION!

sum of 10A to 10H = 30 A max.

(D) 40- and 50-Ampere Branch Circuits.

A 40- or 50-ampere branch circuit shall be permitted to supply cooking appliances that are fastened in place in any occupancy. In other than dwelling units, such circuits shall be permitted to supply fixed lighting units with heavy-duty lampholders, infrared heating units, or other utilization equipment.

Exception: In dwelling unit (s), 40- and 50- ampere branch circuit(s) shall be permitted to supply fixed lighting units with heavy-duty lampholders, infrared heating units, or other utilization equipment where a label is permanently affixed to every outlet and visible after installation, without opening any covers, that identifies every outlet on the branch circuit and states that the sum of the load among all of them, excluding inrush current, must not exceed the branch-circuit ampere rating at any given time. The label should read the following or similar:

10G

CAUTION!

sum of 10A to 10H = 40 A max.

(E) Branch Circuits Larger Than 50 Amperes.

Branch circuits larger than 50 amperes shall supply only nonlighting outlet loads.

Exception: Lightning outlet loads shall be permitted where a label is permanently affixed to every outlet and visible after installation, without opening any covers, that identifies every outlet on the branch circuit and states that the sum of the load among all of them, excluding inrush current, must not exceed the branch-circuit ampere rating at any given time. The label should read the following or similar:

10G

CAUTION!

sum of 10A to 10H = 60 A max.

Statement of Problem and Substantiation for Public Input

A warning/caution label is a suitable alternative to lower currents for preventing/mitigating overload. An example for each of the exceptions has the labels for the respective outlets reading, with 10G being a hardwired outlet and 10B being a receptacle of the circuit's ampere rating, with the underscores being a placeholder for the respective branch-circuit ampere ratings:

10G
CAUTION!
sum of 10A to 10H = ___ A max.

10B
CAUTION!
sum of 10A to 10H = ___ A max.

Submitter Information Verification

Submitter Full Name: Conrad Ko
Organization: [Not Specified]
Street Address:
City:
State:
Zip:

Submittal Date: Wed Jun 07 14:23:42 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The substantiation provided is not clear and did not provide any evidence to support the use of labels will improve safety.

Public Input No. 4183-NFPA 70-2023 [Section No. 210.23(E)]

(E) Branch Circuits Larger Than 50 Amperes.

Branch circuits larger than 50 amperes shall supply only nonlighting outlet loads in accordance with 210 .18, Exception No 1.

Statement of Problem and Substantiation for Public Input

Subsection 210.23(E) as written, nullifies the Exception under section 210.18 where it requires conditions of maintenance and supervision ensure qualified persons service the equipment.

Submitter Information Verification

Submitter Full Name: Mathher Abbassi
Organization: Abbassi Electric Corp.
Street Address:
City:
State:
Zip:

Submittal Date: Wed Sep 06 20:05:47 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The added language is not needed as 210.23(E) covers multiple-outlet branch circuits, while 210.18 covers branch circuit rating.

Public Input No. 970-NFPA 70-2023 [Section No. 210.24]

210.24 Branch-Circuit Requirements — Summary.

The requirements for circuits that have two or more outlets or receptacles, other than the receptacle circuits of 210.11(C)(1), (C)(2), and (C)(3), are summarized in Table 210.24(1) for copper conductors and Table 210.24(2) for aluminum and copper-clad aluminum conductors. Table 210.24(1) and Table 210.24(2) provide only a summary of minimum requirements. See 210.19, 210.20, and 210.21 for the specific requirements applying to branch circuits.

Table 210.24(1) Summary of Branch-Circuit Requirements — Copper Conductors

Circuit Rating	10 A	15 A	20 A	30 A	40 A	50 A
Conductors (min. size):	-	-	-	-	-	-
Circuit wires	14	14	12	10	8	6
Taps	14	14	14	14	12	12
Fixture wires and cords			See 240.5.	-	-	-
Overcurrent Protection	**10 A**	**15 A**	**20 A**	**30 A**	**40 A**	**50 A**
Outlet devices:	-	-	-	-	-	-
Lampholders permitted	Any type	Any type	Any type	Heavy duty	Heavy duty	Heavy duty
Receptacle rating[1]	Not applicable[2]	~~15 max.~~ 15 A	~~15 A or~~ 20 A	30 A	40 A or 50 A	50 A
Maximum Load	**10 A**	**15 A**	**20 A**	**30 A**	**40 A**	**50 A**
Permissible load	See 210.23(A).	See 210.23(B).	See 210.23(B).	See 210.23(C).	See 210.23(D).	See 210.23(D).

[1]For receptacle rating of cord-connected electric-discharge luminaires, see 410.62(C).

[2]Branch circuits rated 10-amperes shall not supply receptacle outlets.

Table 210.24(2) Summary of Branch-Circuit Requirements — Aluminum and Copper-Clad Aluminum Conductors

Circuit Rating	10 A	15 A	20 A	30 A	40 A	50 A	
Conductors (min. size):	-	-	-	-	-	-	
Circuit wires	12	12	10	8	6	4	
Taps	12	12	12	12	10	10	
Fixture wires and cords	-	-	-				See 240.5. - -
Overcurrent Protection	**10 A**	**15 A**	**20 A**	**30 A**	**40 A**	**50 A**	
Outlet devices:	-	-	-	-	-	-	
Lampholders permitted	Any type	Any type	Any type	Heavy duty	Heavy duty	Heavy duty	
Receptacle rating[1]	Not applicable[2]	~~15 max.~~ 15 A	~~15 A or~~ 20 A	30 A	40 A or 50 A	50 A	
Maximum Load	**10 A**	**15 A**	**20 A**	**30 A**	**40 A**	**50 A**	
Permissible load	See 210.23(A).	See 210.23(B).	See 210.23(B).	See 210.23(C).	See 210.23(D).	See 210.23(D).	

[1]For receptacle rating of cord-connected electric-discharge luminaires, see 410.62(C).

[2]Branch circuits rated 10-amperes shall not supply receptacle outlets.

Statement of Problem and Substantiation for Public Input

Removed allowance for receptacles rated lower than branch-circuit ampere rating (e.g., multiple 15 A receptacles on 20 A circuits) as per my public input for 210.21(B).

Submitter Information Verification

Submitter Full Name: Conrad Ko
Organization: [Not Specified]
Street Address:
City:

State:
Zip:
Submittal Date: Wed Jun 07 15:03:31 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: No substantiation was provided to warrant the change. 15-A receptacles having feed-through terminals are listed for 20 A.

Public Input No. 1912-NFPA 70-2023 [Section No. 210.25(B)]

(B) Common Area Branch Circuits.

Branch circuits installed for receptacle outlets, lighting, central alarm, signal, communications, or other purposes for public or common areas of a two-family dwelling, a multifamily dwelling, or a multi-occupancy building shall not be supplied from equipment that supplies an individual dwelling unit or tenant space.

> Informational Note: Examples of public or common areas include, but are not limited to, lobbies, corridors, stairways, laundry rooms, roofs, elevators, washrooms, store rooms, driveways (parking), and mechanical rooms.

Statement of Problem and Substantiation for Public Input

Add receptacle outlets to the list of specific examples of equipment/systems such as lighting, communications, etc. in common areas that are not to be powered by a branch circuit from an individual dwelling unit or tenant space.

Receptacle outlets are very common, and additional receptacles are often in high demand. It is often easy, convenient and all too common for someone to tap off an individual dwelling unit or tenant space branch circuit to power a receptacle outlet that is installed in a common area.

Submitter Information Verification

Submitter Full Name: Gary Hein
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 07 14:59:36 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The substantiation provided does not correlate with the requirements of 210.25(A) and 240.24(B).

Public Input No. 1600-NFPA 70-2023 [Section No. 210.52]

210.52 Dwelling Unit ~~- Receptacle~~ , Guest Room, Guest Suites, Dormitory Unit, and Similar Area 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 as follows:

(1) Part of a luminaire or appliance, or

(2) Controlled by a listed wall-mounted control device 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 (5½ ft) above the floor

Permanently installed electric baseboard heaters equipped with factory-installed receptacle outlets 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.

Informational Note: Listed baseboard heaters include instructions that may not permit their installation below receptacle outlets.

(A) General Provisions.

In every kitchen, family room, dining room, living room, parlor, library, den, sunroom, bedroom, recreation room, or similar room or area ~~of dwelling units~~ , receptacle outlets shall be installed in accordance with the general provisions specified in 210.52(A)(1) through (A)(4).

(1) Spacing.

Receptacles shall be installed such that no point measured horizontally along the floor line of any wall space is more than 1.8 m (6 ft) from a receptacle outlet.

(2) Wall Space.

As used in this section, a wall space shall include the following:

(1) Any space 600 mm (2 ft) or more in width (including space measured around corners) and unbroken along the floor line by doorways and similar openings, fireplaces, stationary appliances, ~~and fixed~~ fixed in place furniture, fixed in place desks, and fixed cabinets that do not have countertops or similar work surfaces

(2) The space occupied by fixed panels in walls, excluding sliding panels

(3) The space afforded by fixed room dividers, such as freestanding bar-type counters or railings

(3) Floor Receptacles.

Receptacle outlets in or on floors shall not be counted as part of the required number of receptacle outlets unless located within 450 mm (18 in.) of the wall.

(4) Countertop and Similar Work Surface Receptacle Outlets.

Receptacles installed for countertop and similar work surfaces as specified in 210.52(C) shall not be considered as the receptacle outlets required by 210.52(A).

(B) Small Appliances.

(1) Receptacle Outlets Served.

In the kitchen, pantry, breakfast room, dining room, or similar area of a dwelling unit, the two or more 20-ampere small-appliance branch circuits required by 210.11(C)(1) shall serve all wall and floor receptacle outlets covered by 210.52(A), all countertop outlets covered by 210.52(C), and receptacle outlets for refrigeration equipment.

Exception No. 1: In addition to the required receptacles specified by 210.52, switched receptacles supplied from a general-purpose 15- or 20-ampere branch circuit shall be permitted in accordance with 210.70(A)(1), Exception No. 1.

Exception No. 2: In addition to the required receptacles specified by 210.52, a receptacle outlet to serve a specific appliance shall be permitted to be supplied from an individual branch circuit rated 15 amperes or greater.

(2) No Other Outlets.

The two or more small-appliance branch circuits specified in 210.52(B)(1) shall have no other outlets.

Exception No. 1: A receptacle installed solely for the electrical supply to and support of an electric clock in any of the rooms specified in 210.52(B)(1) shall be permitted to be served by a small-appliance branch circuit.

Exception No. 2: Receptacles installed to provide power for supplemental equipment and lighting on gas-fired ranges, ovens, or counter-mounted cooking units shall be permitted to be served by a small-appliance branch circuit.

(3) Kitchen Receptacle Requirements.

Receptacles installed in a kitchen to serve countertop surfaces shall be supplied by not fewer than two small-appliance branch circuits, either or both of which shall also be permitted to supply receptacle outlets in the same kitchen and in other rooms specified in 210.52(B)(1). Additional small-appliance branch circuits shall be permitted to supply receptacle outlets in the kitchen and other rooms specified in 210.52(B)(1). No small-appliance branch circuit shall serve more than one kitchen.

(C) Countertops and Work Surfaces.

In kitchens, pantries, breakfast rooms, dining rooms, and similar areas of dwelling units, receptacle outlets for countertop and work surfaces that are 300 mm (12 in.) or wider shall be installed in accordance with 210.52(C)(1) through (C)(3) and shall not be considered as the receptacle outlets required by 210.52(A).

For the purposes of this section, where using multioutlet assemblies, each 300 mm (12 in.) of multioutlet assembly containing two or more receptacles installed in individual or continuous lengths shall be considered to be one receptacle outlet.

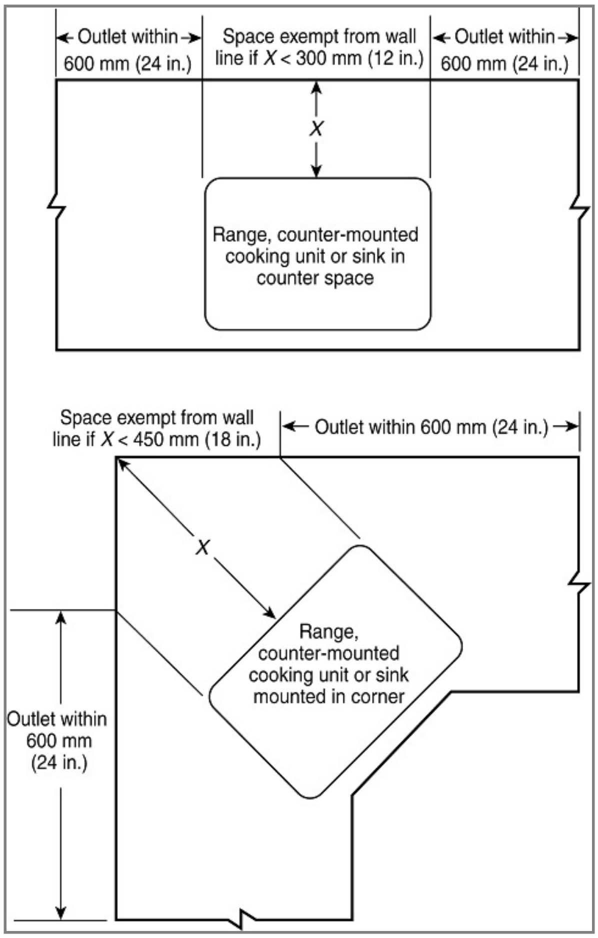
(1) Wall Spaces.

Receptacle outlets shall be installed so that no point along the wall line is more than 600 mm (24 in.) measured horizontally from a receptacle outlet in that space. The location of the receptacles shall be in accordance with 210.52(C)(3).

Exception No. 1: Receptacle outlets shall not be required directly behind a range, counter-mounted cooking unit, or sink in the installation described in Figure 210.52(C)(1).

Exception No. 2: Where a required receptacle outlet cannot be installed in the wall areas shown in Figure 210.52(C)(1), the receptacle outlet shall be permitted to be installed as close as practicable to the countertop area to be served. The total number of receptacle outlets serving the countertop shall not be less than the number needed to satisfy 210.52(C)(1). These outlets shall be located in accordance with 210.52(C)(3).

Figure 210.52(C)(1) Determination of Area Behind a Range, Counter-Mounted Cooking Unit, or Sink.



(2) Island and Peninsular Countertops and Work Surfaces.

Receptacle outlets, if installed to serve an island or peninsular countertop or work surface, shall be installed in accordance with 210.52(C)(3). If a receptacle outlet is not provided to serve an island or peninsular countertop or work surface, provisions shall be provided at the island or peninsula for future addition of a receptacle outlet to serve the island or peninsular countertop or work surface.

(3) Receptacle Outlet Location.

Receptacle outlets shall be located in one or more of the following:

(1) On or above, but not more than 500 mm (20 in.) above, a countertop or work surface

(2) In a countertop using receptacle outlet assemblies listed for use in countertops

(3) In a work surface using receptacle outlet assemblies listed for use in work surfaces or listed for use in countertops

Receptacle outlets rendered not readily accessible by appliances fastened in place, appliance garages, sinks, or rangetops as covered in 210.52(C)(1), Exception No. 1, or appliances occupying assigned spaces shall not be considered as these required outlets.

Informational Note No. 1: See 406.5(E) for installation of receptacles in countertops and 406.5(F) for installation of receptacles in work surfaces. See 380.10 for installation of multioutlet assemblies.

Informational Note No. 2: See Informative Annex J and ANSI/ICC A117.1-2009, *Standard on Accessible and Usable Buildings and Facilities*, for additional information.

(D) Bathrooms.

At least one receptacle outlet shall be installed in bathrooms within 900 mm (3 ft) of the outside edge of each sink. The receptacle outlet shall be located on a wall or partition that is adjacent to the sink or sink countertop, located on the countertop, or installed on the side or face of the sink cabinet. In no case shall the receptacle be located more than 300 mm (12 in.) below the top of the sink or sink countertop. Receptacle outlet assemblies listed for use in countertops shall be permitted to be installed in the countertop.

Informational Note: See 406.5(E) and 406.5(G) for requirements on installation of receptacles in countertops.

(E) Outdoor Outlets.

Outdoor receptacle outlets shall be installed in accordance with 210.52(E)(1) through (E)(3).

(1) One-Family and Two-Family Dwellings.

For a one-family dwelling and each unit of a two-family dwelling that is at grade level, at least one receptacle outlet readily accessible from grade and not more than 2.0 m (6½ ft) above grade level shall be installed at the front and back of the dwelling.

(2) Multifamily Dwellings.

For each dwelling unit of a multifamily dwelling where the dwelling unit is located at grade level and provided with individual exterior entrance/egress, at least one receptacle outlet readily accessible from grade and not more than 2.0 m (6½ ft) above grade level shall be installed.

(3) Balconies, Decks, and Porches.

Balconies, decks, and porches that are within 102 mm (4 in.) horizontally of the dwelling unit shall have at least one receptacle outlet accessible from the balcony, deck, or porch. The receptacle outlet shall not be located more than 2.0 m (6½ ft) above the balcony, deck, or porch walking surface.

(F) Laundry Areas.

In dwelling units, at least one receptacle outlet shall be installed in areas designated for the installation of laundry equipment.

Exception No. 1: A receptacle for laundry equipment shall not be required in a dwelling unit of a multifamily building where laundry facilities are provided on the premises for use by all building occupants.

Exception No. 2: A receptacle for laundry equipment shall not be required in other than one-family dwellings where laundry facilities are not to be installed or permitted.

(G) Basements, Garages, and Accessory Buildings.

For one- and two-family dwellings, and multifamily dwellings, at least one receptacle outlet shall be installed in the areas specified in 210.52(G)(1) through (G)(3). These receptacles shall be in addition to receptacles required for specific equipment. Receptacles supplying only a permanently installed premises security system shall not be considered as meeting these requirements.

(1) Garages.

In each attached garage and in each detached garage with electric power, at least one receptacle outlet shall be installed in each vehicle bay and not more than 1.7 m (5½ ft) above the floor.

Exception: Garage spaces not attached to an individual dwelling unit of a multifamily dwelling shall not require a receptacle outlet in each vehicle bay.

(2) Accessory Buildings.

In each accessory building with electric power.

(3) Basements.

In each separate unfinished portion of a basement.

(H) Hallways.

In dwelling units, hallways of 3.0 m (10 ft) or more in length shall have at least one receptacle outlet.

As used in this subsection, the hallway length shall be considered the length along the centerline of the hallway without passing through a doorway.

(I) Foyers.

Foyers that are not part of a hallway in accordance with 210.52(H) and that have an area that is greater than 5.6 m^2 (60 ft^2) shall have a receptacle(s) located in each wall space 900 mm (3 ft) or more in width. Doorways, door-side windows that extend to the floor, and similar openings shall not be considered wall space.

Statement of Problem and Substantiation for Public Input

Currently the NEC has multiple, slightly different receptacle placement requirements which create oppottiunity for confusion. Making these changes to 210.52 removes the need for Sections 210.60(A) but also maintain the intent of that Section. By including the "Fixed in Place Furniture and Fixed in place desks" in Section 210.52(A)(2)(1) it will ensure the fixed furniture in a hotel guest room will be treated like a break in a wall, triggering the need for a receptacle outlet within 6ft of that break. This will maintain the intent in Section 210.60(B) of having at least two (2) receptacle outlets accessible. This revision also greatly simplifies the application of the receptacle placement rules for occupancies where people are intended to live and sleep, whether temporarily or permaenently.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1602-NFPA 70-2023 [Section No. 210.60]	
Public Input No. 1602-NFPA 70-2023 [Section No. 210.60]	

Submitter Information Verification

Submitter Full Name:	Kyle Krueger
Organization:	NECA
Affiliation:	NECA
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Thu Jul 27 10:02:52 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: Section 210.52 addresses receptacle outlets and therefore should not be retitled to expand the scope. The language in 210.60(A) is clear. The substantiation indicated receptacles should be provided to address furniture fixed in place however it would impact receptacle placement that could reduce the number of receptacles along the wall space.

Public Input No. 289-NFPA 70-2023 [New Section after 210.52(A)]

TITLE OF NEW CONTENT

Type your content here ...

210.52.A(5) Receptacle placement. Where a receptacle is installed in the direct path of a sliding panel, such as a barn door, it shall be recessed to prevent the sliding panel from contacting any attachment plug that may be installed or the receptacle shall be provided with a suitable guard.

Additional Proposed Changes

File Name	Description	Approved
barn_door.png	barn door outlet	

Statement of Problem and Substantiation for Public Input

With Barn doors being all the new rage, many receptacles are still being installed behind them, exposing anything plugged into the receptacle to extreme physical damage. This wall space either needs to be prohibited completely as available wall space, or provisions need to be put in place to guard anything plugged into them.

Submitter Information Verification

Submitter Full Name: adam hosler
Organization: Sarpy County
Street Address:
City:
State:
Zip:

Submittal Date: Mon Feb 06 11:04:48 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: A recessed receptacle will not address the damage to a cord being plugged into an outlet behind a door, swinging or barn door. A receptacle can be located beyond the sliding door as already addressed with pocket doors.

Public Input No. 1915-NFPA 70-2023 [Section No. 210.52(A)(1)]

(1) Spacing.

Receptacles shall be installed such that no point measured horizontally along the floor line of any wall space is more than 1.8 m (6 ft) from a receptacle outlet. The placement of the receptacle, within the six-foot limit, shall allow for the insertion of an attachment plug into the receptacle.

Statement of Problem and Substantiation for Public Input

210.52 (A) (1) Clarify the receptacle outlets point of measurement. Provide clarity regarding where the measurement from a receptacle outlet is to be measured from. For example, is the measurement from the edge of the body of the receptacle outlet, or the center point of the receptacle outlet neither of which will allow for the insertion of an attachment plug.

Submitter Information Verification

Submitter Full Name:	Gary Hein
Organization:	[Not Specified]
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Aug 07 15:10:48 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The proposed language is not necessary as it would have limited impact on dimensional measurements. The language does not add clarity to the requirement.

Public Input No. 1405-NFPA 70-2023 [Section No. 210.52(A)(2)]

(2) Wall Space.

As used in this section, a wall space shall include the following:

(1) Any space 600 mm (2 ft) or more in width (including space measured around corners) and unbroken along the floor line by doorways and similar openings, fireplaces, stationary appliances, and fixed cabinets that do not have countertops or similar work surfaces

(2) The space occupied by fixed panels in walls, excluding sliding panels

(3) The space afforded by fixed room dividers, such ~~as freestanding bar-type counters or railings~~ as railings

Statement of Problem and Substantiation for Public Input

Omit 'free-standing bar-type counters' from NEC text.

The number of burns increased with the increased number of receptacles that were required for the 2020 code cycle for kitchen island and peninsula countertop and work surfaces at 210.52C2 and 210.52C3. A bar stool will most likely be placed at a bar type counter. Receptacles on the face of wall and counter spaces in dwelling kitchens spaces have proven to be a safety hazard. Anything that plugs into these receptacles could easily weave through the legs of the bar stools. According to the IAEI Analysis of Code Changes book, cords were inadvertently snagged causing second and third degree burns.

This change along with NEC 2023's 210.52C2 code change will make it so receptacles are no longer allowed in the vertical faces of bar counters, islands, peninsulas and work surfaces that have fixed room divider construction. Any receptacle at one of the above mentioned locations should meet the requirements of the current 210.52C2 and 210.52C3. The receptacle(s) belong on or above the countertop/work surface or in the countertop with listed countertop/work surface outlet assemblies.

Submitter Information Verification

Submitter Full Name: Norman Feck
Organization: State of Colorado
Affiliation: self
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jul 14 07:37:27 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: NEC 210.52(A)(2) establishes the required wall space for determining receptacle locations. NEC 210.52(C)(2) establishes the restrictions for locating the receptacle for a work surface or countertop.

Public Input No. 376-NFPA 70-2023 [Section No. 210.52(A)(2)]

(2) Wall Space.

As used in this section, a wall space shall include the following:

(1) Any space 600 mm (2 ft) or more in width (including space measured around corners) and unbroken along the floor line by doorways and similar openings, fireplaces, stationary appliances, and fixed cabinets that do not have countertops or similar work surfaces

(2) The space occupied by fixed panels in walls, excluding sliding panels

(3) The space afforded by fixed room dividers, such as freestanding bar-type counters or railings

(4) Receptacle outlets shall not be installed below a countertop or work surface within 300 mm (12 in.).

Statement of Problem and Substantiation for Public Input

With the changes to 210.52(C) for the 2023 NEC the language would seem to allow for standard wall space receptacle outlets to be installed up to a height of 1.7 m (5 1/2 ft.) above the floor. This would still allow for the installation of a recognized hazard at island and peninsular countertops. The proposed change would prohibit any receptacle outlet from being installed in a location below a countertop or work surface within 300 mm (12 in.) of the top of that surface and eliminate the hazard where the wall space would require a receptacle outlet.

Submitter Information Verification

Submitter Full Name:	Dustin Behounek
Organization:	State of Colorado
Affiliation:	IAEI
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Feb 27 19:24:47 EST 2023
Committee:	NEC-P02

Committee Statement

Resolution: NEC 210.52(A)(2) establishes the required wall space for determining receptacle locations.

Public Input No. 1917-NFPA 70-2023 [Section No. 210.52(A)(3)]

(3) Floor Receptacles.

Receptacle outlets in or on floors shall not be counted as part of the required number of receptacle outlets unless located within 450 mm (18 in.) of the wall. The placement of the receptacle, within the 18-inch limit, shall allow for the insertion of an attachment plug into the receptacle.

Statement of Problem and Substantiation for Public Input

210.52 (A) (3) Clarify the receptacle outlets point of measurement. Provide clarity regarding where the measurement from a receptacle outlet is to be measured from. For example, is the measurement from the edge of the body of the receptacle outlet, or the center point of the receptacle outlet neither of which will allow for the insertion of an attachment plug.

Submitter Information Verification

Submitter Full Name: Gary Hein
Organization: [Not Specified]
Street Address:
City:
State:
Zip:

Submittal Date: Mon Aug 07 15:17:14 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The proposed language is not necessary as it would have limited impact on dimensional measurements. The language does not add clarity to the requirement.

Public Input No. 1397-NFPA 70-2023 [New Section after 210.52(A)(4)]

TITLE OF NEW CONTENT

210.52A2(5) Column Receptacles

A minimum of one receptacle outlet shall be installed in columns with a overall width of 2.5 m (8') or greater. This measurement is made using the circumference of a round column and the perimeter measurement for other than a round column.

Statement of Problem and Substantiation for Public Input

If ample wall space exists in a dwelling, furniture tends to get placed beside those walls. More furniture usually means more electrical products on or beside the furniture. The goal here is to prevent cords from running across a walkway from a nearby wall or the use of extension cords. The dimensions used with this new columns proposal stem from the current code's use of 2' or greater wall spaces at 210.52A2(1).

Small columns have a greater chance of being free of furniture. Large columns could easily be used for something like a lamp on a stand. Under this new code, small overall width columns would not require a wall space receptacle (those with an overall width of of less than 8') meaning this code is not too restrictive. Larger width (those with an overall width between 8' and 16') would now require a minimum of one receptacle. Wall spaces wider than this, for these isolated structures, are not considered columns any longer, but are wall spaces that fall under 210.52A2(1) through 210.52A2(4).

A new NEC definition for column has been proposed in Article 100 and reads:
Column - A decorative or load bearing structure that extends from floor to ceiling, is isolated from other columns, and has an overall width of up to 5 m (16').

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1395-NFPA 70-2023 [New Definition after Definition: Collector Rings.]	
Public Input No. 1395-NFPA 70-2023 [New Definition after Definition: Collector Rings.]	

Submitter Information Verification

Submitter Full Name:	Norman Feck
Organization:	State of Colorado
Affiliation:	self
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Thu Jul 13 08:32:48 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: There is insufficient substantiation to require receptacles specific to columns. The language would create an enforcement challenge. NEC 210.52(A)(2)(1) would already address “any space 2 ft or more in width (including space measured around corners).”

Public Input No. 288-NFPA 70-2023 [Section No. 210.52(A)(4)]

(4) Countertop and Similar Work Surface Receptacle Outlets.

Receptacles installed for countertop and similar work surfaces as specified in 210.52(C) shall not be considered as the receptacle outlets required by 210.52(A).

<u>No receptacle shall be installed below a countertop or work surface unless the top of the receptacle is at least 24" below the surface of the countertop or work surface.</u>

Statement of Problem and Substantiation for Public Input

The language in 210.52(C)(3) is intended to prohibit receptacles below the surface of the countertop or work surface, but stops short of completely prohibiting receptacles in that location. Placing receptacles below these surfaces can result in a serious safety hazard. This additional language will address this issue.

Submitter Information Verification

Submitter Full Name:	Don Ganiere
Organization:	none
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sat Feb 04 16:41:08 EST 2023
Committee:	NEC-P02

Committee Statement

Resolution: NEC 210.52(A)(4) establishes that receptacles for countertops and work surfaces are not to be considered as the receptacles located along the wall in accordance with 210.52(A). NEC 210.52(C)(2) establishes the restrictions for locating the receptacle for a work surface or countertop.

Public Input No. 321-NFPA 70-2023 [Section No. 210.52(A)(4)]

~~(4) Countertop and Similar Work Surface Receptacle Outlets.~~

~~Receptacles installed for countertop and similar work surfaces as specified in 210.52(C) shall not be considered as the receptacle outlets required by 210.52(A) .~~

Additional Proposed Changes

File Name	Description	Approved
210.52_A_and_C_.pdf	Wall spaces at cabinets having countertops	

Statement of Problem and Substantiation for Public Input

For required wall space receptacle outlets in Dwelling Units-

According to 210.52(A)(2)(1), a wall space SHALL INCLUDE any space 2 ft or more in width (including space measured around corners) and unbroken along the floor line by doorways and similar openings, fireplaces, stationary appliances, and FIXED CABINETS THAT DO NOT HAVE COUNTERTOPS or similar work surfaces.

This means the wall spaces at kitchen cabinets having countertops are included in this requirement!

But, according to 210.52(A)(4) and 210.52(C), Receptacles installed for countertop and similar work surfaces SHALL NOT be considered as the wall space receptacle outlets required by 210.52(A).

So, on a wall having cabinets with countertops where do we install the wall receptacles required by 210.52(A)? On the floor as permitted by 210.52(A)(3)? This would not work because most cabinets are 24" deep and would mean floor receptacles would be too far from wall to satisfy 210.52(A)(3). Cord drops as permitted by 210.50(A)? This would be impractical because cords would interfere with opening the upper cabinet doors! How about below the countertops on the face of the cabinets? Is this even permitted? Where is the wording that permits these wall spaces to be omitted from the 210.52(A) requirements? The fact is, there isn't any wording that permits these wall spaces to be omitted from this requirement!
This literally means receptacle outlets must be installed for the WALL SPACES at the cabinets!!!

Here is a very simple solution to this conundrum. If 210.52(A)(4) is deleted and 210.52(C) revised as proposed, then the countertop receptacle outlets can also be used to satisfy the requirement for wall space receptacle outlets. Problem solved!

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 322-NFPA 70-2023 [Section No. 210.52(C) [Excluding any Sub-Sections]]	

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:

Submittal Date: Fri Feb 10 08:33:06 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: The receptacles serving the countertop or work surface are located to serve that specific location based on the multi-appliance usage requiring the need for those receptacles. NEC 210.52(A) is determining the usable wall space where general use receptacles are placed to support other general loads. NEC 210.52(C)(2) establishes the restrictions for locating the receptacle for a work surface or countertop.

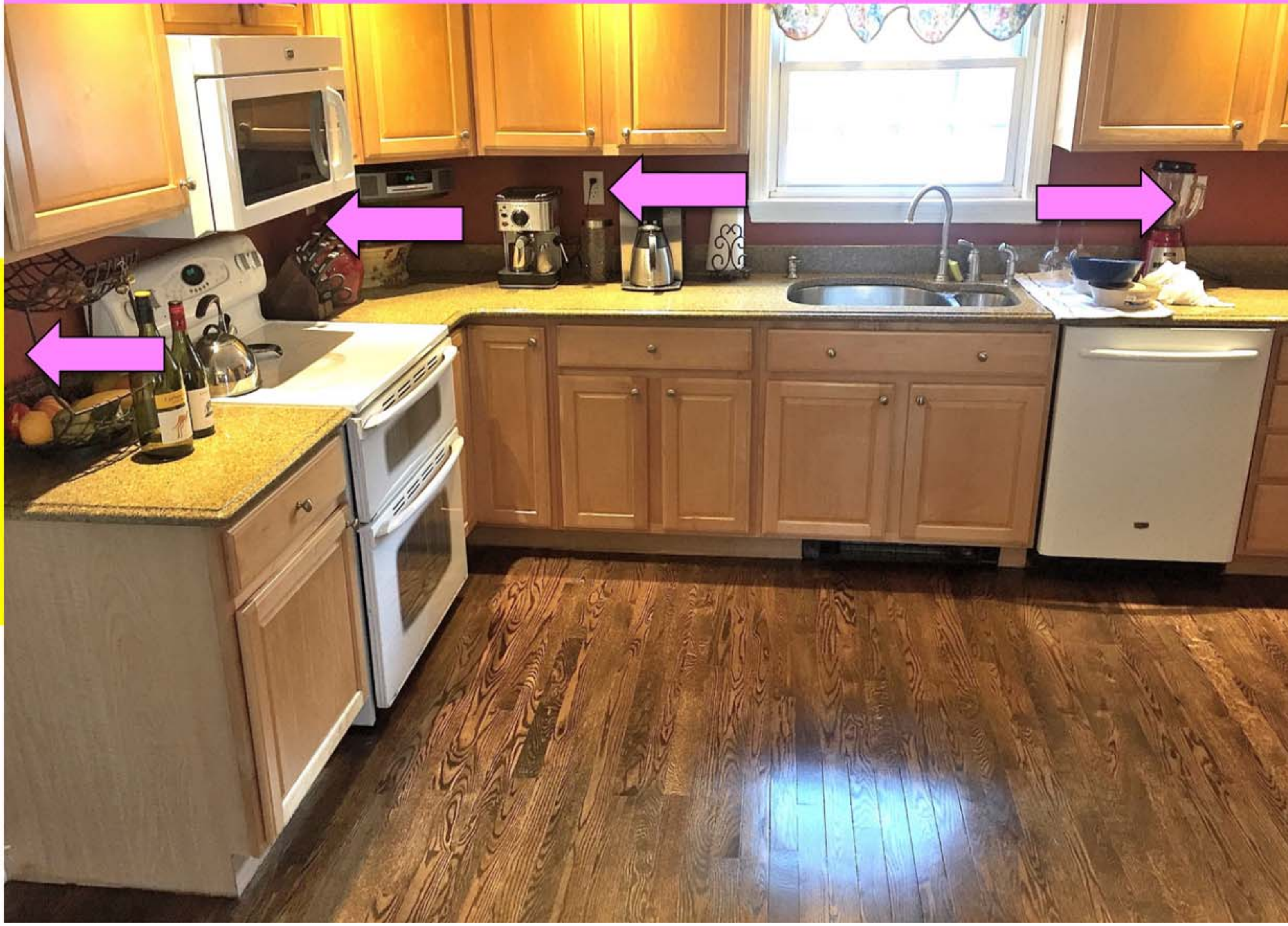
Wall Spaces At Cabinets Having Countertops

Russ LeBlanc

According to 210.52(A)(2)(1), a wall space SHALL INCLUDE any space 2 ft or more in width (including space measured around corners) and unbroken along the floor line by doorways and similar openings, fireplaces, stationary appliances, and FIXED CABINETS THAT DO NOT HAVE COUNTERTOPS or similar work surfaces.

This means the wall spaces at kitchen cabinets having countertops are included in this requirement!

These receptacles cannot be used to satisfy 210.52(A) requirements!



But, according to 210.52(A)(4) and 210.52(C), Receptacles installed for countertop and similar work surfaces SHALL NOT be considered as the wall space receptacle outlets required by 210.52(A)

These receptacles cannot be used to satisfy 210.52(A) requirements!

These receptacles cannot be used to satisfy 210.52(A) requirements!


Cord pendants per 210.50(A) would be impractical since they would interfere with opening the upper cabinet doors!

Here is a very simple solution to this conundrum. If 210.52(A)(4) is deleted and 210.52(C) revised as proposed, then the countertop receptacle outlets can also be used to satisfy the requirement for wall space receptacle outlets. Problem solved!

Public Input No. 3274-NFPA 70-2023 [Section No. 210.52(A)(4)]

(4) Countertop and Similar Work Surface Receptacle Outlets.

Receptacles installed for countertop and similar work surfaces as specified in 210.52(C) shall not be considered as the receptacle outlets required by 210.52(A).<u>A receptacle outlet installed on the exterior side of a countertop support base for purposes other than to supply the countertop shall be located no more than 12 inches above finished floor.</u>

Statement of Problem and Substantiation for Public Input

A receptacle outlet installed on the exterior of a countertop support base for the purpose on complying with section 210.52 or for general convenience may result in the user utilizing these cords for countertop appliance and thus exposing the user to the hazard of cords hanging over the top. A receptacle outlet installed no more than 12 inches above finished floor will provide receptacle access for general use at the same time preventing appliance cords from reaching the receptacle thus protecting the user from the hazard of hanging cords.

Submitter Information Verification

Submitter Full Name:	David Humphrey
Organization:	County of Henrico, Virginia
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Thu Aug 31 08:39:57 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: NEC 210.52(A)(4) establishes that receptacles for countertops and work surfaces are not to be considered as the receptacles located along the wall in accordance with 210.52(A). NEC 210.52(C)(2) establishes the restrictions for locating the receptacle for a work surface or countertop.

Public Input No. 1914-NFPA 70-2023 [Section No. 210.52(B)(1)]

(1) Receptacle Outlets Served.

In the kitchen, pantry, breakfast room, dining room, or similar area of a dwelling unit, the two or more 20-ampere small-appliance branch circuits required by 210.11(C)(1) shall serve all wall and floor receptacle outlets covered by 210.52(A), all countertop outlets covered by 210.52(C), and receptacle outlets for refrigeration equipment.

Make it clear that each receptacle outlet on a duplex receptacle outlet for example is not required to be connected to more than one of the two or more required small appliance branch circuits.

Exception No. 1: In addition to the required receptacles specified by 210.52, switched receptacles supplied from a general-purpose 15- or 20-ampere branch circuit shall be permitted in accordance with 210.70(A)(1), Exception No. 1.

Exception No. 2: In addition to the required receptacles specified by 210.52, a receptacle outlet to serve a specific appliance shall be permitted to be supplied from an individual branch circuit rated 15 amperes or greater.

Statement of Problem and Substantiation for Public Input

In 2022, I had an electrical engineer insist that the NEC required two branch circuits to power any duplex receptacles subject to 210.52 (B) (1). I insisted that the NEC simply requires two branch circuits to power the receptacles in a 210.11 (C) (1) covered space. This was a discussion and heartburn that did not need to happen. Clarity in the form of revised code language or an Informational Note will be greatly appreciated.

Submitter Information Verification

Submitter Full Name: Gary Hein
Organization: [Not Specified]
Street Address:
City:
State:
Zip:

Submittal Date: Mon Aug 07 15:05:32 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The proposed language is confusing and does not add clarity. The existing language requirement is for the receptacle outlet and not the receptacle. The code does not require a duplex receptacle to be fed by both small appliance branch circuits.

Public Input No. 1831-NFPA 70-2023 [Section No. 210.52(B)(3)]

(3) Kitchen Receptacle Requirements.

~~Receptacles~~ Where two or more receptacles are installed in a kitchen to serve countertop surfaces, they shall be supplied by not fewer than ~~two small~~ two of the required small -appliance branch circuits, either or both of which shall also be permitted to supply receptacle outlets in the same kitchen and in other rooms specified in 210.52(B)(1). Additional small-appliance branch circuits shall be permitted to supply receptacle outlets in the kitchen and other rooms specified in 210.52(B)(1). No small-appliance branch circuit shall serve more than one kitchen.

Statement of Problem and Substantiation for Public Input

Considerable confusion has been generated by this section when 1 or fewer countertop receptacles are required to meet code requirements. If a single countertop receptacle is required, supplying the receptacle with two circuits provides no additional utility. Installing additional receptacles to serve very limited countertop space, could increase hazard for individuals by encouraging temporary placement of additional small appliance on cooktops or in sink basins. The additional required small appliance circuit can serve a refrigerator and/or wall outlets, which still provides for diversification of kitchen loads. I have recently encountered situations when the AHJ fails an installation with a one duplex receptacle serving 12" of countertop because of the current wording of this code.

Submitter Information Verification

Submitter Full Name: IEC National
Organization: IEC
Affiliation: Matthew Grover
Street Address:
City:
State:
Zip:

Submittal Date: Sun Aug 06 08:26:14 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The current language provides the utility to serve the necessary loads in consideration of the two receptacles found in a duplex configuration from the two small appliance branch circuits. The two small appliance branch circuits will still supply the same load capacity through the two receptacles in the duplex configuration.

Public Input No. 3644-NFPA 70-2023 [Section No. 210.52(B)(3)]

(3) Kitchen Receptacle Requirements.

Receptacles installed in a kitchen to serve countertop surfaces shall be supplied by not fewer than two small-appliance branch circuits, either or both of which shall also be permitted to supply receptacle outlets in the same kitchen and in other rooms specified in 210.52(B)(1). Additional small-appliance branch circuits shall be permitted to supply receptacle outlets in the kitchen and other rooms specified in 210.52(B)(1). No small-appliance branch circuit shall serve more than one kitchen.

<u>Exception: Outside areas not used as the principle kicthen at one and two family and multi-family dwelling units</u>

Statement of Problem and Substantiation for Public Input

By definition outdoor grilling areas may fall under this requirement. If a grilling area near a swimming pool or other outdoor attraction that otherwise meets the article 100 definition the requirement of this section to supply two appliance branch circuits may reasonably be construed as applying in this scenario.

Submitter Information Verification

Submitter Full Name: David Humphrey
Organization: County of Henrico, Virginia
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 05 11:40:39 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The outdoor area that meets the definition of a kitchen needs to follow the rules for the wiring installations for a kitchen. There are a number of configurations for outdoor kitchens similar to indoor kitchens that need the same requirements to operate and provide appropriate safety parameters.

Public Input No. 2093-NFPA 70-2023 [Section No. 210.52(C)]

(C) Countertops and Work Surfaces.

In kitchens, pantries, breakfast rooms, dining rooms, and similar areas of dwelling units, receptacle outlets for countertop and work surfaces that are 300 mm (12 in.) or wider shall be installed in accordance with 210.52(C)(1) through (C)(3) and shall not be considered as the receptacle outlets required by 210.52(A).

For the purposes of this section, where using multioutlet assemblies, each 300 mm (12 in.) of multioutlet assembly containing two or more receptacles installed in individual or continuous lengths shall be considered to be one receptacle outlet.

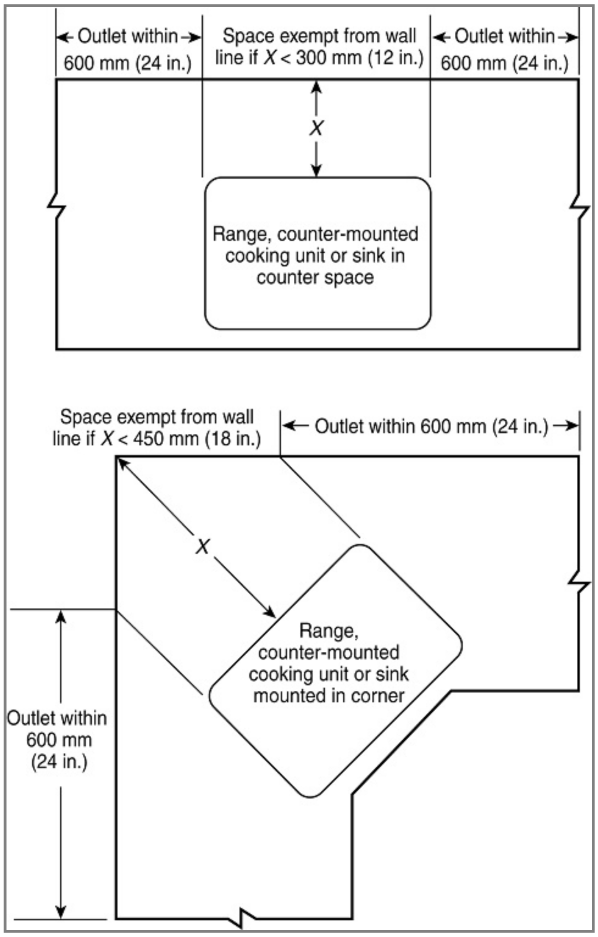
(1) Wall Spaces.

Receptacle outlets shall be installed so that no point along the wall line is more than 600 mm (24 in.) measured horizontally from a receptacle outlet in that space. The location of the receptacles shall be in accordance with 210.52(C)(3).

Exception No. 1: Receptacle outlets shall not be required directly behind a range, counter-mounted cooking unit, or sink in the installation described in Figure 210.52(C)(1).

Exception No. 2: Where a required receptacle outlet cannot be installed in the wall areas shown in Figure 210.52(C)(1), the receptacle outlet shall be permitted to be installed as close as practicable to the countertop area to be served. The total number of receptacle outlets serving the countertop shall not be less than the number needed to satisfy 210.52(C)(1). These outlets shall be located in accordance with 210.52(C)(3).

Figure 210.52(C)(1) Determination of Area Behind a Range, Counter-Mounted Cooking Unit, or Sink.



(2) Island and Peninsular Countertops and Work Surfaces.

Receptacle outlets, if installed to serve an island or peninsular countertop or work surface, shall be installed in accordance with 210.52(C)(3). If a receptacle outlet is not provided to serve an island or peninsular countertop or work surface, provisions shall be provided at the island or peninsula for future addition of a receptacle outlet to serve the island or peninsular countertop or work surface.

(3) Receptacle Outlet Location.

Receptacle outlets shall be located in one or more of the following:

~~On~~
(a) On or above, but not more than 500 mm (20 in.) above, a countertop or work surface

~~In~~
(b) In a countertop using receptacle outlet assemblies listed for use in countertops

~~In~~
(c) In a work surface using receptacle outlet assemblies listed for use in work surfaces or listed for use in countertops

Receptacle outlets rendered not readily accessible by appliances fastened in place, appliance garages, sinks, or rangetops as covered in 210.52(C)(1), Exception No. 1, or appliances occupying assigned spaces shall not be considered as these required outlets.

Informational Note No. 1: See 406.5(E) for installation of receptacles in countertops and 406.5(F) for installation of receptacles in work surfaces. See 380.10 for installation of multioutlet assemblies.

Informational Note No. 2: See Informative Annex J and ANSI/ICC A117.1-2009, *Standard on Accessible and Usable Buildings and Facilities*, for additional information.

(4) Additional Receptacle Outlets- All receptacle outlets installed for countertops or work surfaces shall be connected to one of the two required small appliance branch circuits and must comply with 210.52(C)(1) through (C)(3). If additional receptacle outlets are installed for small appliances, then an additional small appliance branch circuit(s) must be provided for these receptacle outlets.

Statement of Problem and Substantiation for Public Input

1) Cleans up the style issue with subparagraphs being numbers after numbered header. Should alternate between numbers and letters.
2) 2023 NEC removed the requirement for countertop and worksurface receptacles to be installed below the countertop. This practice is still be utilized and requested by developers, owners, and tenants to provide power to small appliances. The interpretation is that this additional receptacle is not a "required" receptacle, but the NEC only establishes the minimum requirements. Additional receptacles can always be installed beyond the minimum "required" receptacle.
In addition, there are some dwelling units containing additional appliances that are being considered "small appliances" and located on the small appliance circuit, E.G.: Full-Size refrigerator, under-cabinet refrigerator, trash compactor, ice maker, warming drawer. These "small" appliances do not require dedicated branch circuits and are being installed within the small appliance branch circuits to cut corners. This practice is overloading these circuits and leads to unexpected nuisance tripping by tenant / owner / occupant of the dwelling unit when they plug in a toaster, blender, or mixer into a countertop receptacle.
The proposed language is not perfect at resolving these issues, but at least requires additional small appliance branch circuits if receptacle outlets are installed for additional receptacles beyond the minimum required for countertops and worksurfaces. This will at least increase the cost of providing additional non-required receptacles below the countertop, and may also deter contractors from connecting other below counter appliances to the small appliance circuits.

Submitter Information Verification

Submitter Full Name:	Josh Wiley
Organization:	Jordan Skala Engineers
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Fri Aug 11 18:11:30 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: Receptacles located to serve the appliance in a location other than on the countertop is permitted. The branch circuit and receptacles serving the countertop are not permitted to serve other outlets except as permitted in 210.52(B).

Public Input No. 3383-NFPA 70-2023 [Section No. 210.52(C)]

(C) Countertops and Work Surfaces.

In kitchens, pantries, breakfast rooms, dining rooms, and similar areas of dwelling units, receptacle outlets for countertop and work surfaces that are 300 mm (12 in.) or wider shall be installed in accordance with 210.52(C)(1) through (C)(3) and shall not be considered as the receptacle outlets required by 210.52(A).

For the purposes of this section, where using multioutlet assemblies, each 300 mm (12 in.) of multioutlet assembly containing two or more receptacles installed in individual or continuous lengths shall be considered to be one receptacle outlet.

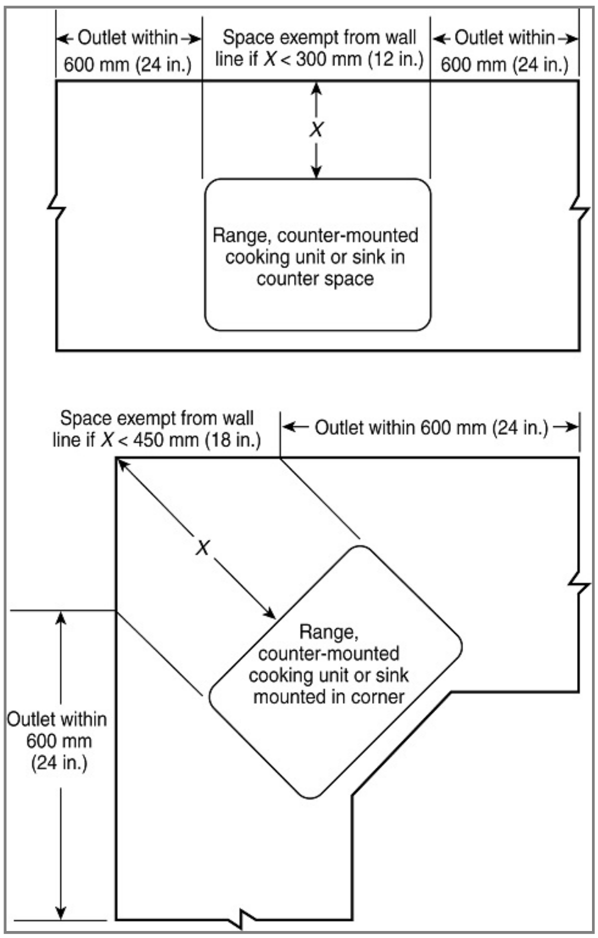
(1) Wall Spaces.

Receptacle outlets shall be installed so that no point along the wall line is more than 600 mm (24 in.) measured horizontally from a receptacle outlet in that space. The location of the receptacles shall be in accordance with 210.52(C)(3).

Exception No. 1: Receptacle outlets shall not be required directly behind a range, counter-mounted cooking unit, or sink in the installation described in Figure 210.52(C)(1).

Exception No. 2: Where a required receptacle outlet cannot be installed in the wall areas shown in Figure 210.52(C)(1), the receptacle outlet shall be permitted to be installed as close as practicable to the countertop area to be served. The total number of receptacle outlets serving the countertop shall not be less than the number needed to satisfy 210.52(C)(1). These outlets shall be located in accordance with 210.52(C)(3).

Figure 210.52(C)(1) Determination of Area Behind a Range, Counter-Mounted Cooking Unit, or Sink.



(2) Island and Peninsular Countertops and Work Surfaces.

Receptacle outlets, if installed to serve an island or peninsular countertop or work surface, shall be installed in accordance with 210.52(C)(3). If a receptacle outlet is not provided to serve an island or peninsular countertop or work surface, provisions shall be provided at the island or peninsula for future addition of a receptacle outlet to serve the island or peninsular countertop or work surface.

(3) Receptacle Outlet Location.(1) On or above, but not more than 500 mm (20 in.) above, a countertop or worksurface. **Receptacle outlets may be located below the countertop or worksurface, but only energized when positioned above the countertop or worksurface.**

Receptacle outlets shall be located in one or more of the following:

(1) On or above, but not more than 500 mm (20 in.) above, a countertop or work surface

(2) In a countertop using receptacle outlet assemblies listed for use in countertops

(3) In a work surface using receptacle outlet assemblies listed for use in work surfaces or listed for use in countertops

Receptacle outlets rendered not readily accessible by appliances fastened in place, appliance garages, sinks, or rangetops as covered in 210.52(C)(1), Exception No. 1, or appliances occupying assigned spaces shall not be considered as these required outlets.

Informational Note No. 1: See 406.5(E) for installation of receptacles in countertops and 406.5(F) for installation of receptacles in work surfaces. See 380.10 for installation of multioutlet assemblies.

Informational Note No. 2: See Informative Annex J and ANSI/ICC A117.1-2009, *Standard on Accessible and Usable Buildings and Facilities*, for additional information.

Statement of Problem and Substantiation for Public Input

(1) On or above, but not more than 500 mm (20 in.) above, a countertop or worksurface. Receptacle outlets may be located below the countertop or worksurface, but only energized when positioned above the countertop or worksurface.

Submitter Information Verification

Submitter Full Name: Kevin Jolly
Organization: ABB
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 01 17:39:30 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: No substantiation has been provided to require the receptacles to be deenergized when located below the work surface.

Public Input No. 13-NFPA 70-2023 [Section No. 210.52(C)(1)]

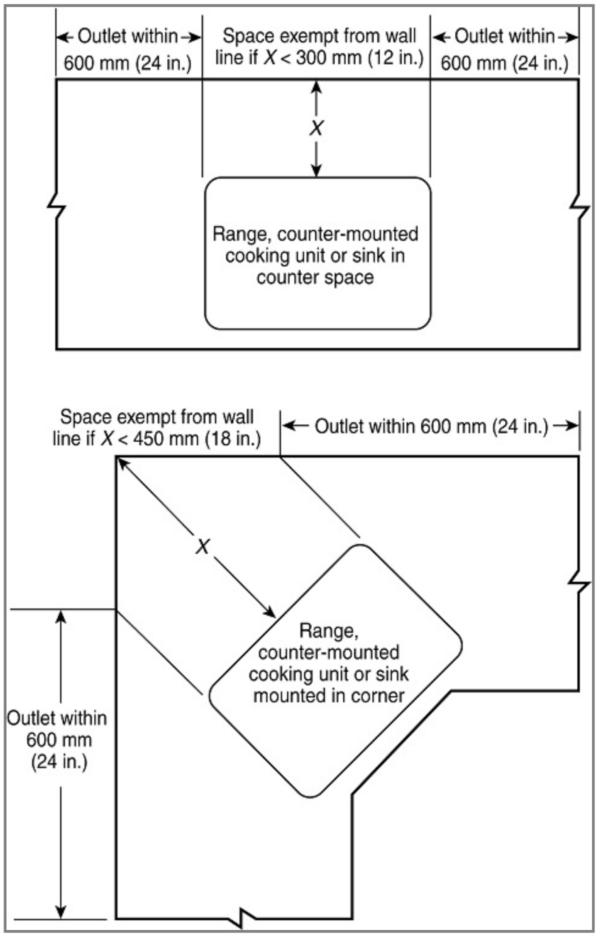
(1) Wall Spaces.

Receptacle outlets shall be installed so that no point along the wall line, that is parallel to the countertop edge, is more than 600 mm (24 in.) measured horizontally from a receptacle outlet in that space. The location of the receptacles shall be in accordance with 210.52(C)(3).

Exception No. 1: Receptacle outlets shall not be required directly behind a range, counter-mounted cooking unit, or sink in the installation described in Figure 210.52(C)(1).

Exception No. 2: Where a required receptacle outlet cannot be installed in the wall areas shown in Figure 210.52(C)(1), the receptacle outlet shall be permitted to be installed as close as practicable to the countertop area to be served. The total number of receptacle outlets serving the countertop shall not be less than the number needed to satisfy 210.52(C)(1). These outlets shall be located in accordance with 210.52(C)(3).

Figure 210.52(C)(1) Determination of Area Behind a Range, Counter-Mounted Cooking Unit, or Sink.



Statement of Problem and Substantiation for Public Input

In cases where a short section of countertop is installed between two perpendicular walls, to comply with the current text, it can easily be interpreted that a receptacle would be required on each wall. Most, if not all, kitchen appliances intended for use on countertops come with a 2' cord. A countertop measuring only 2' wide and installed in a corner, can easily be serviced by one receptacle if centrally located on ONE of the adjacent walls. By requiring only one receptacle outlet in the given example, there is no risk of utilizing an extension cord to service this area.
To require a receptacle on each wall is redundant and only serves to inflate construction costs.

Submitter Information Verification

Submitter Full Name: scott borsos
Organization: State of NJ
Affiliation: Code Enforcement Official

Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 09:54:15 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: Insufficient substantiation has been provided to support the language revision. Confusion may be created in attempting to align a point along the wall with edge of the counter. The existing language is clear and enforceable.

Public Input No. 1919-NFPA 70-2023 [Section No. 210.52(C)(1)]

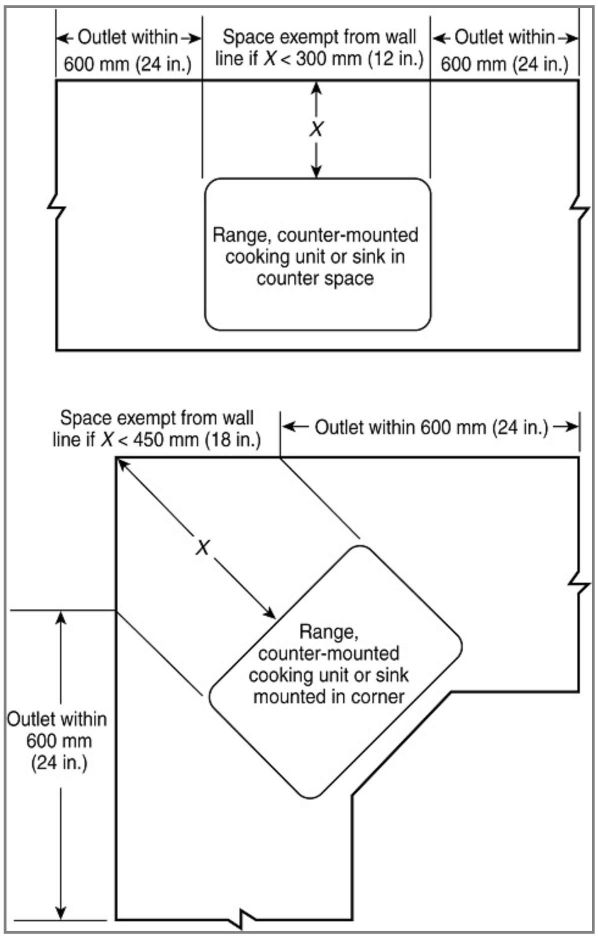
(1) Wall Spaces.

Receptacle outlets shall be installed so that no point along the wall line is more than 600 mm (24 in.) measured horizontally from a receptacle outlet in that space. The location of the receptacles shall be in accordance with 210.52(C)(3). The placement of the receptacle, within the 24-inch limit, shall allow for the insertion of an attachment plug into the receptacle.

Exception No. 1: Receptacle outlets shall not be required directly behind a range, counter-mounted cooking unit, or sink in the installation described in Figure 210.52(C)(1).

Exception No. 2: Where a required receptacle outlet cannot be installed in the wall areas shown in Figure 210.52(C)(1), the receptacle outlet shall be permitted to be installed as close as practicable to the countertop area to be served. The total number of receptacle outlets serving the countertop shall not be less than the number needed to satisfy 210.52(C)(1). These outlets shall be located in accordance with 210.52(C)(3).

Figure 210.52(C)(1) Determination of Area Behind a Range, Counter-Mounted Cooking Unit, or Sink.



Statement of Problem and Substantiation for Public Input

210.52 (C) (1) Clarify the receptacle outlets point of measurement. Provide clarity regarding where the measurement from a receptacle outlet is to be measured from. For example, is the measurement from the edge of the body of the receptacle outlet, or the center point of the receptacle outlet neither of which will allow for the insertion of an attachment plug.

Submitter Information Verification

Submitter Full Name: Gary Hein
Organization: [Not Specified]
Street Address:
City:
State:

Zip:
Submittal Date: Mon Aug 07 15:29:54 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The proposed language is not necessary as it would have limited impact on dimensional measurements. The language does not add clarity to the requirement.

Public Input No. 1316-NFPA 70-2023 [Sections 210.52(C)(1), 210.52(C)(2)]

Sections 210.52(C)(1), 210.52(C)(2)

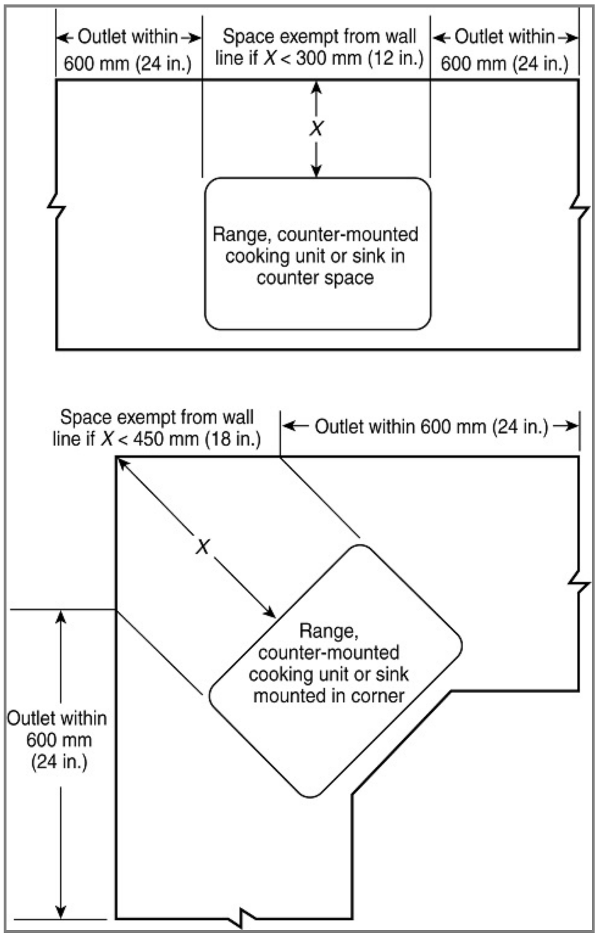
(1) Wall Spaces.

Receptacle outlets shall be installed so that no point along the wall line is more than 600 mm (24 in.) measured horizontally from a receptacle outlet in that space. The location of the receptacles shall be in accordance with 210.52(C)(3).

Exception No. 1: Receptacle outlets shall not be required directly behind a range, counter-mounted cooking unit, or sink in the installation described in Figure 210.52(C)(1).

Exception No. 2: Where a required receptacle outlet cannot be installed in the wall areas shown in Figure 210.52(C)(1), the receptacle outlet shall be permitted to be installed as close as practicable to the countertop area to be served. The total number of receptacle outlets serving the countertop shall not be less than the number needed to satisfy 210.52(C)(1). These outlets shall be located in accordance with 210.52(C)(3).

Figure 210.52(C)(1) Determination of Area Behind a Range, Counter-Mounted Cooking Unit, or Sink.



(2) Island and Peninsular Countertops and Work Surfaces.

Receptacle outlets, if installed to serve an island or peninsular countertop or work surface, shall be installed in accordance with 210.52(C)(3). ~~If a receptacle outlet is not provided to serve an island or peninsular countertop or work surface, provisions shall be provided at the island or peninsula for future addition of a receptacle outlet to serve the island or peninsular countertop or work surface.~~

Statement of Problem and Substantiation for Public Input

Since receptacle outlets are now optional for island and peninsular countertops and work surfaces, this language is design criteria and not a life safety issue.
If a builder or homeowner desires a countertop receptacle, it should be addressed during design of the residence and the builder should ensure provisions are made for the receptacle outlet. It is not necessary to require “future” provisions for countertop receptacles in every residence.

Submitter Information Verification

Submitter Full Name: IEC National
Organization: IEC
Affiliation: Ron Alley
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jul 07 18:04:55 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8192-NFPA 70-2024

Statement: CMP 2 reaffirms receptacle outlets are not required to be installed at island and peninsular countertops and work surfaces. Such locations may be designed where the requirements in 210.52(C)(3) and (4) cannot be met. The requirement for “future provisions” is also retained as certain construction methods may not allow receptacle outlet that meet the requirements of 210.52(C)(3) and (4) to be added at a later date. 210.52(C)(4) has been added to clarify as to where receptacle outlets can and cannot be installed, at new construction or a future date.

Public Input No. 1155-NFPA 70-2023 [Section No. 210.52(C)(2)]

(2) Island and Peninsular Countertops and Work Surfaces.

Receptacle outlets ~~, if installed to serve an island or peninsular countertop or work surface,~~ shall be installed in accordance with 210.52(C)(3). ~~If a receptacle outlet is not provided to serve an island or peninsular countertop or work surface, provisions shall be provided at the island or peninsula for future addition of a receptacle outlet to serve the island or peninsular countertop or work surface.~~

Statement of Problem and Substantiation for Public Input

The change that was made for the 2023 NEC eliminated 1 problem but created a far more dangerous one: stretching extension cords from the wall to the island or peninsula. I am not proposing that this should revert to the pre-2023 language. I would like the code to require the countertop outlet or tombstone. by requiring the receptacle outlet on the island this would eliminate both hazards.

Submitter Information Verification

Submitter Full Name: Donny Fox
Organization:
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 20 16:25:33 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8192-NFPA 70-2024

Statement: CMP 2 reaffirms receptacle outlets are not required to be installed at island and peninsular countertops and work surfaces. Such locations may be designed where the requirements in 210.52(C)(3) and (4) cannot be met. The requirement for "future provisions" is also retained as certain construction methods may not allow receptacle outlet that meet the requirements of 210.52(C)(3) and (4) to be added at a later date. 210.52(C)(4) has been added to clarify as to where receptacle outlets can and cannot be installed, at new construction or a future date.

Public Input No. 1228-NFPA 70-2023 [Section No. 210.52(C)(2)]

(2) Island and Peninsular Countertops and Work Surfaces.

Receptacle outlets, if installed to serve an island or peninsular countertop or work surface, shall be installed in accordance with 210.52(C)(3). If a receptacle outlet is not provided to serve an island or peninsular countertop or work surface, provisions shall be provided at the island or peninsula for future addition of a receptacle outlet to serve the island or peninsular countertop or work surface. A receptacle outlet installed on the exterior side of a countertop support base for purposes other than to supply the countertop shall be located no more than 12 inches above finished floor.

Additional Proposed Changes

File Name	Description	Approved
.1687955613997		

Statement of Problem and Substantiation for Public Input

Current text may be construed as permitting a receptacle outlet installed directly below a countertop surface by a simple declaration by the installer that the receptacle is for other purposes or to comply with other sections of the code. This could effectivily defeat the safety provisions this section seeks to address. By establishing a minimum distance between the countertop surface and a receptacle outlet installed below the top for "other purposes" typical appliance cords would not reach the lower receptacle outlet and users would likely not be tempted to route cords over the countertop edge.

Submitter Information Verification

Submitter Full Name: David Humphrey
Organization: County of Henrico, Virginia
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 28 08:29:44 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8192-NFPA 70-2024

Statement: CMP 2 reaffirms receptacle outlets are not required to be installed at island and peninsular countertops and work surfaces. Such locations may be designed where the requirements in 210.52(C)(3) and (4) cannot be met. The requirement for “future provisions” is also retained as certain construction methods may not allow receptacle outlet that meet the requirements of 210.52(C)(3) and (4) to be added at a later date. 210.52(C)(4) has been added to clarify as to where receptacle outlets can and cannot be installed, at new construction or a future date.

Table 722.179(B) Cable Type Markings

Cable Type	Cable Marking
Class 4 plenum cable	CL4P
Class 3 plenum cable	CL3P
Class 2 plenum cable	CL2P
Power-limited fire alarm plenum cable	FPLP
~~Nonconductive optical fiber plenum cable~~	~~OFNP~~
~~Conductive optical fiber plenum cable~~	~~OFCP~~
Class 4 riser cable	CL4R
Class 3 riser cable	CL3R
Class 2 riser cable	CL2R
Power-limited fire alarm riser cable	FPLR
~~Nonconductive optical fiber riser cable~~	~~OFNR~~
~~Conductive optical fiber riser cable~~	~~OFCR~~
Class 4 general-purpose cable	CL4
Class 3 general-purpose cable	CL3
Class 2 general-purpose cable	CL2
Power-limited fire alarm cable	FPL
~~Nonconductive general-purpose optical fiber cable~~	~~OFN~~
~~Conductive general-purpose optical fiber cable~~	~~OFC~~
~~Alternative nonconductive general-purpose optical fiber cable~~	~~OFNG~~
~~Alternative conductive general-purpose optical fiber cable~~	~~OFCG~~
Class 3 cable — limited use	CL3X
Class 2 cable — limited use	CL2X
~~Undercarpet cable~~	~~CMUC~~

Note: All types of CL2, CL3, CL4 and FPL cables containing optical fibers are provided with the suffix “-OF.”

Public Input No. 1546-NFPA 70-2023 [Section No. 210.52(C)(2)]

(2) Island ~~and Peninsular Countertops~~ , Peninsular, or Summer Kitchen Countertops , and Work Surfaces.

Receptacle outlets, if installed to serve an island ~~or peninsular countertop~~ , peninsular or summer kitchen countertops or work ~~surface~~ surfaces , shall be installed in accordance with 210.52(C)(3). If a receptacle outlet is not provided to serve an island ~~or~~ , peninsular ~~countertop~~ or summer kitchen countertops or work ~~surface~~ surfaces , provisions shall be provided at the island, peninsula or ~~peninsula~~ summer kitchen for future addition of a receptacle outlet to serve the island ~~or~~ , peninsular ~~countertop~~ or summer kitchen countertops or work ~~surface~~ surfaces .

Statement of Problem and Substantiation for Public Input

Some inspecting agencies are requiring two small appliance circuit to a summer kitchen when they are sometimes not needed. It should be an option just as outlets will be for Islands and Peninsulas.

Submitter Information Verification

Submitter Full Name: John Leahy
Organization: City of West Palm beach
Street Address:
City:
State:
Zip:

Submittal Date: Tue Jul 25 09:13:16 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Summer Kitchen Countertop is not defined in the NEC and would create additional confusion.

Public Input No. 1658-NFPA 70-2023 [Section No. 210.52(C)(2)]

(2) Island and Peninsular Countertops~~- and Work Surfaces.~~

~~Receptacle outlets, if installed to serve an island or peninsular countertop or work surface, shall be installed in accordance with 210.52(C)(3) . If a receptacle outlet is not provided to serve an island or peninsular countertop or work surface, provisions shall be provided at the island or peninsula for future addition of a receptacle outlet to serve the island or peninsular countertop or work surface~~

.

At least one receptacle shall be installed on island and peninsula countertops and installed according to 210.52C3(1) and (2). No receptacle shall be located in the vertical face of island countertops. No receptacle shall be located in the vertical face of a peninsula countertops other than the wall space above counter height where the peninsula begins. The countertop space where a peninsula butts to a wall, and shares with other countertop area, may be considered peninsula countertop area .

Statement of Problem and Substantiation for Public Input

'Work surface' was removed from the title because the work surfaces of something like a work bench are a different animal than kitchen countertops. By deleting work surface, the work surface may get none, one, or more receptacles and they could be placed wherever the electrician chooses (other than face up in the work surface 406.5G). No receptacles should be allowed in the vertical faces of island countertops or peninsula countertops due to burns by hot liquids. According to IAEI Analysis of Changes, cords get inadvertently snagged and have become more dangerous with increased numbers of island and peninsula receptacles that were installed in this vertical face manner.

Without requiring at least one receptacle on an island, however, homeowners are at risk if they use an extension cord to the island. Peninsulas should also require one or more countertop receptacles and for the same reason. A receptacle that's located in the wall space, above counter height, that's within the width of a peninsula would constitute a required peninsula receptacle.

Submitter Information Verification

Submitter Full Name: Norman Feck
Organization: State of Colorado
Affiliation: self
Street Address:
City:
State:
Zip:

Submittal Date: Thu Jul 27 16:57:12 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8192-NFPA 70-2024

Statement: CMP 2 reaffirms receptacle outlets are not required to be installed at island and peninsular countertops and work surfaces. Such locations may be designed where the requirements in 210.52(C)(3) and (4) cannot be met. The requirement for "future provisions" is also retained as certain construction methods may not allow receptacle outlet that meet the requirements of 210.52(C)(3) and (4) to be added at a later date. 210.52(C)(4) has been added to clarify as to where receptacle outlets can and cannot be installed, at new construction or a future date.

Public Input No. 2574-NFPA 70-2023 [Section No. 210.52(C)(2)]

(2) Island and Peninsular Countertops and Work Surfaces.

Receptacle outlets, if installed to serve an island or peninsular countertop or work surface, shall be installed in accordance with 210.52(C)(3) .

~~If a receptacle outlet is not provided to serve an island or peninsular countertop or work surface, provisions shall be provided at the island or peninsula for future addition of a receptacle outlet to serve the island or peninsular countertop or work surface.~~

Statement of Problem and Substantiation for Public Input

Receptacles are not required to serve island or peninsular countertop or work surfaces. Therefore, the language, "provisions shall be provided for future addition of a receptacle outlet" is design criteria and not a life safety issue. In fact, provisions for a "future" addition of a receptacle could result in a violation of 210.52(C)(3)(2) & (3). The "future" receptacle most likely will not be subject to permit and inspection and could result in a receptacle installation in a side panel of an island or peninsular cabinet.

Submitter Information Verification

Submitter Full Name: Ron Alley
Organization: Northern New Mexico IEC
Affiliation: NNMIEC
Street Address:
City:
State:
Zip:

Submittal Date: Tue Aug 22 14:34:45 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8192-NFPA 70-2024

Statement: CMP 2 reaffirms receptacle outlets are not required to be installed at island and peninsular countertops and work surfaces. Such locations may be designed where the requirements in 210.52(C)(3) and (4) cannot be met. The requirement for "future provisions" is also retained as certain construction methods may not allow receptacle outlet that meet the requirements of 210.52(C)(3) and (4) to be added at a later date. 210.52(C)(4) has been added to clarify as to where receptacle outlets can and cannot be installed, at new construction or a future date.

Public Input No. 318-NFPA 70-2023 [Section No. 210.52(C)(2)]

(2) Island and Peninsular Countertops and Work Surfaces.

Receptacle outlets, if installed to serve an island or peninsular countertop or work surface, shall be installed in accordance with 210.52(C)(3). If a receptacle outlet is not provided to serve an island or peninsular countertop or work surface, provisions shall be provided at the island or peninsula for future addition of a receptacle outlet to serve the island or peninsular countertop or work surface.

Additional Proposed Changes

File Name	Description	Approved
210.52_C_2_.docx	210.52(C)(2)	

Statement of Problem and Substantiation for Public Input

This submitted revision will eliminate a number of kitchen accidents that are caused by the installation and use of kitchen island and peninsula side mounted receptacles.

Submitter Information Verification

Submitter Full Name: Louis Petrucci
Organization:
Street Address:
City:
State:
Zip:
Submittal Date: Thu Feb 09 12:54:59 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8192-NFPA 70-2024

Statement: CMP 2 reaffirms receptacle outlets are not required to be installed at island and peninsular countertops and work surfaces. Such locations may be designed where the requirements in 210.52(C)(3) and (4) cannot be met. The requirement for “future provisions” is also retained as certain construction methods may not allow receptacle outlet that meet the requirements of 210.52(C)(3) and (4) to be added at a later date. 210.52(C)(4) has been added to clarify as to where receptacle outlets can and cannot be installed, at new construction or a future date.

210.52(C)(2)

Proposed insert (Revision)

Replace the word ~~if~~ after Receptacle outlets with when, in the first sentence.

The second sentence to be deleted in its entirety.

In its place insert the following sentence:

One receptacle outlet shall be installed for each island or peninsula as per and in accordance with 210.52(C)(3). This will not limit the number of receptacles desired.

Why:

As per the data compiled by the Consumer Product Safety Commission a number of burns, 9,700 from 1991 and 2020 have happened. These have resulted in second and third degree burns and many of these incidents are the results of people coming in contact (pulling) on cords from appliances that are plugged into side mounted receptacles. Included in these incidents are 10 fatalities. The way I am looking at the present code, 210.52(3) that will eliminate a number of these incidents. Unfortunately, by the NEC only requiring provisions if a receptacle is not wanted during original construction I believe a side mounted receptacle, without a permit will be installed once the AHJ has left the property.

Let’s face it, many un-acceptable means to power appliances on the islands and/or peninsulas will be used if a receptacle is not properly installed.

Public Input No. 3995-NFPA 70-2023 [Section No. 210.52(C)(2)]

(2) Island and Peninsular Countertops and Work Surfaces.

Receptacle outlets ~~, if installed to serve an island~~ shall be installed to serve island or peninsular countertop or work ~~surface, shall be~~ surfaces. The number of required receptacle outlets shall be calculated at one for the first 9 ft^2 and one additional receptacle outlet for each additional 18 ft^2. Receptacles shall be listed for countertop use only and installed in accordance with ~~210~~ 406 . ~~52~~ 5 (~~C~~ E) and 406.5 (~~3~~ G) . ~~If a receptacle outlet is not provided to serve an island or peninsular countertop or work surface, provisions shall be provided at the island or peninsula for future addition of a receptacle outlet to serve the island or peninsular countertop or work surface.~~ The locations of the required receptacle outlets shall be placed no closer than 2 feet from the working edge of the countertop surface. The actual placement of the receptacle outlets shall be permitted to be determind by the designer, owner or installer but shall not be located closer than 4 feet any other receptacle outlets located on the surface of the countertop. If islands and peninsular work surfaces are provided with a back splash or elevated countertops or work sufaces, receptacle outlets shall be permitted to be installed in accordance with 210.52(C)(1) and (C)(3)

Statement of Problem and Substantiation for Public Input

The 2023 version of this requirement basically created additional hazards by making this optional. If there are no receptacle outlets installed in an island of a residential kitchen, the occupant could be forced to use extension cords to provide temporary power for kitchen appliances needed or required for food prep or food serving. The option of providing power for the future was not defined and needed clarity. This will prepare contractors, designers and installers to make provisions for the additional space required for the listed device when push in to the closed position. This will also eliminate the cord of an appliance taking a path over the countertop edge to the receptacle mounted on the cabinet in accordance with the 2020 provisions of 210.52(C)(3) which will eliminate the likelihood of the appliance being pulled off the countertop by the cord. This requirement basically requires that receptacles need to be installed as if it was a countertop with a wall or backsplash.

Submitter Information Verification

Submitter Full Name: Mark Cook

Organization: Faith Technologies Electrical

Street Address:

City:

State:

Zip:

Submittal Date: Wed Sep 06 13:04:03 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: FR-8192-NFPA 70-2024

Statement: CMP 2 reaffirms receptacle outlets are not required to be installed at island and peninsular countertops and work surfaces. Such locations may be designed where the requirements in 210.52(C)(3) and (4) cannot be met. The requirement for “future provisions” is also retained as certain construction methods may not allow receptacle outlet that meet the requirements of 210.52(C)(3) and (4) to be added at a later date. 210.52(C)(4) has been added to clarify as to where receptacle outlets can and cannot be installed, at new construction or a future date.

Public Input No. 4313-NFPA 70-2023 [Section No. 210.52(C)(2)]

(2) Island and Peninsular Countertops and Work Surfaces.

Receptacle outlets, if installed to serve an island or peninsular countertop or work surface, shall be installed in accordance with 210.52(C)(3). If a receptacle outlet is not provided to serve an island or peninsular countertop or work surface, ~~provisions shall~~ a duplex receptacle shall be provided ~~at the~~ inside the island or peninsula for future ~~addition of~~ connections of a receptacle ~~outlet~~ outlets to serve the island or peninsular countertop or work surface.

Statement of Problem and Substantiation for Public Input

My experience in reviewing this change with installers, inspectors and builders is that all of us have different concerns.
We, as installers, don't like the idea of placing a conduit with only a string. If conduit gets damaged by concrete or excess of glue, it will affect pulling conductors in the future.
We prefer to install a cable in the conduit and terminate it in a junction box with a blank cover.
Inspectors are concerned about having conductors there and not being able to be checked for GFCI protection and having this junction box accessible for non-qualified persons to do future additions.
I noticed pop up type receptacles come with cords; this way additional receptacle to serve counter tops can be connected to this proposed duplex receptacle for future connections. My statement is that this installation will be safer.

Submitter Information Verification

Submitter Full Name: Armando Lozano
Organization: MSF Electric, Inc.
Street Address:
City:
State:
Zip:

Submittal Date: Thu Sep 07 10:55:45 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8192-NFPA 70-2024

Statement: CMP 2 reaffirms receptacle outlets are not required to be installed at island and peninsular countertops and work surfaces. Such locations may be designed where the requirements in 210.52(C)(3) and (4) cannot be met. The requirement for "future provisions" is also retained as certain construction methods may not allow receptacle outlet that meet the requirements of 210.52(C)(3) and (4) to be added at a later date. 210.52(C)(4) has been added to clarify as to where receptacle outlets can and cannot be installed, at new construction or a future date.

Public Input No. 4408-NFPA 70-2023 [Section No. 210.52(C)(2)]

(2) Island and Peninsular Countertops and Work Surfaces.

~~Receptacle outlets, if installed to~~

At least on receptacle shall be installed to serve an island or peninsular countertop or work surface, shall be installed in accordance with 210.52(C)(3) .

~~If a receptacle outlet is not provided to serve an island or peninsular countertop or work surface, provisions shall be provided at the island or peninsula for future addition of a receptacle outlet to serve the island or peninsular countertop or work surface.~~

-

Statement of Problem and Substantiation for Public Input

Allowing provisions for a receptacle to be installed in the future will create a situation where extension cords will be used or the receptacle will be installed after inspection creating a possible dangerous situation being installed under a countertop. There is no reason not to provide a minimum of one receptacle above the countertop, there are many products that comply, not installing at least one receptacle in my opinion goes against 90.1 (A)

Submitter Information Verification

Submitter Full Name: Michael Dempsey
Organization: Trinity Code Inspections
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 14:35:57 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8192-NFPA 70-2024

Statement: CMP 2 reaffirms receptacle outlets are not required to be installed at island and peninsular countertops and work surfaces. Such locations may be designed where the requirements in 210.52(C)(3) and (4) cannot be met. The requirement for “future provisions” is also retained as certain construction methods may not allow receptacle outlet that meet the requirements of 210.52(C)(3) and (4) to be added at a later date. 210.52(C)(4) has been added to clarify as to where receptacle outlets can and cannot be installed, at new construction or a future date.

Public Input No. 3404-NFPA 70-2023 [Sections 210.52(C)(2), 210.52(C)(3)]

Sections 210.52(C)(2), 210.52(C)(3)

(2) Island and Peninsular Countertops and Work Surfaces.

Receptacle outlets ~~, if installed to serve an island or peninsular~~ shall be installed so that no point on the countertop or work surface ~~, shall be installed in accordance with 210.52(C)(3) . If a receptacle outlet is not provided to serve an island or peninsular countertop or work surface, provisions shall be provided at the island or peninsula for future addition of a receptacle outlet to serve the island or peninsular countertop or work surface.~~ is more than 900mm (36 in.) from a receptacle outlet.

(3) Receptacle Outlet Location.

Receptacle outlets shall be located in one or more of the following:

(1) On or above, but not more than 500 mm (20 in.) above, a countertop or work surface

(2) In a countertop using receptacle outlet assemblies listed for use in countertops

(3) In a work surface using receptacle outlet assemblies listed for use in work surfaces or listed for use in countertops

Receptacle outlets rendered not readily accessible by appliances fastened in place, appliance garages, sinks, or rangetops as covered in 210.52(C)(1), Exception No. 1, or appliances occupying assigned spaces shall not be considered as these required outlets.

Informational Note No. 1: See 406.5(E) for installation of receptacles in countertops and 406.5(F) for installation of receptacles in work surfaces. See 380.10 for installation of multioutlet assemblies.

Informational Note No. 2: See Informative Annex J and ANSI/ICC A117.1-2009, *Standard on Accessible and Usable Buildings and Facilities*, for additional information.

Statement of Problem and Substantiation for Public Input

2023 code attempted to address the CPSC reports on incidents caused by hanging cords off the top of kitchen islands and peninsulas. The code removed all requirements for receptacles serving the countertops of islands and peninsulas. However, it unintentionally allows other receptacles to be mounted on the sides of kitchen islands and peninsulas.

This PI is attempting to address the CPSC report while also recognizing the need for required receptacles serving the countertops of kitchen islands and peninsulas.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3405-NFPA 70-2023 [New Section after 210.52(C)(3)]	
Public Input No. 3405-NFPA 70-2023 [New Section after 210.52(C)(3)]	

Submitter Information Verification

Submitter Full Name: Megan Hayes
Organization: NEMA
Street Address:
City:
State:
Zip:
Submittal Date: Sat Sep 02 15:38:42 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8192-NFPA 70-2024

Statement: CMP 2 reaffirms receptacle outlets are not required to be installed at island and peninsular countertops and work surfaces. Such locations may be designed where the requirements in 210.52(C)(3) and (4) cannot be met. The requirement for “future provisions” is also retained as certain construction methods may not allow receptacle outlet that meet the requirements of 210.52(C)(3) and (4) to be added at a later date. 210.52(C)(4) has been added to clarify as to where receptacle outlets can and cannot be installed, at new construction or a future date.

Public Input No. 3405-NFPA 70-2023 [New Section after 210.52(C)(3)]

210.52(C)(4) Receptacle outlet locations prohibited.

Required and permitted receptacle outlets shall not be installed on cabinet sides or wall surfaces that are underneath countertops and work surfaces. This prohibition includes receptacle outlets installed on adjacent walls extending from the base cabinets within 2 feet horizontally and downward from the countertop and work surface edge within 2 feet vertically.

Statement of Problem and Substantiation for Public Input

2023 code attempted to address the CPSC reports on incidents caused by hanging cords off the top of kitchen islands and peninsulas. The code removed all requirements for receptacles serving the countertops of islands and peninsulas. However, it unintentionally allows other receptacles to be mounted on the sides of kitchen islands and peninsulas.

This PI is attempting to address the CPSC report while also recognizing the need for required receptacles serving the countertops of kitchen islands and peninsulas.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3404-NFPA 70-2023 [Sections 210.52(C)(2), 210.52(C)(3)]	
Public Input No. 3404-NFPA 70-2023 [Sections 210.52(C)(2), 210.52(C)(3)]	

Submitter Information Verification

Submitter Full Name:	Megan Hayes
Organization:	NEMA
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sat Sep 02 15:42:24 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: FR-8192-NFPA 70-2024

Statement: CMP 2 reaffirms receptacle outlets are not required to be installed at island and peninsular countertops and work surfaces. Such locations may be designed where the requirements in 210.52(C)(3) and (4) cannot be met. The requirement for “future provisions” is also retained as certain construction methods may not allow receptacle outlet that meet the requirements of 210.52(C)(3) and (4) to be added at a later date. 210.52(C)(4) has been added to clarify as to where receptacle outlets can and cannot be installed, at new construction or a future date.

Public Input No. 1541-NFPA 70-2023 [Section No. 210.52(C)(3)]

(3) Receptacle Outlet Location.

Receptacle outlets shall be located in one or more of the following:

(1) On or above, but not more than 500 mm (20 in.) above, a countertop or work surface

(2) In a countertop ~~using receptacle outlet assemblies listed for use in countertops~~ .

(3) In a work surface ~~using receptacle outlet assemblies listed for use in work surfaces or listed for use in countertops~~ .

Receptacle outlets rendered not readily accessible by appliances fastened in place, appliance garages, sinks, or rangetops as covered in 210.52(C)(1), Exception No. 1, or appliances occupying assigned spaces shall not be considered as these required outlets.

Informational Note No. 1: See 406.5(E) for installation of receptacles in countertops and 406.5(F) for installation of receptacles in work surfaces. See 380.10 for installation of multioutlet assemblies.

Informational Note No. 2: See Informative Annex J and ANSI/ICC A117.1-2009, *Standard on Accessible and Usable Buildings and Facilities*, for additional information.

Statement of Problem and Substantiation for Public Input

The reference to worksurface and countertop receptacles is unnecessary, as the informational note is adequate. There is no need to repeat information found elsewhere in the NEC. See Style Manual 4.1.1

Submitter Information Verification

Submitter Full Name:	John McCamish
Organization:	NECA IBEW Electrical Training
Affiliation:	Self
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Jul 24 17:39:12 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The language is maintained to clarify the requirements for the installer to use appropriate receptacle assemblies.

Public Input No. 1901-NFPA 70-2023 [Section No. 210.52(C)(3)]

(3) Receptacle Outlet Location.

Receptacle outlets shall be located in one or more of the following:

(1) On or above, but not more than 500 mm (20 in.) above, a countertop or work surface

(2) In a countertop using receptacle outlet assemblies listed for use in countertops

(3) In a work surface using receptacle outlet assemblies listed for use in work surfaces or listed for use in countertops

Receptacle outlets rendered not readily accessible by appliances fastened in place, appliance garages, sinks, or rangetops as covered in 210.52(C)(1), Exception No. 1, or appliances occupying assigned spaces shall not be considered as these required outlets.

Exception No. 1: Installations designed to ADA Standards for Accessible Design.

Informational Note No. 1: See 406.5(E) for installation of receptacles in countertops and 406.5(F) for installation of receptacles in work surfaces. See 380.10 for installation of multioutlet assemblies.

Informational Note No. 2: See Informative Annex J and ANSI/ICC A117.1-2009, *Standard on Accessible and Usable Buildings and Facilities*, for additional information.

Statement of Problem and Substantiation for Public Input

This public input is being submitted on behalf of the Minnesota Department of Labor and Industry. Currently, the Department's inspection staff includes 14-office/field staff, 12-state field inspectors, 2-virtual inspectors and 50 plus contract electrical inspectors that complete over 170,000 electrical inspections annually.

Installers, designers, and AHJ's have been forced to debate if the requirements of 210.52(C)(3) must be adhered to in all instances or if receptacle outlets could be installed in the face of cabinets as part of a design that considers the standards for Accessible Design. Exception #1 will give us clear direction to allow receptacle outlet placement per the ADA Standards for Accessible Design.

Submitter Information Verification

Submitter Full Name: Dean Hunter
Organization: Minnesota Department of Labor
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 07 13:18:24 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Where the NEC is addressing a safety issue, it must also be addressed for those requiring accessibility. It is the understanding of CMP-2 that a new version of the A117.1 Standards will align and work within the requirements of the NEC regarding placement of receptacle outlets in the kitchen.

Public Input No. 1922-NFPA 70-2023 [Section No. 210.52(C)(3)]

(3) Receptacle Outlet Location.

Receptacle outlets shall be located in one or more of the following:

(1) On or above, but not more than 500 mm (20 in.) above, a countertop or work surface. The placement of the receptacle, within the 20-inch limit, shall allow for the insertion of an attachment plug into the receptacle.

(2) In a countertop using receptacle outlet assemblies listed for use in countertops

(3) In a work surface using receptacle outlet assemblies listed for use in work surfaces or listed for use in countertops

Receptacle outlets rendered not readily accessible by appliances fastened in place, appliance garages, sinks, or rangetops as covered in 210.52(C)(1), Exception No. 1, or appliances occupying assigned spaces shall not be considered as these required outlets.

Informational Note No. 1: See 406.5(E) for installation of receptacles in countertops and 406.5(F) for installation of receptacles in work surfaces. See 380.10 for installation of multioutlet assemblies.

Informational Note No. 2: See Informative Annex J and ANSI/ICC A117.1-2009, *Standard on Accessible and Usable Buildings and Facilities*, for additional information.

Statement of Problem and Substantiation for Public Input

210.52 (C) (3) (1) Clarify the receptacle outlet point of measurement. Provide clarity regarding where the measurement from a receptacle outlet is to be measured from. For example, is the measurement from the edge of the body of the receptacle outlet, or the center point of the receptacle outlet neither of which will allow for the insertion of an attachment plug.

Submitter Information Verification

Submitter Full Name: Gary Hein
Organization: [Not Specified]
Street Address:
City:
State:
Zip:

Submittal Date: Mon Aug 07 15:33:29 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The proposed language is not necessary as it would have limited impact on dimensional measurements. The language does not add clarity to the requirement.

Public Input No. 2338-NFPA 70-2023 [Section No. 210.52(C)(3)]

(3) Receptacle Outlet Location.

Receptacles outlets are prohibited to be installed below a countertop or work surface. Receptacle outlets shall be located in one or more of the following:

(1) On or above, but not more than 500 mm (20 in.) above, a countertop or work surface

(2) In a countertop using receptacle outlet assemblies listed for use in countertops

(3) In a work surface using receptacle outlet assemblies listed for use in work surfaces or listed for use in countertops

Receptacle outlets rendered not readily accessible by appliances fastened in place, appliance garages, sinks, or rangetops as covered in 210.52(C)(1), Exception No. 1, or appliances occupying assigned spaces shall not be considered as these required outlets.

Informational Note No. 1: See 406.5(E) for installation of receptacles in countertops and 406.5(F) for installation of receptacles in work surfaces. See 380.10 for installation of multioutlet assemblies.

Informational Note No. 2: See Informative Annex J and ANSI/ICC A117.1-2009, *Standard on Accessible and Usable Buildings and Facilities*, for additional information.

Statement of Problem and Substantiation for Public Input

This added language will increase electrical safety based on the data from the CPSC demonstrating the injuries caused by children and the elderly inadvertently tripping over cords from cooking appliances and suffering deadly burns. In addition, with this added language to the second level subdivision even if a homeowner decided to install a non-required receptacle outlet this requirement would prohibit that installation.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 16 13:24:02 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8192-NFPA 70-2024

Statement: CMP 2 reaffirms receptacle outlets are not required to be installed at island and peninsular countertops and work surfaces. Such locations may be designed where the requirements in 210.52(C)(3) and (4) cannot be met. The requirement for "future provisions" is also retained as certain construction methods may not allow receptacle outlet that meet the requirements of 210.52(C)(3) and (4) to be added at a later date. 210.52(C)(4) has been added to clarify as to where receptacle outlets can and cannot be installed, at new construction or a future date.

Public Input No. 3335-NFPA 70-2023 [Section No. 210.52(C)(3)]

(3) Receptacle Outlet Location.

Receptacle outlets shall be located in one or more of the following:

(1) On or above, but not more than 500 mm (20 in.) above, a countertop or work surface

(2) In a countertop using receptacle outlet assemblies listed for use in countertops

(3) In a work surface using receptacle outlet assemblies listed for use in work surfaces or listed for use in countertops

Receptacle outlets rendered not readily accessible by appliances fastened in place, appliance garages, sinks, or rangetops as covered in 210.52(C)(1), Exception No. 1, or appliances occupying assigned spaces shall not be considered as these required outlets.

Informational Note No. 1: See 406.5(E) for installation of receptacles in countertops and 406.5(F) for installation of receptacles in work surfaces. See 380.10 for installation of multioutlet assemblies.

Informational Note No. 2: See Informative Annex J and ~~ANSI/~~ ICC A117.1-~~2009~~ 2017 , *Standard on Accessible and Usable Buildings and Facilities*, for additional information.

Statement of Problem and Substantiation for Public Input

Reference publication update for A117 from 2009 to 2017. Please see PI-3338.

Submitter Information Verification

Submitter Full Name: Jessica Hubert
Organization: Guardian Services Inc.
Affiliation: Representing the DARAC Advisory Group
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 01 13:01:14 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8192-NFPA 70-2024

Statement: CMP 2 reaffirms receptacle outlets are not required to be installed at island and peninsular countertops and work surfaces. Such locations may be designed where the requirements in 210.52(C)(3) and (4) cannot be met. The requirement for “future provisions” is also retained as certain construction methods may not allow receptacle outlet that meet the requirements of 210.52(C)(3) and (4) to be added at a later date. 210.52(C)(4) has been added to clarify as to where receptacle outlets can and cannot be installed, at new construction or a future date.

Public Input No. 81-NFPA 70-2023 [Section No. 210.52(C)(3)]

(3) Receptacle Outlet Location.

Receptacle outlets shall be located in one or more of the following:

(1) On or above, but not more than 500 mm (20 in.) above, a countertop or work surface

(2) In a countertop using receptacle outlet assemblies listed for use in countertops

(3) In a work surface using receptacle outlet assemblies listed for use in work surfaces or listed for use in countertops

(4) <u>Below countertop or work surfaces: Not more than 300 mm (12 in.) below the countertop or work surface. Receptacles installed below a countertop or work surface shall not be located where the countertop or work surface extends more than 150 mm (6 in.) beyond its support base.</u>

Receptacle outlets rendered not readily accessible by appliances fastened in place, appliance garages, sinks, or rangetops as covered in 210.52(C)(1), Exception No. 1, or appliances occupying assigned spaces shall not be considered as these required outlets.

Informational Note No. 1: See 406.5(E) for installation of receptacles in countertops and 406.5(F) for installation of receptacles in work surfaces. See 380.10 for installation of multioutlet assemblies.

Informational Note No. 2: See Informative Annex J and ANSI/ICC A117.1-2009, *Standard on Accessible and Usable Buildings and Facilities*, for additional information.

Statement of Problem and Substantiation for Public Input

Greetings CMP 2,

The language I propose it familiar to you all. The language is extracted directly from the 2020 National Electrical Code. Now, me being on CMP 5 and CMP 17 is going to haunt me when I say the following as I am sure it will be refered to as unsubstantiated information and thus disgarded. However, I would not feel right unless I voiced opposition to the develpment of the removal of this provision in the 2023 NEC Development Cycle.

The evolution of this removal of receptacles below a countertop or workspace is quite interesting. After reading all the "documents" that were presented about some accidents that took place, it made me remember back when those same type of accidents were presented in order to actually get "more" receptacles on the islands and penisulars. In fact, I remember the passonate pleas of IAEI and their inspector representatives, the passionate please of the device manufacturers saying extension cords will be used due to the lack of receptacles on the islands or penisulars. I can still hear their monetary passion ringing in my ears.

So, what CMP 2 has done now is create a situation where AFTER an electrical inspection, when the small appliance branch circuit going to the island or penisular is capped off in a junction box, the homeowners realize they need those receptacles they proceed to call an electrician to install the receptacles and since we know the likelihood of no inspection being performed will take place you now have an electrician installing receptacles below the countertop or work surface.

Now, I know what you will say. Paul, we can't control what someone does or doesn't do. I hear you. However, this rule now requires the SABC to be installed at the island and peninsular and then only permits the future receptacle to be installed in or above he island or peninsular. The irony of this is a TIA was presented by the Home Builders Association to add back the provision for below the countertop or workspace, the same folks who originally didn't want electricians having to cut receptacle outlets in their fancy islands or peninsulars. Isn't that indeed ironic.

Lastly, what you have created is folks who buy these homes will not know the junction box exists, they will again go back to using the small extension cords draped from the receptacles on the wall counter space over to the island or peninsular for crock pots, warmers, blenders and so forth during family gatherings where the risk of those cords causing things to be pulled off the counter are far greater than a receptacle located on the island and peninsular that follows the rules given for the exact situation in the 2020 NEC.

It amazes me we fought for more receptacles to serve the islands and peninsulars for years, substantiated the need to go from 12" x 24", to a square foot method, to now nothing. Sorry folks...that was a poor move and yes it is my opinion so I am sure you folks will file it in the round bin at the end of the table but thanks for listening anyway.

Submitter Information Verification

Submitter Full Name:	Paul Abernathy
Organization:	Fast Trax System | Electrical Code Academy, Inc.
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Jan 09 15:46:56 EST 2023
Committee:	NEC-P02

Committee Statement

Resolution: FR-8192-NFPA 70-2024

Statement: CMP 2 reaffirms receptacle outlets are not required to be installed at island and peninsular countertops and work surfaces. Such locations may be designed where the requirements in 210.52(C)(3) and (4) cannot be met. The requirement for “future provisions” is also retained as certain construction methods may not allow receptacle outlet that meet the requirements of 210.52(C)(3) and (4) to be added at a later date. 210.52(C)(4) has been added to clarify as to where receptacle outlets can and cannot be installed, at new construction or a future date.

Public Input No. 322-NFPA 70-2023 [Section No. 210.52(C) [Excluding any Sub-Sections]]

In kitchens, pantries, breakfast rooms, dining rooms, and similar areas of dwelling units, receptacle outlets for countertop and work surfaces that are 300 mm (12 in.) or wider shall be installed in accordance with 210.52(C)(1) through (C)(3)~~ and shall not be considered as the receptacle outlets required by 210.52(A)~~ . .

For the purposes of this section, where using multioutlet assemblies, each 300 mm (12 in.) of multioutlet assembly containing two or more receptacles installed in individual or continuous lengths shall be considered to be one receptacle outlet.

Additional Proposed Changes

File Name	Description	Approved
210.52_A_and_C_.pdf	Wall spaces at cabinets with countertops	

Statement of Problem and Substantiation for Public Input

For required wall space receptacle outlets in Dwelling Units-

According to 210.52(A)(2)(1), a wall space SHALL INCLUDE any space 2 ft or more in width (including space measured around corners) and unbroken along the floor line by doorways and similar openings, fireplaces, stationary appliances, and FIXED CABINETS THAT DO NOT HAVE COUNTERTOPS or similar work surfaces.

This means the wall spaces at kitchen cabinets having countertops are included in this requirement!

But, according to 210.52(A)(4) and 210.52(C), Receptacles installed for countertop and similar work surfaces SHALL NOT be considered as the wall space receptacle outlets required by 210.52(A).

So, on a wall having cabinets with countertops where do we install the wall receptacles required by 210.52(A)? On the floor as permitted by 210.52(A)(3)? This would not work because most cabinets are 24" deep and would mean floor receptacles would be too far from wall to satisfy 210.52(A)(3). Cord drops as permitted by 210.50(A)? This would be impractical because cords would interfere with opening the upper cabinet doors! How about below the countertops on the face of the cabinets? Is this even permitted? Where is the wording that permits these wall spaces to be omitted from the 210.52(A) requirements? The fact is, there isn't any wording that permits these wall spaces to be omitted from this requirement!
This literally means receptacle outlets must be installed for the WALL SPACES at the cabinets!!!

Here is a very simple solution to this conundrum. If 210.52(A)(4) is deleted and 210.52(C) revised as proposed, then the countertop receptacle outlets can also be used to satisfy the requirement for wall space receptacle outlets. Problem solved!

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 321-NFPA 70-2023 [Section No. 210.52(A)(4)]	Wall spaces at cabinets having countertops

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:
Submittal Date: Fri Feb 10 08:39:23 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: Cabinets with countertops are not considered wall space as found in 210.52(A)(4). Any cabinets located outside of areas denoted in 210.52(C) could have the receptacle located above the cabinet not more than 5 ft 6 inches in height 210.52(4).

Wall Spaces At Cabinets Having Countertops

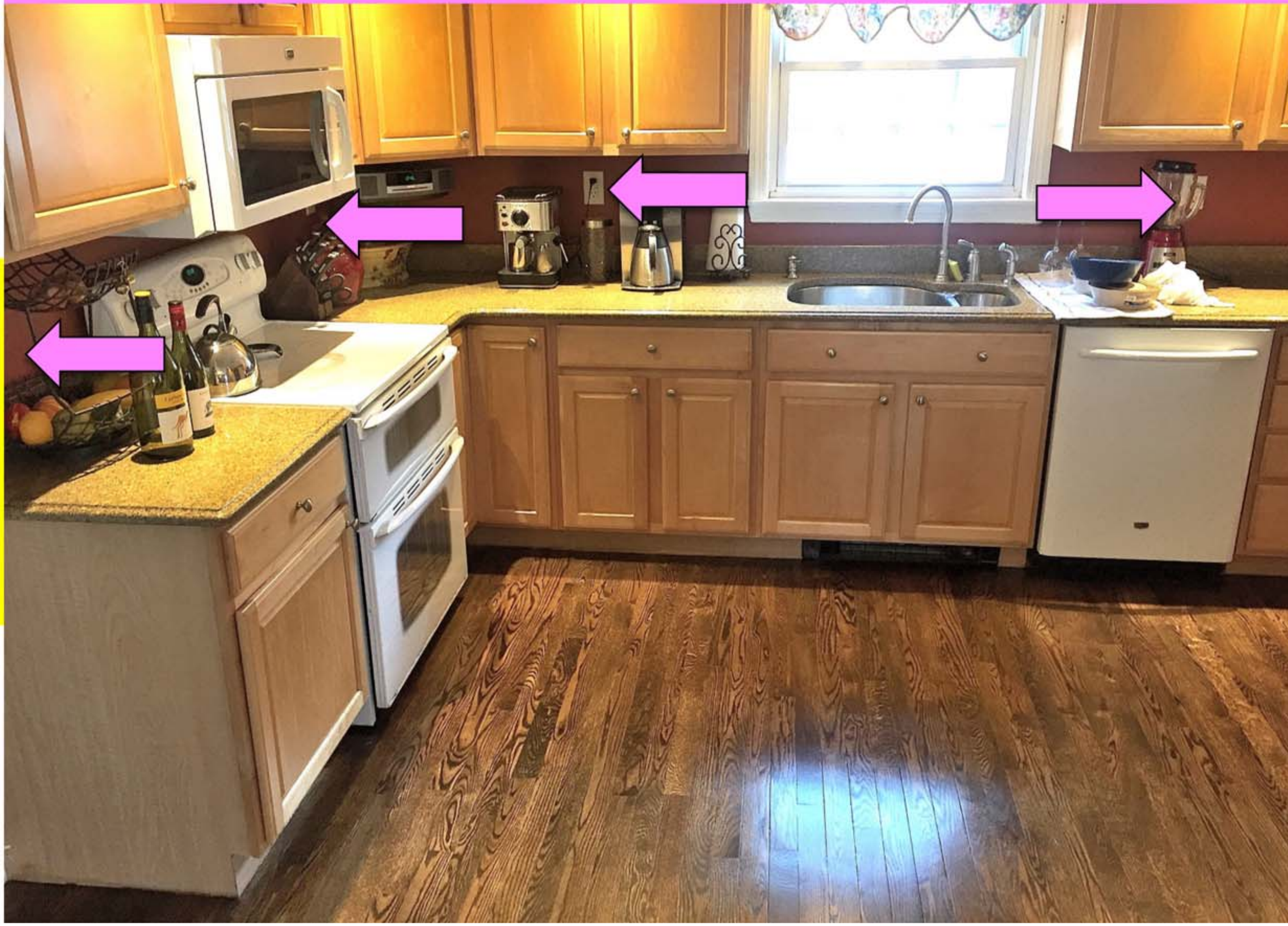
Russ LeBlanc

According to 210.52(A)(2)(1), a wall space SHALL INCLUDE any space 2 ft or more in width (including space measured around corners) and unbroken along the floor line by doorways and similar openings, fireplaces, stationary appliances, and FIXED CABINETS THAT DO NOT HAVE COUNTERTOPS or similar work surfaces.

This means the wall spaces at kitchen cabinets having countertops are included in this requirement!

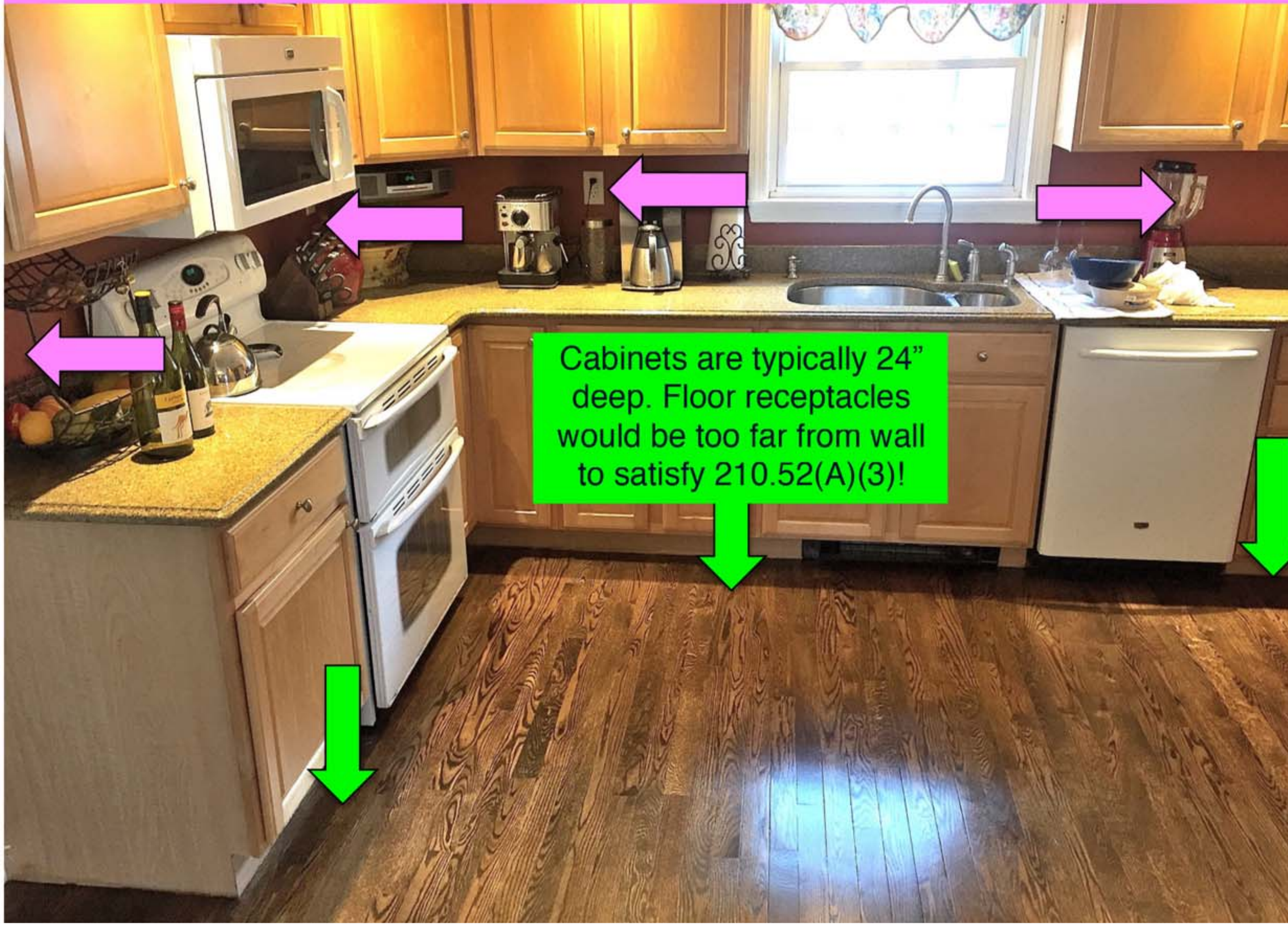
These receptacles cannot be used to satisfy 210.52(A) requirements!

But, according to 210.52(A)(4) and 210.52(C), Receptacles installed for countertop and similar work surfaces SHALL NOT be considered as the wall space receptacle outlets required by 210.52(A)



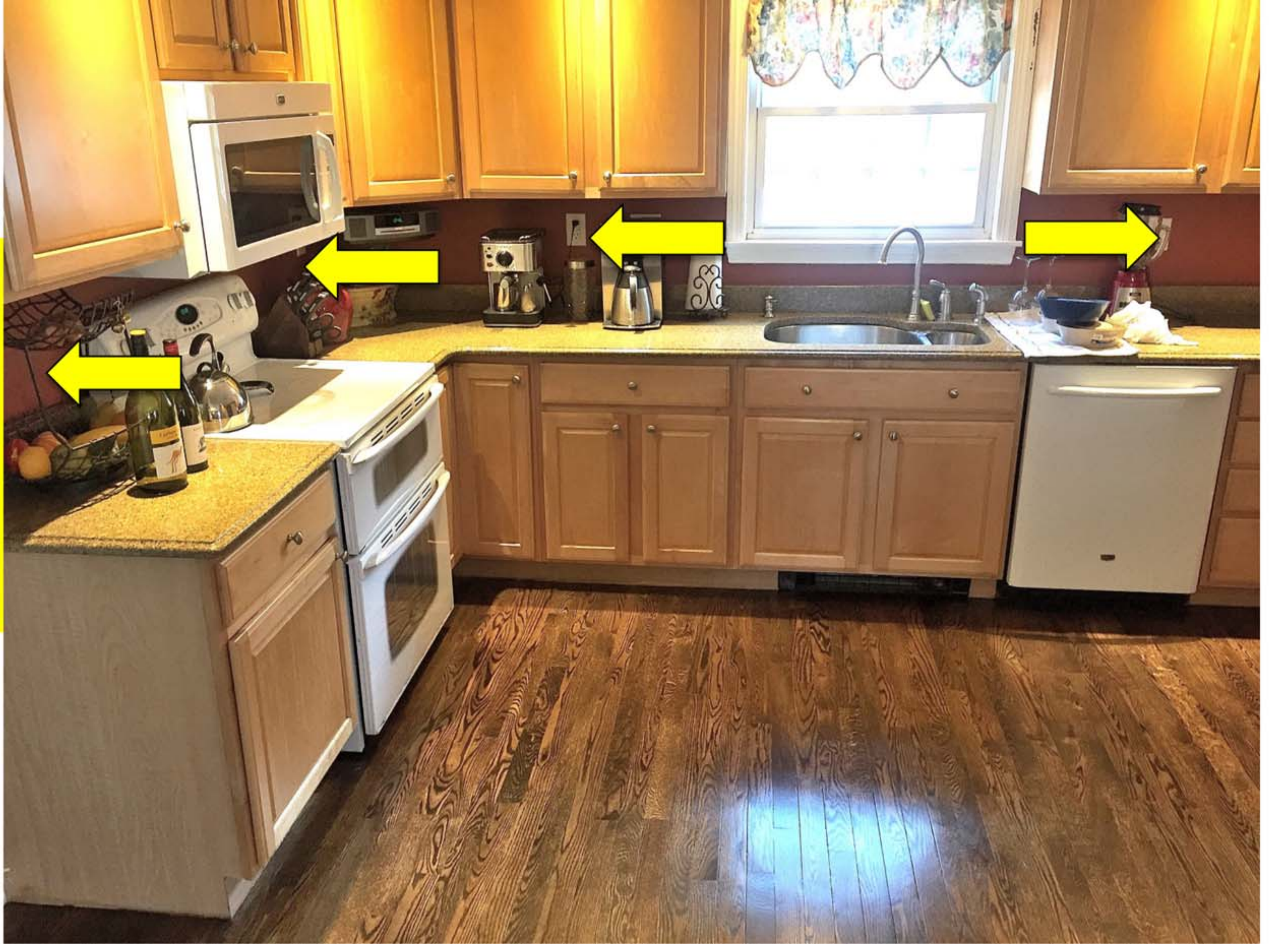
These receptacles cannot be used to satisfy 210.52(A) requirements!

These receptacles cannot be used to satisfy 210.52(A) requirements!




Cord pendants per 210.50(A) would be impractical since they would interfere with opening the upper cabinet doors!

Here is a very simple solution to this conundrum. If 210.52(A)(4) is deleted and 210.52(C) revised as proposed, then the countertop receptacle outlets can also be used to satisfy the requirement for wall space receptacle outlets. Problem solved!



Public Input No. 1924-NFPA 70-2023 [Section No. 210.52(D)]

(D) Bathrooms.

At least one receptacle outlet shall be installed in bathrooms within 900 mm (3 ft) of the outside edge of each sink. The placement of the receptacle , within the 36-inch limit, shall allow for the insertion of an attachment plug into the receptacle. The receptacle outlet shall be located on a wall or partition that is adjacent to the sink or sink countertop, located on the countertop, or installed on the side or face of the sink cabinet. In no case shall the receptacle be located more than 300 mm (12 in.) below the top of the sink or sink countertop. Receptacle outlet assemblies listed for use in countertops shall be permitted to be installed in the countertop.

Informational Note: See 406.5(E) and 406.5(G) for requirements on installation of receptacles in countertops.

Statement of Problem and Substantiation for Public Input

210.52 (D) Clarify the receptacle outlets point of measurement. Provide clarity regarding where the measurement from a receptacle outlet is to be measured from. For example, is the measurement from the edge of the body of the receptacle outlet, or the center point of the receptacle outlet neither of which will allow for the insertion of an attachment plug.

Submitter Information Verification

Submitter Full Name: Gary Hein
Organization: [Not Specified]
Street Address:
City:
State:
Zip:

Submittal Date: Mon Aug 07 15:36:34 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The proposed language is not necessary as it would have limited impact on dimensional measurements. The language does not add clarity to the requirement.

Public Input No. 3646-NFPA 70-2023 [Section No. 210.52(D)]

(D) Bathrooms.

(1) Receptacle Outlet Requirement. At least one receptacle outlet shall be installed in bathrooms within 900 mm (3 ft) of the outside edge of each sink.

(2) Receptacle Outlet Location. The receptacle outlet shall be located on a wall or partition that is adjacent to the sink or sink countertop, located on the countertop, or installed on the side or face of the sink cabinet. In no case shall the receptacle be located more than 300 mm (12 in.) below the top of the sink or sink countertop.

(3) Countertops. Receptacle outlet assemblies listed for use in countertops shall be permitted to be installed in the countertop.

Informational Note: See 406.5(E) and 406.5(G) for requirements on installation of receptacles in countertops.

Statement of Problem and Substantiation for Public Input

Breaking up 210.52(D) into a list item format to facilitate understanding for Code users. In accordance with NFPA Style Manual section 3.5.1.2 additional subdivisions shall be used where multiple requirements can be broken into independent requirements.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 05 11:53:55 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8037-NFPA 70-2024
Statement: The section is revised to comply with NEC Style Manual 3.5.1.2.

Public Input No. 669-NFPA 70-2023 [Section No. 210.52(D)]

(D) Bathrooms.

At least one receptacle outlet shall be installed in bathrooms within 900 mm (3 ft) of the outside edge of each sink ~~. The~~ and within 2 ft of any toilet. The receptacle outlet shall be located on a wall or partition that is adjacent to the sink or sink countertop, located on the countertop, or installed on the side or face of the sink cabinet. In no case shall the receptacle be located more than 300 mm (12 in.) below the top of the sink or sink countertop. Receptacle outlet assemblies listed for use in countertops shall be permitted to be installed in the countertop.

Informational Note: See 406.5(E) and 406.5(G) for requirements on installation of receptacles in countertops.

Statement of Problem and Substantiation for Public Input

Bidets are being installed everywhere, and this sometimes results in homeowners putting in an extension cord in lieu of permanent wiring. It makes sense to have a permanently installed receptacle in this case, to avoid the future use of extension cords.

Submitter Information Verification

Submitter Full Name: Jesse Duvuvei
Organization: MIDDLE DEPARTMENT INSPECTION AGENCY
Street Address:
City:
State:
Zip:
Submittal Date: Thu Apr 20 13:24:49 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: NEC 406.9(C) exception 4 permits the installation of a receptacle near the toilet. Insufficient substantiation has been provided to support the proposed requirement.

Public Input No. 1406-NFPA 70-2023 [Section No. 210.52(E)(1)]

(1) One-Family and Two-Family Dwellings.

For a one-family dwelling and each unit of a two-family dwelling that is at grade level, at least one receptacle outlet readily accessible from grade and not more than 2.0 m (6½ ft) above grade level shall be installed at the prominent front face and ~~back~~ the prominent back face of the dwelling.

Statement of Problem and Substantiation for Public Input

It seems necessary to add the words prominent and face twice in 210.52E1 because it's left too open for interpretation. Some don't like the look and want the receptacle on the side of the house favoring the front or back of the house.

The CMP's reply to this public input, placed for the 2023 cycle, was, "The proposed language is too restrictive and this language could have enforcement implications". By adding 'prominent front and back faces' to the code language is not any more or any less restrictive than current code language. The goal of this public input is to add clarity to current code intent.

If, for example, it is allowable to deem an outdoor receptacle outlet placed on the side of a dwelling that favors the rear of the dwelling, the required back-of-dwelling-receptacle then the added code language is no more restrictive than current code language. If, however, this same receptacle outlet, located on the side of the dwelling, does not constitute a back-of-dwelling-receptacle then the added code language would be more restrictive.

The NEC Handbook has an exhibit drawing showing the required receptacle outlets placed at the front face and the back face of the house illustration.

Submitter Information Verification

Submitter Full Name: Norman Feck
Organization: State of Colorado
Affiliation: self
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jul 14 08:08:50 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The additional language does not add clarity. "Prominent" is not a defined term in the NEC and would be subject to interpretation.

Public Input No. 1927-NFPA 70-2023 [Section No. 210.52(E)(1)]

(1) One-Family and Two-Family Dwellings.

For a one-family dwelling and each unit of a two-family dwelling that is at grade level, at least one receptacle outlet readily accessible from grade and not more than 2.0 m (6½ ft) above grade level shall be installed at the front and back of the dwelling. The placement of the receptacle, within the 6.5-foot limit, shall allow for the insertion of an attachment plug into the receptacle.

Statement of Problem and Substantiation for Public Input

210.52 (E) (1) Clarify the receptacle outlets point of measurement. Provide clarity regarding where the measurement from a receptacle outlet is to be measured from. For example, is the measurement from the edge of the body of the receptacle outlet, or the center point of the receptacle outlet neither of which will allow for the insertion of an attachment plug.

Submitter Information Verification

Submitter Full Name: Gary Hein
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 07 15:39:01 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The proposed language is not necessary as it would have limited impact on dimensional measurements. The language does not add clarity to the requirement.

Public Input No. 1928-NFPA 70-2023 [Section No. 210.52(E)(2)]

(2) Multifamily Dwellings.

For each dwelling unit of a multifamily dwelling where the dwelling unit is located at grade level and provided with individual exterior entrance/egress, at least one receptacle outlet readily accessible from grade and not more than 2.0 m (6½ ft) above grade level shall be installed. The placement of the receptacle, within the 6.5-foot limit, shall allow for the insertion of an attachment plug into the receptacle.

Statement of Problem and Substantiation for Public Input

210.52 (E) (2) Clarify the receptacle outlets point of measurement. Provide clarity regarding where the measurement from a receptacle outlet is to be measured from. For example, is the measurement from the edge of the body of the receptacle outlet, or the center point of the receptacle outlet neither of which will allow for the insertion of an attachment plug.

Submitter Information Verification

Submitter Full Name: Gary Hein
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 07 15:41:57 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The proposed language is not necessary as it would have limited impact on dimensional measurements. The language does not add clarity to the requirement.

Public Input No. 1407-NFPA 70-2023 [Section No. 210.52(E)(3)]

(3) Balconies, Decks, and Porches.

Balconies, decks, and porches that are within 102 mm (4 in.) horizontally of the dwelling unit shall have at least one receptacle outlet accessible from the balcony, deck, or porch. The receptacle outlet shall not be located more than 2.0 m (6½ ft) above the balcony, deck, or porch walking surface. <u>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 receptacle outlet installed.</u>

Statement of Problem and Substantiation for Public Input

Stairways cause separate spaces. Added receptacles for these added deck spaces would add safety by preventing extension cords draped across the steps. Multi-tier deck installations likely means more elaborate and greater square footage decks, although, square footage does not factor into current code language or the language of this new public input.

This public input is similar to my 2023 proposal. The CMP objected to 'within the perimeter' and 'accessible and within it's perimeter' taken from the Handbook which have been edited out along with other wording. What remains of this public input may have merit.

Submitter Information Verification

Submitter Full Name: Norman Feck

Organization: State of Colorado

Affiliation: self

Street Address:

City:

State:

Zip:

Submittal Date: Fri Jul 14 09:14:16 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: Substantiation has not been provided to convey the hazard of concern. Statistical evidence of the hazards of permanent extension cord use in such situations would be helpful.

Public Input No. 1929-NFPA 70-2023 [Section No. 210.52(E)(3)]

(3) Balconies, Decks, and Porches.

Balconies, decks, and porches that are within 102 mm (4 in.) horizontally of the dwelling unit shall have at least one receptacle outlet accessible from the balcony, deck, or porch. The receptacle outlet shall not be located more than 2.0 m (6½ ft) above the balcony, deck, or porch walking surface. The placement of the receptacle, within the 6.5-foot limit, shall allow for the insertion of an attachment plug into the receptacle.

Statement of Problem and Substantiation for Public Input

210.52 (E) (3) Clarify the receptacle outlets point of measurement. Provide clarity regarding where the measurement from a receptacle outlet is to be measured from. For example, is the measurement from the edge of the body of the receptacle outlet, or the center of the receptacle outlet neither of which will allow for the insertion of an attachment plug.

Submitter Information Verification

Submitter Full Name: Gary Hein
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 07 15:44:12 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The proposed language is not necessary as it would have limited impact on dimensional measurements. The language does not add clarity to the requirement.

Public Input No. 1930-NFPA 70-2023 [Section No. 210.52(G)(1)]

(1) Garages.

In each attached garage and in each detached garage with electric power, at least one receptacle outlet shall be installed in each vehicle bay and not more than 1.7 m (5½ ft) above the floor.

Exception: Garage spaces not attached to an individual dwelling unit of a multifamily dwelling shall not require a receptacle outlet in each vehicle bay. *The placement of the receptacle, within the 5.5-foot limit, shall allow for the insertion of an attachment plug into the receptacle.*

Statement of Problem and Substantiation for Public Input

210.52 (G) (1) Clarify the receptacle outlet point of measurement. Provide clarity regarding where the measurement from a receptacle outlet is to be measured from. For example, is the measurement from the edge of the body of the receptacle outlet, or the center point of the receptacle outlet neither of which will allow for the insertion of an attachment plug.

Submitter Information Verification

Submitter Full Name:	Gary Hein
Organization:	[Not Specified]
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Aug 07 15:46:04 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The proposed language is not necessary as it would have limited impact on dimensional measurements. The language does not add clarity to the requirement.

Public Input No. 1932-NFPA 70-2023 [Section No. 210.52(G)(1)]

(1) Garages.

In each attached garage and in each detached garage with electric power, at least one receptacle outlet shall be installed in each vehicle bay and not more than 1.7 m (5½ ft) above the floor.

Exception: Garage spaces not attached, excluding legally attached garage spaces, to an individual dwelling unit of a multifamily dwelling shall not require a receptacle outlet in each vehicle bay.

Statement of Problem and Substantiation for Public Input

210.52 (G) (1) exception clarify what is meant by "garage spaces not attached" and adapt language to not exclude legally attached garage spaces.

- In many condo developments, for example, the garage spaces are in separate garage buildings with individual/separate garage bays or in an open garage building.
- While the garage/parking spaces are not physically attached to a condo they are "legally attached" to a specific condo. Owners of "legally attached" but detached individual/separate garage bays in a multifamily dwelling are often allowed to make changes to their garage bay just as if they were not part of a multifamily dwelling unit.

Submitter Information Verification

Submitter Full Name:	Gary Hein
Organization:	[Not Specified]
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Aug 07 15:48:57 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The proposed language does not add clarity. The term "legally attached" is undefined and could introduce unintended consequences, such as invoking local zoning ordinances.

Public Input No. 1849-NFPA 70-2023 [Section No. 210.52 [Excluding any Sub-Sections]]

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 as follows:

(1) Part of a luminaire or appliance, or

(2) Controlled by a listed snap switch or listed wall-mounted control device ~~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 (5½ ft) above the floor

Permanently installed electric baseboard heaters equipped with factory-installed receptacle outlets 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.

Informational Note: Listed baseboard heaters include instructions that may not permit their installation below receptacle outlets.

Statement of Problem and Substantiation for Public Input

A switch controlled receptacle should not be permitted to be one of the required receptacles no matter why it is switch controlled. There is no definition of "wall-mount control device" and the addition of switch makes it clear that this applies where a receptacle is controlled by a standard snap switch or wall-mounted control device.

Submitter Information Verification

Submitter Full Name: Don Ganiere
Organization: none
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 06 14:58:59 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7607-NFPA 70-2024 PI-1849: The submitter did not provide substantiation for deleting the reference to 210.70(A)(1), Exception No. 1.

Statement: The language has been revised to provide consistency with 210.70. Section 404.14 requires switches to be listed.

Public Input No. 867-NFPA 70-2023 [Section No. 210.52 [Excluding any Sub-Sections]]

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 as follows:

(1) Part of a luminaire or appliance, or

(2) Controlled by a listed wall-mounted control device 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 (5½ ft) above the floor

(5) <u>Located behind a television/monitor mounted on the wall.</u>

Permanently installed electric baseboard heaters equipped with factory-installed receptacle outlets 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.

Informational Note: Listed baseboard heaters include instructions that may not permit their installation below receptacle outlets.

Statement of Problem and Substantiation for Public Input

When outlets are laid out in a unit most contractors will count the outlet that is installed for a TV/Monitor as one of the required outlets. This outlet is rendered unusable on most TV mountings, leaving no outlet on that wall for general use.

Submitter Information Verification

Submitter Full Name: John Leahy
Organization: [Not Specified]City of West Palm Beach, Florida
Street Address:
City:
State:
Zip:
Submittal Date: Mon May 22 09:53:07 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The language proposed is already in 210.52(4) by addressing the receptacles located 1.7 m (5-1/2 ft) above the floor.

Public Input No. 1602-NFPA 70-2023 [Section No. 210.60]

~~**210.60** Guest Rooms, Guest Suites, Dormitory Units, and Similar Occupancies.~~

~~**(A)** General.~~

~~Guest rooms or guest suites in hotels or motels, sleeping rooms in dormitory units, and similar occupancies shall have receptacle outlets installed in accordance with 210.52(A) and (D). Guest rooms or guest suites provided with permanent provisions for cooking shall have receptacle outlets installed in accordance with all of the applicable rules in 210.52 .~~

~~**(B)** Receptacle Placement.~~

~~The total number of receptacle outlets shall not be less than required in 210.52(A) . These receptacle outlets shall be permitted to be located conveniently for permanent furniture layout. At least two receptacle outlets shall be readily accessible. Where receptacles are installed behind the bed, the receptacle shall be located to prevent the bed from contacting any attachment plug that may be installed or the receptacle shall be provided with a suitable guard.~~

Statement of Problem and Substantiation for Public Input

Currently the NEC has multiple, slightly different receptacle placement requirements which create oppottiunity for confusion. Deleting 210.60 and making slight revisions to Section 210.52 removes the need for Sections 210.60 but also maintain the intent of that Section. By including the “Fixed in Place Furniture and Fixed in place desks” in Section 210.52(A)(2)(1) it will ensure the fixed furniture in a hotel guest room will be treated like a break in a wall, triggering the need for a receptacle outlet within 6ft of that break. This will maintain the intent in Section 210.60(B) of having at least two (2) receptacle outlets accessible. This revision also greatly simplifies the application of the receptacle placement rules for occupancies where people are intended to live and sleep, whether temporarily or permaenently.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1600-NFPA 70-2023 [Section No. 210.52]	
Public Input No. 1600-NFPA 70-2023 [Section No. 210.52]	

Submitter Information Verification

Submitter Full Name: Kyle Krueger

Organization: NECA

Affiliation: NECA

Street Address:

City:

State:

Zip:

Submittal Date: Thu Jul 27 10:36:12 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: Section 210.52 addresses receptacle outlets and therefore should not be retitled to expand the scope. The language in 210.60 is clear. The substantiation indicated receptacles should be provided to address furniture fixed in place and would impact receptacle placement that could reduce the number of receptacles along the wall space.

Public Input No. 801-NFPA 70-2023 [Section No. 210.60]

210.60 Guest ~~Rooms,~~ Rooms and Guest Suites of Hotels , ~~Dormitory Units, and Similar Occupancies~~ Motels, and Dormitories .

(A) General.

Guest rooms or guest suites in hotels ~~or~~ , motels, ~~sleeping rooms in dormitory units, and similar occupancies~~ and dormitories shall have receptacle outlets installed in accordance with 210.52(A) and (D). Guest rooms or guest suites provided with permanent provisions for cooking shall have receptacle outlets installed in accordance with all of the applicable rules in 210.52.

(B) Receptacle Placement.

The total number of receptacle outlets shall not be less than required in 210.52(A). These receptacle outlets shall be permitted to be located conveniently for permanent furniture layout. At least two receptacle outlets shall be readily accessible. Where receptacles are installed behind the bed, the receptacle shall be located to prevent the bed from contacting any attachment plug that may be installed or the receptacle shall be provided with a suitable guard.

Statement of Problem and Substantiation for Public Input

OBJECTIVE:
• USABILITY of NEC® and consistent CORRELATION with the defined term's EXTRACT source NFPA 101® Life Safety Code® regarding INDIVIDUAL guest rooms and INDIVIDUAL guest suites within dormitories versus the ENTIRE dormitory occupancy.

To address the INDIVIDUAL guest rooms and INDIVIDUAL guest suites of dormitories consistently with usage in NFPA 101® and other Codes, in a companion Public Input No. 799, "Dormitories" is being ADDED to the list of occupancies for "Guest Rooms and Guest Suites", in addition to EXTRACTING NFPA 101® 's informational content for the definition "Dormitory" that addresses the INDIVIDUAL guest rooms and individual guest suites of dormitories. NEC® Correlation Committee [NEC-AAC] take note.
.
BACKGROUND: Users of NEC® have encountered interpretational discrepancies with the present confusing wording. Presently, interpretation confusion exists to readers of NEC® regarding the use of the term "dormitory UNIT" versus the present definition's ambiguous clause " ... group SLEEPING ACCOMMODATIONS are provided for more than 16 persons who are not members of the same family IN ONE ROOM, OR A SERIES OF CLOSELY ASSOCIATED ROOMS, ...". Because of misinterpretation, it has been interpreted by some AHJs that the "UNIT" itself MUST accommodate "MORE THAN 16 PERSONS".
.
The phrase "IN ONE ROOM, OR A SERIES OF CLOSELY ASSOCIATED ROOMS" refers to "who are NOT MEMBERS of the SAME FAMILY", and does NOT refer to the "group SLEEPING ACCOMMODATIONS" having to be within in ONE room or ONE suite of rooms. Consequently, "dormitory" refers to the ENTIRE building or the ENTIRE space within that building AS AN OCCUPANCY that must accommodate MORE THAN 16 persons, and NOT to EACH specific sleeping room accommodating more than 16 persons.
.
Misuse of the term "dormitory UNIT" has effectively DIMINISHED SAFETY for what are colloquially called "dormitory rooms" that are now wrongly NOT treated as guest rooms or guest suites WITHIN a DORMITORY OCCUPANY. These so-called dormitory UNITS (INDIVIDUAL ROOMS) are being misinterpreted such that intended GFCI, AFCI, SPD and other protection requirements do NOT APPLY for DORMITORY bedrooms, for DORMITORY living rooms, and for closets and hallways INSIDE the so-called dormitory UNIT if that "UNIT" accommodates FEWER THAN 17 OCCUPANTS.
.
It is essential therefore that the terminology and usage for dormitories and for guest rooms and guest suites of dormitories in NFPA 70® be clarified at this time, CONSISTENT with NFPA 101, to avoid enforcement confusion between Codes.
.
Related Public Inputs address the corresponding changes elsewhere in NFPA 70 that must be revised accordingly.
.
"Similar" (i.e., "Similar occupancies") is a vague and unenforceable term per NEC® Style Manual 3.2.1 and Table 3.2.1, and "and similar occupancies" must be eliminated. Arbitrary inspection interpretations have resulted in inconsistency as to what exactly constitutes a "similar occupancy". NEC® Correlation Committee [NEC-AAC] take note.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 798-NFPA 70-2023 [Definition: Dormitory Unit.]	Clarification of NEC ambiguity in the definition extracted from NFPA 101
Public Input No. 798-NFPA 70-2023 [Definition: Dormitory Unit.]	

Submitter Information Verification

Submitter Full Name: Brian Rock
Organization: Hubbell Incorporated
Street Address:

City:
State:
Zip:
Submittal Date: Fri May 12 17:21:02 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7982-NFPA 70-2024

Statement: The terminology and usage for dormitories and for guest rooms and guest suites of dormitories in NFPA 70® is being clarified, to be consistent with NFPA 101 and to avoid enforcement confusion.

Public Input No. 1934-NFPA 70-2023 [Section No. 210.62]

210.62 Show Windows.

At least one 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet shall be installed within 450 mm (18 in.) of the top of each show window. No point along the top of the window shall be farther than 1.8 m (6 ft) from a receptacle outlet. The placement of the receptacle, within the 18-inch and 6 ft limit, shall allow for the insertion of an attachment plug into the receptacle.

Statement of Problem and Substantiation for Public Input

Clarify the receptacle outlet point of measurement. Provide clarity regarding where the measurement from a receptacle outlet is to be measured from. For example, is the measurement from the edge of the body of the receptacle outlet, or the center point of the receptacle outlet neither of which will allow for the insertion of an attachment plug.

Submitter Information Verification

Submitter Full Name: Gary Hein

Organization: [Not Specified]

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 07 15:59:58 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: The proposed language is not necessary as it would have limited impact on dimensional measurements. The language does not add clarity to the requirement.

Public Input No. 3478-NFPA 70-2023 [Section No. 210.63]

210.63 Equipment Requiring Servicing.

A 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet shall be installed at an accessible location within 7.5 m (25 ft) of the equipment as specified in 210.63(A) and (B).

Informational Note: See 210.8(E) for requirements on GFCI protection.

(A) Heating, Air-Conditioning, and Refrigeration Equipment.

The required receptacle outlet shall be located on the same level as the heating, air-conditioning, and refrigeration equipment. The receptacle outlet shall not be connected to the load side of the equipment's branch-circuit disconnecting means.

<u>Heating , Air-Conditioning and Refrigeration equipment installed behind accessible ceiling panels shall have a service receptacle installed with 5' of the access panel</u>

<u>This receptacle shall be provide with GFCI protection for personnel</u>

<u>The ground fault protection for this receptacle shall be readily accessible only from the ceiling space.</u>

Exception: A receptacle outlet shall not be required at one- and two-family dwellings for the service of evaporative coolers.

(B) Other Electrical Equipment.

In other than one- and two-family dwellings, a receptacle outlet shall be located as specified in 210.63(B)(1) and (B)(2).

(1) Indoor Service Equipment.

The required receptacle outlet shall be located within the same room or area as the service equipment.

(2) Indoor Equipment Requiring Dedicated Equipment Spaces.

Where equipment, other than service equipment, requires dedicated equipment space as specified in 110.26(E), the required receptacle outlet shall be located within the same room or area as the electrical equipment and shall not be connected to the load side of the equipment's disconnecting means.

Statement of Problem and Substantiation for Public Input

The installation of HVAC equipment within the cavity of a ceiling space creates challenging issues with the placement of the required service receptacle.
The most common approach is to utilize a receptacle within the space bellow the equipment to serve this function. The Elevation of the equipment itself consumes a large quantity of a cord if the receptacle is place within the 25" requirement.
In addition to the placement, the GFCI component of this requirement would require the receptacle to be readily accessible.
Buildings with large open floors, such as office spaces, restaurants and retail spaces often have no wall space within the 25' requirement.
This leads HVAC technician to resort to use of either longer cords, or creative solutions such as employing the use of the circuit typically installed for the condensate pump. This circuit is typically not GFCI protected, and the space above the ceiling is generally fully of metallic components, presenting a shock and fall hazard.
Placing a receptacle at the same elevation and withing practical reach of the unit would allow a safer working environment.
HVAC system designers have installed 120-volt circuits for condensate removal for years. Building with multiple units typically have multiple pumps on a single circuit. To utilize this circuit for use as the service receptacle requirement, it would need to be supplied by a Ground fault device that is readily accessible, such as a breaker.
The mechanical code addresses failure of the condensate pump with an interlock requirement to disable the unit on failure. But loss of this circuit to ground fault could lead to multiple units shut down.
It appears the proposed receptacle would need relief from the definition of readily accessible.
The use of a ladder is most likely already being employed to service the unit. This proposal includes the exclusion of this portion of the requirements and has the following benefits.
A) The receptacle would be in a practical position to eliminate the use of cords
B) The receptacle if allowed to be GFCI would be in a place where its operation would not affect other equipment.
C) The circuit for this receptacle is most likely already in place

Submitter Information Verification

Submitter Full Name:	William Cahill
Organization:	Somerville City Of
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sun Sep 03 18:41:01 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The receptacle for HVAC systems is currently required to be within 25 ft of the HVAC equipment. Restricting to within 5 ft of the unit may create impracticable conditions to implement this provision of the NEC. The committee does not support the GFCI being located in a location that is not readily accessible.

Public Input No. 1498-NFPA 70-2023 [Section No. 210.63(A)]

(A) Heating, Air-Conditioning, and Refrigeration Equipment.

The required receptacle outlet shall be located on the same level, and outdoors for outdoor located equipment, as the heating, air-conditioning, and refrigeration equipment. The receptacle outlet shall not be connected to the load side of the equipment's branch-circuit disconnecting means.

Exception: A receptacle outlet shall not be required at one- and two-family dwellings for the service of evaporative coolers.

Statement of Problem and Substantiation for Public Input

As written, an indoor GFCI protected receptacle could serve as the required 210.63A receptacle if it landed within 25' of the equipment. Outdoor equipment can take special tools and charging equipment to service the heating, air-conditioning, and refrigeration equipment meaning it will likely be a specialized worker that services the equipment. This worker won't always have access to the indoor receptacle beyond locked doors, and it is preferable to not route extension cords through doorways.

Submitter Information Verification

Submitter Full Name: Norman Feck
Organization: State of Colorado
Affiliation: self
Street Address:
City:
State:
Zip:

Submittal Date: Fri Jul 21 18:02:19 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: NEC Section 400.12 already prohibits a cord from being run through doors or windows to reach the outside. Section 210.63 states that all 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlets shall be installed at an acceptable location within 7.5 m (25 ft) of the equipment specified in 260.63(A) and (B).

Public Input No. 1832-NFPA 70-2023 [Section No. 210.63(A)]

(A) Heating, Air-Conditioning, and Refrigeration Equipment.

The required receptacle outlet shall be located on the same level as the heating, air-conditioning, and refrigeration equipment. The receptacle outlet shall not be connected to the load side of the equipment's branch-circuit disconnecting means.

Exception No. 1 : A receptacle outlet shall not be required at one- and two-family dwellings for the service of evaporative coolers.

Exception No. 2: A receptacle outlet shall not be required for equipment located above ceilings in a dwelling unit.

Statement of Problem and Substantiation for Public Input

Much modern residential heating and cooling equipment is located above ceiling access panels. Locating receptacles for servicing the equipment above the access panel can make accessing the outlet and device difficult if they themselves require service.

Submitter Information Verification

Submitter Full Name:	IEC National
Organization:	IEC
Affiliation:	Matthew Grover
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sun Aug 06 08:45:28 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: A receptacle outlet is required. However, the current language does not require the receptacle to be located above the ceiling and below the floor or attic above.

Public Input No. 277-NFPA 70-2023 [Section No. 210.63(A)]

(A) Heating, Air-Conditioning, and Refrigeration Equipment.

The required receptacle outlet shall be located on the same level as the heating, air-conditioning, and refrigeration equipment. The receptacle outlet shall not be connected to the load side of the equipment's branch-circuit disconnecting means. The required receptacle shall not be located inside of the heating, air-conditioning, and refrigeration equipment.

Exception: A receptacle outlet shall not be required at one- and two-family dwellings for the service of evaporative coolers.

Statement of Problem and Substantiation for Public Input

The code language as written seems to leave open the possibility of installing the receptacle inside of the equipment. This is a common installation practice for AHU's. The problem is, this means in order to access the receptacle you must open the equipment (very often the receptacle is installed with the other electrical items) and expose yourself to electrical hazards from the power wiring going to the equipment.

Submitter Information Verification

Submitter Full Name: Jesse Duvuvei

Organization: Middle Department Inspection Agency

Street Address:

City:

State:

Zip:

Submittal Date: Fri Feb 03 09:03:01 EST 2023

Committee: NEC-P02

Committee Statement

Resolution: Insufficient substantiation has been provided that demonstrates a hazard would exist from a receptacle located inside the equipment where proper access is established.

Public Input No. 3637-NFPA 70-2023 [Section No. 210.63(A)]

(A) Heating, Air-Conditioning, and Refrigeration Equipment.

The required receptacle outlet shall be located on the same level as the heating, air-conditioning, and refrigeration equipment. The receptacle outlet shall not be connected to the load side of the equipment's branch-circuit disconnecting means. When the Heating, Air-Conditioning, and Refrigeration equipment is located outside, the receptacle outlet shall be located outside.

Exception: A receptacle outlet shall not be required at one- and two-family dwellings for the service of evaporative coolers.

Statement of Problem and Substantiation for Public Input

this public input seeks to address the issue when a technician works on equipment and the doors to the home are locked preventing access to a receptacle needed during work. Instances have been shared with this submitter noting that this issue often arises when the required receptacle is located inside the home. requiring the receptacle to serve this need will increase safety.

Submitter Information Verification

Submitter Full Name: Thomas Domitrovich
Organization: Eaton Corporation
Street Address:
City:
State:
Zip:

Submittal Date: Tue Sep 05 10:56:52 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: NEC Section 400.12 already prohibits a cord from being run through doors or windows to reach the outside. Section 210.63 states that all 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlets shall be installed at an acceptable location within 7.5 m (25 ft) of the equipment specified in 260.63(A) and (B).

Public Input No. 272-NFPA 70-2023 [Section No. 210.63(B)]

(B) Other Electrical Equipment.

In other than one- and two-family dwellings ~~, a receptacle~~ a receptacle outlet shall be ~~located as specified in 210.63(B)(1) and (B)(2).~~

~~**(1)** Indoor Service Equipment.~~

~~The required receptacle outlet shall be located~~

provided within the same

~~room or~~

area as

~~the than service equipment, requires dedicated equipment space as specified in 110.26(E) , the required~~

indoor switchboards, switchgear, panelboards, motor control centers, and service equipment.

~~**(2)** Indoor Equipment Requiring Dedicated Equipment Spaces.~~

~~Where equipment, other~~

Exception: A receptacle outlet shall

~~be located within the same room or area as the electrical equipment and shall not be connected to the load side of the equipment's disconnecting means~~

not be required for premises wiring systems that do not include a solidly-grounded system operating at less than 150 volts to ground .

Statement of Problem and Substantiation for Public Input

New to the 2023 NEC, service equipment requires dedicated electrical space. That means (B)(1) is no longer needed because it is covered by (B)(2). With (B)(1) not being needed, there is no reason to have a number list when one sentence can do the job. This PI also suggests specifying the types equipment that areas covered instead of referring to a different article that is several pages away from this section. This should be viewed strictly as an effort to increase usability. The language about the load side of the disconnect should be removed because it never should have existed to begin with. If I have a building supplied a by a feeder circuit, how do I satisfy the requirement without installing a separate supply to the building, in violation of 225.30? An exception is being proposed for premises wiring systems that do not have a realistic source of 120V. It is not reasonable to require a transformer to be installed at a structure that only contains 480V (or greater) circuits or equipment.
Alternatively, 210.63(B) could be deleted in its entirety, as it provided very little in terms of safety and as it is currently written it often comes at massive price.

Submitter Information Verification

Submitter Full Name:	Ryan Jackson
Organization:	Self-employed
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Thu Feb 02 13:04:34 EST 2023
Committee:	NEC-P02

Committee Statement

Resolution: FR-8191-NFPA 70-2024

Statement: The language has been simplified to align with revisions to the dedicated electrical space established in the 2023 NEC. The language requiring the receptacle to not be located on the load side of the equipment disconnecting means is removed.

Public Input No. 10-NFPA 70-2023 [Section No. 210.63(B)(2)]

(2) Indoor Equipment Requiring Dedicated Equipment Spaces.

Where equipment, other than service equipment, requires dedicated equipment space as specified in 110.26(E), the required receptacle outlet shall be located within the same room or area as the electrical equipment ~~and shall not be connected to the load side of the equipment's disconnecting means~~ .

Statement of Problem and Substantiation for Public Input

The prohibition of the required receptacle outlet from being connected to the load side of the equipment's disconnecting means is impossible to achieve in some installations, such as a small tenant space with a single 208Y/120V panelboard in the tenant space and the panelboard is served by a feeder. Without adding completely unnecessary equipment, this prohibition results in a scenario that is impossible for engineers and contractors to achieve and impossible for AHJs to enforce.

Additionally, this prohibition will cause facilities with more than one panelboard, switchboard, or motor control center to be provided with circuits that crisscross the facility so that the required receptacle outlet is served from equipment in another location of the facility. Depending on the size of the facility, this can cause a very significant cost increase and unnecessarily consume natural resources in the conduit and wire required to crisscross the facility.

Finally, this prohibition is inconsistent with section 210.63(B)(1), which does not prohibit the required receptacle from being connected to the load side of the service equipment. This prohibition implies that the CMP considers having an energized receptacle outlet at switchboards, switchgear, panelboards, and motor control centers (which may all be connected to the load side of the service equipment) to be more essential than having an energized receptacle outlet at the service equipment itself.

Submitter Information Verification

Submitter Full Name: Jason Rohe
Organization: Schnackel Engineers
Street Address:
City:
State:
Zip:

Submittal Date: Wed Jan 04 08:11:00 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8191-NFPA 70-2024

Statement: The language has been simplified to align with revisions to the dedicated electrical space established in the 2023 NEC. The language requiring the receptacle to not be located on the load side of the equipment disconnecting means is removed.

Public Input No. 2094-NFPA 70-2023 [Section No. 210.63(B)(2)]

(2) Indoor Equipment Requiring Dedicated Equipment Spaces.

Where equipment, other than service equipment, requires dedicated equipment space as specified in 110.26(E), the required receptacle outlet shall be located within the same room or area as the electrical equipment and shall not be connected to the load side of the equipment’s disconnecting means.

<u>Exception 1: Where the equipment is located in a plenum space, the required receptacle outlet shall be located as close as practicable to the equipment, but outside of the plenum space.</u>

<u>Exception 2: Where all of the electrical equipment in a building is located in the same room, the required receptacle can be connected to the load side of the equipment's disconnecting means.</u>

Statement of Problem and Substantiation for Public Input

1) Mechanical rooms are often plenum spaces and contain disconnect switches which require dedicated equipment space. These are often very small rooms that barely contain the air handler itself. Receptacles are not plenum rated. Proposed language would allow locating the required receptacle just outside the mechanical room and plenum space.
2) In buildings with 1 house panel and the service disconnect is outside or at the meter center, providing a receptacle that is not powered from the load side of that panel's disconnect is impossible to comply. Proposed language creates and exception that makes compliance possible.

Submitter Information Verification

Submitter Full Name: Josh Wiley
Organization: Jordan Skala Engineers
Street Address:
City:
State:
Zip:
Submittal Date: Fri Aug 11 18:22:22 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The receptacles must be located to comply with 300.22 and avoid compliance issues with cords.

Public Input No. 4009-NFPA 70-2023 [Section No. 210.63(B)(2)]

(2) Indoor Equipment Requiring Dedicated Equipment Spaces.

Where equipment, other than service equipment, requires dedicated equipment space as specified in 110.26(E), the required receptacle outlet shall be located within the same room or area as the electrical equipment and if possible shall not be connected to the load side of the equipment's disconnecting means.

Statement of Problem and Substantiation for Public Input

As written, the unrealistic requirement could create additional problems with applying tap rules, the use of transformers and the connection of terminations to new and existing equipment and creating additional safety issues in accordance with 70E with requirements of establishing an electrically safe working condition on this equipment. Understanding the intent of the requirement and the need for test equipment that requires a power supply. In the application of such a process, temporary power or other means for power is typically planned for and provided by skilled and qualified persons. There is no substantiation for this power to be installed under such stringent requirements. For smaller type occupancies this can almost be impossible to comply with.

Submitter Information Verification

Submitter Full Name:	Mark Cook
Organization:	Faith Technologies Electrical
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Wed Sep 06 13:50:47 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: FR-8191-NFPA 70-2024

Statement: The language has been simplified to align with revisions to the dedicated electrical space established in the 2023 NEC. The language requiring the receptacle to not be located on the load side of the equipment disconnecting means is removed.

Public Input No. 498-NFPA 70-2023 [Section No. 210.63(B)(2)]

(2) Indoor Equipment Requiring Dedicated Equipment Spaces.

Where equipment, other than service equipment, requires dedicated equipment space as specified in 110.26(E), the required receptacle outlet shall be located within the same room or area as the electrical equipment~~ and shall not be connected to the load side of the equipment's disconnecting means~~ .

Statement of Problem and Substantiation for Public Input

There are circumstances where supply of this receptacle from another source would violate other portions of the code, or be entirely too onerous.

One example being a smaller commercial structure that has a 200a service disconnect that supplies a subpanel across the structure. There is no other panelboard available to supply a branch circuit for the subpanels breaker. You would be required to set one at the service that otherwise would not be needed.

Another is a subfed structure. You are allowed only one feeder or branch circuit to this structure. A branch circuit supply from the main structure or service location would violate 225.30. This requirement would require you to place an extra panelboard at that location with one receptacle supplied from each panel to meet this requirement.

Yet another issue would be multifamily dwelling units. This requirement could violate 210.25. Depending on the need for a house panel and access to occupants.

Submitter Information Verification

Submitter Full Name: Albin Kneggs

Organization: City of Dallas

Street Address:

City:

State:

Zip:

Submittal Date: Tue Mar 21 14:36:12 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: FR-8191-NFPA 70-2024

Statement: The language has been simplified to align with revisions to the dedicated electrical space established in the 2023 NEC. The language requiring the receptacle to not be located on the load side of the equipment disconnecting means is removed.

Public Input No. 772-NFPA 70-2023 [Section No. 210.63(B)(2)]

(2) Indoor Equipment Requiring Dedicated Equipment Spaces.

Where equipment, other than service equipment, requires dedicated equipment space as specified in 110.26(E), the required receptacle outlet shall be located within the same room or area as the electrical equipment~~ and shall not be connected to the load side of the equipment's disconnecting means~~ .

Statement of Problem and Substantiation for Public Input

This is requirement that in many cases is not feasible. An example of this is a small lift station building with a 480/277V service for pumps and a step down transformer serving a 208/120V panelboard. The 208/120V panelboard is not service equipment, but does require dedicated equipment space per NEC 110.26. This panelboard is required to have a receptacle that is not served by this panelboard. Problem being there is not a separate panelboard to feed this receptacle. There are measures in place for temporary power needs during periods of maintenance when this panelboard is out of service, so there is not a need to maintain power to this receptacle during times of maintenance.

Submitter Information Verification

Submitter Full Name: Randall Jacobs
Organization: TKDA Engineers, Architects, and Planners
Affiliation: Individual
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 04 11:01:07 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8191-NFPA 70-2024

Statement: The language has been simplified to align with revisions to the dedicated electrical space established in the 2023 NEC. The language requiring the receptacle to not be located on the load side of the equipment disconnecting means is removed.

Public Input No. 2095-NFPA 70-2023 [Section No. 210.63(B) [Excluding any Sub-Sections]]

In other than ~~one- and two-family~~ dwellings, a receptacle outlet shall be located as specified in 210.63(B)(1) and (B)(2).

Statement of Problem and Substantiation for Public Input

210.8 (E) requires that the receptacle required for 210.63 to be GFCI. The previous language provided an exception for 1 & 2 family dwellings, but not for dwelling units in multifamily buildings. Typically, the electrical panel is located bedroom. 210.8 (E) would require an additional GFCI for every bedroom that has the load center which was not the intent. The proposed language expand the exception to include all dwelling units to resolve this issue.

Submitter Information Verification

Submitter Full Name: Josh Wiley
Organization: Jordan Skala Engineers
Street Address:
City:
State:
Zip:

Submittal Date: Fri Aug 11 18:23:11 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Insufficient substantiation was provided to remove GFCI protection from the receptacle servicing the equipment in multi-family dwellings.

Public Input No. 1945-NFPA 70-2023 [Section No. 210.63 [Excluding any Sub-Sections]]

A 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet shall be installed at an accessible location within 7.5 m (25 ft) of the equipment as specified in 210.63(A) and (B).

Informational Note: See 210.8(E) for requirements on GFCI protection. The placement of the receptacle, within the 25-foot limit, shall allow for the insertion of an attachment plug into the receptacle.

Statement of Problem and Substantiation for Public Input

210.63 Clarify the receptacle outlet point of measurement. Provide clarity regarding where the measurement from a receptacle outlet is to be measured from. For example, is the measurement from the edge of the body of the receptacle outlet, or the center point of the receptacle outlet neither of which will allow for the insertion of an attachment plug.

Submitter Information Verification

Submitter Full Name: Gary Hein
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 08 12:22:16 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The proposed language is not necessary as it would have limited impact on dimensional measurements. The language does not add clarity to the requirement.

Public Input No. 1504-NFPA 70-2023 [Section No. 210.65]

210.65 Meeting Rooms.

(A) General.

Each meeting room of not more than 93 m^2 (1000 ft^2) in other than dwelling units shall have outlets for nonlocking-type, 125-volt, 15- or 20-ampere receptacles. The outlets shall be installed in accordance with 210.65(B). Where a room or space is provided with movable partition(s), each room size shall be determined with the partition in the position that results in the smallest size meeting room.

Informational Note No. 1: For the purposes of this section, meeting rooms are typically designed or intended for the gathering of seated occupants for such purposes as conferences, deliberations, or similar purposes, where portable electronic equipment such as computers, projectors, or similar equipment is likely to be used.

Informational Note No. 2: Examples of rooms that are not meeting rooms include auditoriums, schoolrooms, and coffee shops.

(B) Receptacle Outlets Required.

The total number of receptacle outlets, including floor outlets and receptacle outlets in fixed furniture, shall not be less than as determined in 210.65(B)(1) and (B)(2).

(1) Receptacle Outlets in Fixed Walls.

The required number of receptacle outlets shall be determined in accordance with 210.52(A)(1) through (A)(4). These receptacle outlets shall be permitted to be located as determined by the installer, designer, or building owner.

(2) Floor Outlets.

A meeting room with any floor dimension that is 3.7 m (12 ft) or greater in any direction and that has a floor area of at least 20 m^2 (215 ft^2) shall have at least one floor receptacle outlet, or at least one floor outlet to serve a receptacle(s), located at a distance not less than 1.8 m (6 ft) from any fixed wall for each 20 m^2 (215 ft^2) or fraction thereof.

Informational Note No. 1: See 314.27(B) for requirements on floor boxes used for receptacles located in the floor.

Informational Note No. 2: See 518.1 for requirements on assembly occupancies designed for 100 or more persons.

Exception: In conference rooms larger than 20m ^{2} (215ft ^{2}), where there will be a conference room table in the middle of the room for the purpose of meetings and the table has receptacle outlets manufactured in the table with the ability to be connected to an external power source, only one floor outlet shall be required. This outlet will count as one of the total outlets needed in the conference room in accordance with 210.65(B)(1)

Statement of Problem and Substantiation for Public Input

When designing electrical layouts for large conference rooms and it is known to the designer that a hard wired conference room table that has power outlets in the table for participants of the meeting to plug in any equipment will be used, it is unnecessary to require more than one floor outlet. There will be no additional safety issues because the participants in the meeting can plug into the table that has power. there is no additional cost added to the project for unused floor outlets. The exception also does not prohibit additional floor outlets if they are desired but the end user.

Submitter Information Verification

Submitter Full Name: IEC National
Organization: IEC
Affiliation: Jake Gray
Street Address:
City:
State:
Zip:
Submittal Date: Sat Jul 22 10:47:55 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The proposed revision assumes that the receptacle or outlet will feed a table, which may not be accurate. The use of the room is unknown. The receptacles and outlet are located to serve the area for multiple configurations.

Public Input No. 765-NFPA 70-2023 [Section No. 210.65]

210.65 Meeting Rooms.

(A) General.

Each meeting room of not more than 93 m^2 (1000 ft^2) in other than dwelling units shall have outlets for nonlocking-type, 125-volt, 15- or 20-ampere receptacles. The outlets shall be installed in accordance with 210.65(B). Where a room or space is provided with movable partition(s), each room size shall be determined with the partition in the position that results in the smallest size meeting room.

Informational Note No. 1: For the purposes of this section, meeting rooms are typically designed or intended for the gathering of seated occupants for such purposes as conferences, deliberations, or similar purposes, where portable electronic equipment such as computers, projectors, or similar equipment is likely to be used.

Informational Note No. 2: Examples of rooms that are not meeting rooms include auditoriums, schoolrooms, and coffee shops.

(B) Receptacle Outlets Required.

The total number of receptacle outlets, including floor outlets and receptacle outlets in fixed furniture, shall not be less than as determined in 210.65(B)(1) and (B)(2).

(1) Receptacle Outlets in Fixed Walls.

The required number of receptacle outlets shall be determined in accordance with 210.52(A)(1) through (A)(4). These receptacle outlets shall be permitted to be located as determined by the installer, designer, or building owner.

(2) Floor Outlets.

A meeting room with any floor dimension that is 3.7 m (12 ft) or greater in any direction and that has a floor area of at least 20 m^2 (215 ft^2) shall have at least one floor receptacle outlet, or at least one floor outlet to serve a receptacle(s), located at a distance not less than 1.8 m (6 ft) from any fixed wall for each 20 m^2 (215 ft^2) or fraction thereof.

Informational Note No. 1: See 314.27(B) for requirements on floor boxes used for receptacles located in the floor.

Informational Note No. 2: See 518.1 for requirements on assembly occupancies designed for 100 or more persons.

-Add: Except where the floor outlet will feed a table with dedicated outlets that meet the above distance requirements; in that case only (1) floor outlet is required per table.

-Background: Having a floor core in each meeting room to feed power to each table makes perfect sense. It eliminates cords run across the floor to power the table. I have yet to see a conference room table without dedicated power inserts on top of the table. The requirement to install multiple floor cores to feed say a single 4'x 12' table that already has table inserts is not a productive use of resources; it will not get used.

Statement of Problem and Substantiation for Public Input

-Add: Except where the floor outlet will feed a table with dedicated outlets that meet the above distance requirements; in that case only (1) floor outlet is required per table.
-Background: Having a floor core in each meeting room to feed power to each table makes perfect sense. It eliminates cords run across the floor to power the table. I have yet to see a conference room table without dedicated power inserts on top of the table. The requirement to install multiple floor cores to feed say a single 4'x 12' table that already has table inserts is not a productive use of resources; it will not get used.

Submitter Information Verification

Submitter Full Name: EJ Nemec
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 03 13:04:25 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The proposed revision assumes that the receptacle or outlet will feed a table, which may not be accurate. The use of the room is unknown. The receptacles and outlet are located to serve the area for multiple configurations.

Public Input No. 2096-NFPA 70-2023 [Section No. 210.65(A)]

(A) General.

Each meeting room of not more than 93 m^2 (1000 ft^2) in other than dwelling units shall have outlets for nonlocking-type, 125-volt, 15- or 20-ampere receptacles. The outlets shall be installed in accordance with 210.65(B). Where a room or space is provided with movable partition(s), each room size shall be determined with the partition in the position that results in the smallest size meeting room.

Informational Note No. 1: For the purposes of this section, meeting rooms are typically designed or intended for the gathering of groups of at least 6 seated occupants for such purposes as conferences, deliberations, or similar purposes, where portable electronic equipment such as computers, projectors, or similar equipment is likely to be used.

Informational Note No. 2: Examples of rooms that are not meeting rooms include auditoriums, schoolrooms, and coffee shops.

Statement of Problem and Substantiation for Public Input

The language in the informational note is overly broad and is causing a misapplication and enforcement of this section to apply to individual offices, small open office space, lounges, lobbies, club rooms, dining rooms, and similar type spaces that contain more than 2 chairs where people can talk and have cell phones (portable electronics) because this meets the current definition of "meeting room". A formal definition of "meeting room" would also help to clarify the intent of this section. While not perfect, the proposed language would at least exclude private offices and some smaller spaces from enforcement of this section.

Submitter Information Verification

Submitter Full Name: Josh Wiley
Organization: Jordan Skala Engineers
Street Address:
City:
State:
Zip:

Submittal Date: Fri Aug 11 18:24:30 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The proposed language makes an assumption based on the occupancy permitted. The use of the space may require receptacles or outlets located in accordance with the provision of this section with limited occupants.

Public Input No. 1578-NFPA 70-2023 [Section No. 210.65(B)(2)]

(2) Floor Outlets.

A meeting room with any floor dimension that is 3.7 m (12 ft) or greater in any ~~direction~~ plan dimension and that has a floor area of at least 20 m^2 (215 ft^2) shall have at least one floor receptacle outlet, or at least one floor outlet to serve a receptacle(s), located at a distance not less than 1.8 m (6 ft) from any fixed wall ~~for~~ (or, if not possible to be 1.8 m (6 ft) from all fixed walls, as far from all fixed walls as practical) for each 20 m^2 (215 ft^2) or fraction thereof.

Informational Note No. 1: See 314.27(B) for requirements on floor boxes used for receptacles located in the floor.

Informational Note No. 2: See 518.1 for requirements on assembly occupancies designed for 100 or more persons.

Statement of Problem and Substantiation for Public Input

1) Current language of "in any direction" invites unintended diagonal measurements. The term "Plan Dimension" is borrowed from the International Building Code.

2) Current language cannot be complied with in certain room geometries. For example, a 11'-0" x 12'-0" rectangular meeting room has no point at which a receptacle can be mounted not less than 6 feet from all walls. The use of the word "practical" is intended to allow minor leeway to coordinate the floor outlet location with the legs of planned large furniture, such as conference tables.

Submitter Information Verification

Submitter Full Name: Edward Henderson
Organization: Engineering Services Group, Inc.
Street Address:
City:
State:
Zip:

Submittal Date: Tue Jul 25 18:45:04 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The proposed revised language does not enhance the enforceability of the requirement. The phrase “not possible” is in conflict with the NEC style manual. A room smaller than 215 sq ft is not required to have floor receptacles or outlets.

Public Input No. 1579-NFPA 70-2023 [Section No. 210.65(B)(2)]

(2) Floor Outlets.

A meeting room with any floor dimension that is 3.7 m (12 ft) or greater in any direction and that has a floor area of at least 20 m^2 (215 ft^2) shall have at least one floor receptacle outlet, or at least one floor outlet to serve a receptacle(s), located at a distance not less than 1.8 m (6 ft) from any fixed wall for each 20 m^2 (215 ft^2) or fraction thereof.

Informational Note No. 1: See 314.27(B) for requirements on floor boxes used for receptacles located in the floor.

Informational Note No. 2: See 518.1 for requirements on assembly occupancies designed for 100 or more persons.

Exception to (2): Floor outlets shall not be required to be installed in historical buildings. The quantity of outlets which would be required shall be added to the quantity required by 210.51(B)(1).

Statement of Problem and Substantiation for Public Input

Installation of floor outlets during renovations causes significant damage to historic buildings, including cutting/drilling, damage to ceilings below, or the use of adhesives to install surface mounted products. The required quantity of receptacle outlets is added to part (1) to ensure sufficient availability of receptacles.

Submitter Information Verification

Submitter Full Name: Edward Henderson
Organization: Engineering Services Group, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jul 25 19:03:17 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: There is not a retrofit requirement in this section of the NEC for existing buildings.

Public Input No. 1135-NFPA 70-2023 [Section No. 210.70(A)(1)]

(1) Habitable Rooms, Kitchens, Laundry Areas, and Bathrooms.

At least one lighting outlet controlled by a listed wall-mounted control device shall be installed in every habitable room, kitchen, laundry area, and bathroom. The wall-mounted control device shall be located near ~~an~~ each entrance that permits access to the room on a wall.

Exception No. 1: In other than kitchens, laundry areas, and bathrooms, one or more receptacles controlled by a listed wall-mounted control device shall be permitted in lieu of lighting outlets.

Exception No. 2: Lighting outlets shall be permitted to be controlled by occupancy sensors that are (1) in addition to listed wall-mounted control devices or (2) located at a customary wall switch location and equipped with a manual override that will allow the sensor to function as a wall switch.

Statement of Problem and Substantiation for Public Input

The modified text will allow to an occupant to enter a habitable room at any entrance and operate a wall mounted control device, thereby preventing access to a dark and potentially hazardous situation.

Submitter Information Verification

Submitter Full Name: Greg Chontow
Organization: Boro of Hopatcong, NJ
Street Address:
City:
State:
Zip:

Submittal Date: Mon Jun 19 21:50:53 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The public input provides insufficient substantiation to warrant the revision. Enforcement would be difficult. Access from closets, balconies, internal spaces, and other such areas do not necessarily warrant the addition of a switch.

Public Input No. 1506-NFPA 70-2023 [Section No. 210.70(A)(1)]

(1) Habitable Rooms, Kitchens, Laundry Areas, and Bathrooms.

~~At least one lighting outlet controlled by a listed wall~~ A wall -mounted control device shall be ~~installed in every habitable room, kitchen, laundry area, and bathroom. The wall-mounted control device shall be~~ installed and located near an entrance to the room on a wall~~.~~

~~Exception No. 1: In other than kitchens, laundry areas, and bathrooms, one or more receptacles controlled by a listed wall-mounted control device shall be permitted in lieu of lighting outlets.~~

~~Exception No. 2: Lighting outlets shall be permitted to be controlled by occupancy sensors that are (1) in addition to~~

, controlling at least one lighting outlet by:

(a)one or more listed wall-mounted control devices.

(b)an occupancy censors in addition to the listed wall-mounted control

~~devices or (2)~~

device.

(c)an occupancy censor located at a customary wall switch location and equipped with a manual override that will allow the sensor to function as a wall switch.

Exception No. 1: In other than kitchens, laundry areas, and bathrooms, one or more receptacles controlled by a listed wall-mounted control device shall be permitted in lieu of lighting outlets.

Statement of Problem and Substantiation for Public Input

Habitable rooms, kitchen, laundry and bath rooms were deleted from the subtext because they were redundant to the parent text of this section.
The exception was removed and add to the body of the text to show ease of use of the code by providing a positive list of installation methods instead of exceptions.

Submitter Information Verification

Submitter Full Name: IEC National
Organization: IEC- Jake Gray
Street Address:
City:
State:
Zip:
Submittal Date: Sat Jul 22 12:21:00 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The revised language does not add clarity and does not provide adequate substantiation for the reorganization.

Public Input No. 1836-NFPA 70-2023 [Section No. 210.70(A)(1)]

(1) Habitable Rooms, Kitchens, Laundry ~~Areas~~ Rooms , and Bathrooms.

At least one lighting outlet controlled by a listed wall-mounted control device shall be installed in every habitable room, kitchen, laundry area, and bathroom. The wall-mounted control device shall be located near an entrance to the room on a wall.

Exception No. 1: In other than kitchens, laundry areas, and bathrooms, one or more receptacles controlled by a listed wall-mounted control device shall be permitted in lieu of lighting outlets.

Exception No. 2: Lighting outlets shall be permitted to be controlled by occupancy sensors that are (1) in addition to listed wall-mounted control devices or (2) located at a customary wall switch location and equipped with a manual override that will allow the sensor to function as a wall switch.

Statement of Problem and Substantiation for Public Input

The prevalence of stacked laundry units installed in dedicated closets makes a distinction important. A laundry area could be considered the closet that the unit(s) are located in as they are often separated by a door. With additional requirements for lighting outlets added to the code defining the area around the laundry equipment as a room may prevent lighting outlets from being required in inaccessible areas or otherwise being installed in location where they provide no functional illumination.

This would need to be linked to the definition PI

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1834-NFPA 70-2023 [Definition: Laundry Area.]	
Public Input No. 1835-NFPA 70-2023 [Definition: Laundry Area.]	
Public Input No. 1834-NFPA 70-2023 [Definition: Laundry Area.]	
Public Input No. 1835-NFPA 70-2023 [Definition: Laundry Area.]	

Submitter Information Verification

Submitter Full Name:	IEC National
Organization:	IEC
Affiliation:	Matthew Grover
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sun Aug 06 09:18:41 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The language in this section refers to “laundry areas” and not “laundry rooms.” “Laundry area” is the defined term in Article 100.

Public Input No. 184-NFPA 70-2023 [Section No. 210.70(A)(1)]

(1) Habitable Rooms, Kitchens, Laundry Areas, and Bathrooms.

At least one lighting outlet controlled by a switch or listed wall-mounted control device shall be installed in every habitable room, kitchen, laundry area, and bathroom. The wall-mounted control device shall be located near an entrance to the room on a wall.

Exception No. 1: In other than kitchens, laundry areas, and bathrooms, one or more receptacles controlled by a listed wall-mounted control device shall be permitted in lieu of lighting outlets.

Exception No. 2: Lighting outlets shall be permitted to be controlled by occupancy sensors that are (1) in addition to listed wall-mounted control devices or (2) located at a customary wall switch location and equipped with a manual override that will allow the sensor to function as a wall switch.

Statement of Problem and Substantiation for Public Input

The parent text uses both terms. Leaving the term "switch" out of 210.79(A)(1) suggests that we must use a listed wall-mounted control device (whatever that might be, as it is an undefined term) and that we can't use a switch. This change makes it clear that either device can be used to control the lighting outlet(s) and provides consistency with the parent text of the section.

Submitter Information Verification

Submitter Full Name: Don Ganiere
Organization: none
Street Address:
City:
State:
Zip:

Submittal Date: Tue Jan 17 13:44:30 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7969-NFPA 70-2024
Statement: The language is revised to align with the parent language to include “wall switch” for consistency and usability.

Public Input No. 1902-NFPA 70-2023 [Section No. 210.70(A)(1)]

(1) Habitable Rooms, Kitchens, Laundry Areas, and Bathrooms.

At least one lighting outlet controlled by a listed wall-mounted control device shall be installed in every habitable room, kitchen, laundry area, and bathroom. The wall-mounted control device shall be located near an entrance to the room on a wall.

Exception No. 1: In other than kitchens, laundry areas, and bathrooms, one or more receptacles controlled by a listed wall-mounted control device shall be permitted in lieu of lighting outlets.

Exception No. 2: Lighting outlets shall be permitted to be controlled by occupancy sensors that are (1) in addition to listed wall-mounted control devices or (2) located at a customary wall switch location and equipped with a manual override that will allow the sensor to function as a wall switch.

Exception No. 3: Lighting outlets for closet type laundry area shall be permitted to be outside the closet to provide adequate illumination.

Statement of Problem and Substantiation for Public Input

This public input is being submitted on behalf of the Minnesota Department of Labor and Industry. Currently, the Department's inspection staff includes 14-office/field staff, 12-state field inspectors, 2-virtual inspectors and 50 plus contract electrical inspectors that complete over 170,000 electrical inspections annually.

Apartments or other dwellings that offer laundry equipment to their tenants within their dwelling unit, may have a very small room or space for the laundry equipment. Having this laundry area light directly outside the room or area will provide adequate lighting without being directly within the room or space.

Submitter Information Verification

Submitter Full Name: Dean Hunter
Organization: Minnesota Department of Labor
Street Address:
City:
State:
Zip:

Submittal Date: Mon Aug 07 13:25:36 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The lighting outlet is to be located to provide illumination within the area.

Public Input No. 2187-NFPA 70-2023 [Section No. 210.70(A)(1)]

(1) Habitable Rooms, Kitchens, Laundry Areas, and Bathrooms.

At least one lighting outlet controlled by a wall switch or listed wall-mounted control device shall be installed in every habitable room, kitchen, laundry area, and bathroom. The wall switch or wall -mounted control device shall be located near an entrance to the room on a wall.

Exception No. 1: In other than kitchens, laundry areas, and bathrooms, one or more receptacles controlled by a wall switch or listed wall-mounted control device shall be permitted in lieu of lighting outlets.

Exception No. 2: Lighting outlets shall be permitted to be controlled by occupancy sensors that are (1) in addition to listed wall-mounted control devices or (2) located at a customary wall switch location and equipped with a manual override that will allow the sensor to function as a wall switch.

Statement of Problem and Substantiation for Public Input

In the 2020 NEC the term 'wall-mounted control device' was introduced because lighting and automation control advanced with technology and provided other options than just a regular wall switch. However, a listed wall-mounted control device is an undefined term in the NEC. Adding "wall switch" to this requirement would make it clear a general-use wall switch is permitted to be used to control the lighting outlet as well as a wall-mounted control device.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:

Submittal Date: Mon Aug 14 13:27:25 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7969-NFPA 70-2024
Statement: The language is revised to align with the parent language to include "wall switch" for consistency and usability.

Public Input No. 2188-NFPA 70-2023 [Section No. 210.70(A)(2)]

(2) Additional Locations.

Additional lighting outlets shall be installed in accordance with the following:

(1) At least one lighting outlet controlled by a wall switch or listed wall-mounted control device shall be installed in hallways, stairways, attached garages, detached garages, and accessory buildings with electric power.

(2) For dwelling units, attached garages, and detached garages with electric power, at least one exterior lighting outlet controlled by a wall switch or listed wall-mounted control device shall be installed to provide illumination on the exterior side of outdoor entrances or exits with grade-level access. A vehicle door in a garage shall not be considered as an outdoor entrance or exit.

Exception to (2): For an outdoor, grade-level bulkhead door with stairway access to a sub-grade-level basement, the required lighting outlet that provides illumination on the stairway steps shall be permitted to be located in the basement interior within 1.5 m (5 ft) horizontally of the bottommost stairway riser. This interior lighting outlet shall be permitted to be controlled by a listed wall-mounted control device or by a unit switch of the interior luminaire or interior lampholder.

(3) Where lighting outlets are installed for an interior stairway with six or more risers between floor levels, there shall be a wall switch or listed wall-mounted control device at each floor level and at each landing level that includes a stairway entry to control the lighting outlets.

Exception to (1), (2), and (3): Remote, central, or automatic control of lighting shall be permitted in hallways, in stairways, and at outdoor entrances.

(4) Dimmer control of lighting outlets installed in accordance with 210.70(A)(2)(3) shall not be permitted unless the listed control devices can provide dimming control to maximum brightness at each control location for the interior stairway illumination.

Statement of Problem and Substantiation for Public Input

In the 2020 NEC the term ‘wall-mounted control device’ was introduced because lighting and automation control advanced with technology and provided other options than just a regular wall switch. However, a listed wall-mounted control device is an undefined term in the NEC. Adding “wall switch” to this requirement would make it clear a general-use wall switch is permitted to be used to control the lighting outlet as well as a wall-mounted control device.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:

Submittal Date: Mon Aug 14 13:31:41 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7974-NFPA 70-2024
Statement: The language is revised to align with the parent language to include “wall switch” for consistency and usability.

Public Input No. 275-NFPA 70-2023 [Section No. 210.70(A)(2)]

(2) Additional Locations.

Additional lighting outlets shall be installed in accordance with the following:

(1) At least one lighting outlet controlled by a listed wall-mounted control device shall be installed in hallways, stairways, attached garages, detached garages, and accessory buildings with electric power.

(2) For dwelling units, attached garages, and detached garages with electric power, at least one exterior lighting outlet controlled by a listed wall-mounted control device shall be installed to provide illumination on the exterior side of outdoor entrances or exits with grade-level access. A vehicle door in a garage shall not be considered as an outdoor entrance or exit.~~Exception to (2):~~

(3) Where lighting outlets are installed for an interior stairway with six or more risers between floor levels, there shall be a listed wall-mounted control device at each floor level and at each landing level that includes a stairway entry to control the lighting outlets.

Exception No. 1 to (1), (2), and (3): Remote, central, or automatic control of lighting shall be permitted in hallways, in stairways, and at outdoor entrances.

Exception No. 2 to (2): For an outdoor, grade-level bulkhead door with stairway access to a sub-grade-level basement, the required lighting outlet that provides illumination on the stairway steps shall be permitted to be located in the basement interior within 1.5 m (5 ft) horizontally of the bottommost stairway riser. This interior lighting outlet shall be permitted to be controlled by a listed wall-mounted control device or by a unit switch of the interior luminaire or interior lampholder.

(4) ~~Where lighting outlets are installed for an interior stairway with six or more risers between floor levels, there shall be a listed wall-mounted control device at each floor level and at each landing level that includes a stairway entry to control the lighting outlets.~~

~~*Exception to (1), (2), and (3): Remote, central, or automatic control of lighting shall be permitted in hallways, in stairways, and at outdoor entrances.*~~

(5) Dimmer control of lighting outlets installed in accordance with 210.70(A)(2)(3) shall not be permitted unless the listed control devices can provide dimming control to maximum brightness at each control location for the interior stairway illumination.

Statement of Problem and Substantiation for Public Input

Although Terraview has made it difficult to see, this PI simply moves the exception to item (2) down and renumbers the exceptions so that both apply to list items (1), (2), and (3). Bulkhead enclosure stairs can have more than six risers, which means an outdoor switch at the top of the stairs would be required. The exception added in 2023 needs to cover items (1), (2), and (3), not just (2).

Submitter Information Verification

Submitter Full Name: Ryan Jackson
Organization: Self-employed
Street Address:
City:
State:
Zip:

Submittal Date: Thu Feb 02 13:53:27 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: The locations of the exceptions are in accordance with the NEC Style Manual.

Public Input No. 2190-NFPA 70-2023 [Section No. 210.70(B)]

(B) Guest Rooms or Guest Suites.

In hotels, motels, or similar occupancies, guest rooms or guest suites shall have at least one lighting outlet controlled by a wall switch or listed wall-mounted control device installed in every habitable room and bathroom.

Exception No. 1: In other than bathrooms and kitchens where provided, one or more receptacles controlled by a wall switch or listed wall-mounted control device shall be permitted in lieu of lighting outlets.

Exception No. 2: Lighting outlets shall be permitted to be controlled by occupancy sensors that are (1) in addition to listed wall-mounted control devices or (2) located at a customary wall switch location and equipped with a manual override that allows the sensor to function as a wall switch.

Statement of Problem and Substantiation for Public Input

In the 2020 NEC the term 'wall-mounted control device' was introduced because lighting and automation control advanced with technology and provided other options than just a regular wall switch. However, a listed wall-mounted control device is an undefined term in the NEC. Adding "wall switch" to this requirement would make it clear a general-use wall switch is permitted to be used to control the lighting outlet as well as a wall-mounted control device.

Submitter Information Verification

Submitter Full Name:	Mike Holt
Organization:	Mike Holt Enterprises Inc
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Aug 14 13:35:13 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: FR-7978-NFPA 70-2024

Statement: The language is revised to align with the parent language to include "wall switch" for consistency and usability.

Public Input No. 1538-NFPA 70-2023 [Section No. 210.70(C)]

(C) All Occupancies.

For attics and underfloor spaces, utility rooms, and basements, at least one lighting outlet containing a switch or controlled by a wall switch or listed wall-mounted control device shall be installed where these spaces are used for storage or contain equipment requiring servicing. A point of control shall be at each entry that permits access to the attic and underfloor space, utility room, or basement. Where a lighting outlet is installed for equipment requiring service, the lighting outlet shall be installed at or near the equipment. <u>Control by automatic means, exclusively, shall not be permitted to control all illumination within attics, underfloor spaces, utility rooms, and basements.</u>

Statement of Problem and Substantiation for Public Input

A motion sensor may not pick up an occupant of a storage or equipment space in all areas of a storage or equipment space. A timer switch could also leave an occupant in stranded in the dark. Like 110.26D, illumination control by automatic means only should not be relied upon.

Submitter Information Verification

Submitter Full Name:	Norman Feck
Organization:	State of Colorado
Affiliation:	self
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Jul 24 17:11:04 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution:	FR-7980-NFPA 70-2024
Statement:	The structure of the section is revised to align with the NEC Style Manual. Item 3 is added to prohibit exclusive automatic control of lighting in these areas because automatic controls could leave an occupant stranded in the dark.

Public Input No. 1086-NFPA 70-2023 [Section No. 210.70 [Excluding any Sub-Sections]]

Lighting outlets shall be installed where specified in 210.70(A), (B), and (C). The switch or wall-mounted control device shall not rely exclusively on a battery unless it is sealed and rated for a minimum of ten years' operation; the control emits a distinctive signal that lasts a minimum of 7 days on incipient battery failure; and a means is provided for automatically energizing the lighting outlets upon battery failure.

Statement of Problem and Substantiation for Public Input

UL 217, 41.5, on smoke alarms that rely on batteries, specifies that a ". . . trouble signal shall persist for at least 7 consecutive days."

Most of the time, a dead smoke alarm will not result in serious injury or death. Most of the time, an inoperable lighting outlet will not, either. Then there are the times when unexpected loss of light is dangerous. There are times, to be sure, when utility power fails. Not only are these quite rare, but occupants tend to be warned before they try going down stairways or taking other potentially hazardous risks. Even so, there are exceptions. There also are times when bulbs burn out. Happily, as we move further from reliance on filamented lamps, sudden darkness due to filament breakage has become much more rare.

If a lighting outlet is suddenly turned on, with the requirement for complete battery failure at least there will have been seven or more days of signal leading to it. I would like the nature of the signal to be specified further, but I'll leave that to others

Submitter Information Verification

Submitter Full Name: David Shapiro
Organization: Safety First Electrical
Street Address:
City:
State:
Zip:

Submittal Date: Wed Jun 14 16:44:24 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7966-NFPA 70-2024

Statement: The exhaustion of a battery in a control device does not pose any greater threat to safe egress than the failure of any other element of a lighting branch circuit such as a failed lamp, loss of utility power, or a tripped circuit breaker. The committee also recognizes that the automatic energization of the lighting could also create a safety issue. Additionally, the need for safe egress lighting falls within the scope of the NFPA 101.

Public Input No. 1833-NFPA 70-2023 [Section No. 210.70 [Excluding any Sub-Sections]]

Lighting outlets shall be installed where specified in 210.70(A), (B), and (C). The ~~switch or~~ switch or wall-mounted control ~~device shall~~ device shall not rely exclusively on a battery unless a means is provided for automatically energizing the lighting outlets upon battery failure, or provides an audible or visual indicator when batteries need replacing .

Statement of Problem and Substantiation for Public Input

This revision is needed because this requirement overly restrictive. Lamps and luminaires burn out too, yet there are no requirements for lamps or luminaries to provide "fail safe" lighting when they fail. Why impose such a restrictive requirement on switch manufacturers but not lamp manufacturers or luminaire manufacturers? Smoke alarms which are life safety devices, typically provide an audible "chirp" when their batteries need to be replaced. I don't think a light switch is any more important than a smoke detector. Perhaps less important. Allowing manufacturers design options similar to smoke alarms and other equipment that provides an indicator of low batteries should be permitted for battery-operated wall switches too.

Submitter Information Verification

Submitter Full Name: Russ Leblanc

Organization: Leblanc Consulting Services

Street Address:

City:

State:

Zip:

Submittal Date: Sun Aug 06 08:55:15 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: FR-7966-NFPA 70-2024

Statement: The exhaustion of a battery in a control device does not pose any greater threat to safe egress than the failure of any other element of a lighting branch circuit such as a failed lamp, loss of utility power, or a tripped circuit breaker. The committee also recognizes that the automatic energization of the lighting could also create a safety issue. Additionally, the need for safe egress lighting falls within the scope of the NFPA 101.

Public Input No. 4286-NFPA 70-2023 [Section No. 210.70 [Excluding any Sub-Sections]]

Lighting outlets shall be installed where specified in 210.70(A), (B), and (C). ~~The switch or wall-mounted control device shall not rely exclusively on a battery unless a means is provided for automatically energizing the lighting outlets upon battery failure.~~

Statement of Problem and Substantiation for Public Input

In the panel statements addressing new language in the 2023 NEC® requiring a lighting outlet to automatically energize when the battery fails in a battery-powered control device, CMP-2 states:

“The committee recognizing the need to support illumination upon failure of the control device powered exclusively by a battery that could impede safe egress. The failure mode of a battery powered device must ensure illumination. A sentence is included to permit battery powered control where the lighting outlets are automatically energized upon battery failure.”

and

“The failure of a lighting controller is a potential hazard and having the controller default to the on position is necessary to support appropriate lighting.”

The need to ensure illumination for safe egress upon failure of a control device or any other component of a lighting branch circuit is outside the scope of CMP-2. The NEC covers emergency systems and illumination in article 700 and does not specify where emergency systems or emergency illumination is required. Informational note 4 in 700.1 clarifies that NFPA 101, Life Safety Code, specifies the locations where emergency lighting is considered essential to life safety. Any decision to introduce requirements for emergency lighting in the locations covered by 210.70 should be carefully considered by the appropriate technical committee(s) of NFPA 101.

Additionally, the new 2023 code language introduces a significant electrical shock hazard. Unexpectedly restoring power to a lighting outlet upon battery failure can create a serious safety hazard when someone is performing electrical work at the lighting outlet. Exposed unterminated ungrounded conductors becoming energized poses a serious risk of electric shock since the person working at the lighting outlet would be unaware of a device battery failure and the power being applied.

This public input to 210.70 deletes the new requirement related to battery-powered control devices and eliminates the electric shock hazard created by a control device unexpectedly energizing a lighting outlet.

Submitter Information Verification

Submitter Full Name: Robert Spehalski
Organization: Lutron Electronics Co., Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 09:26:33 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7966-NFPA 70-2024

Statement: The exhaustion of a battery in a control device does not pose any greater threat to safe egress than the failure of any other element of a lighting branch circuit such as a failed lamp, loss of utility power, or a tripped circuit breaker. The committee also recognizes that the automatic energization of the lighting could also create a safety issue. Additionally, the need for safe egress lighting falls within the scope of the NFPA 101.

Public Input No. 4444-NFPA 70-2023 [Section No. 210.70 [Excluding any Sub-Sections]]

Lighting outlets shall be installed where specified in 210.70(A), (B), and (C). The switch or wall-mounted control device shall not rely exclusively ~~on a battery~~ on battery power unless a positive means is provided ~~for automatically energizing the lighting outlets upon battery failure~~ to give advanced notification of impending battery depletion.

Informational Note: Examples of positive means of battery depletion notification include an audible indicator, a visual indicator, a graphical indicator in an application program that controls the wall-mounted control device, or a combination of these, that provides advance notification of battery depletion and the need for battery replacement .

Statement of Problem and Substantiation for Public Input

If the switch or control in a lighting outlet circuit is visible, and there is no power present at the outlet, a person servicing the lighting outlet circuit may assume the circuit is disconnected. In this situation, unexpectedly energizing the circuit would create an electric shock risk.

This proposed revision addresses safe egress by prohibiting use of a control exclusively powered by a battery, unless the control device gives a positive indication when it is approaching battery exhaustion; similar to what is required of smoke detectors. The proposed revision also eliminates the electric shock hazard created when a control device unexpectedly energizes a lighting outlet while the outlet circuit is being serviced.

Submitter Information Verification

Submitter Full Name: Michael o`boyle
Organization: Signify North America Corp.
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 15:27:42 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7966-NFPA 70-2024

Statement: The exhaustion of a battery in a control device does not pose any greater threat to safe egress than the failure of any other element of a lighting branch circuit such as a failed lamp, loss of utility power, or a tripped circuit breaker. The committee also recognizes that the automatic energization of the lighting could also create a safety issue. Additionally, the need for safe egress lighting falls within the scope of the NFPA 101.

Public Input No. 795-NFPA 70-2023 [Section No. 210.70 [Excluding any Sub-Sections]]

Lighting outlets shall be installed where specified in 210.70(A), (B), and (C). ~~The switch~~ A switch or wall-mounted control ~~device~~ device installed per 210.70(A) , (B), or (C), shall not rely exclusively on a battery for operation unless a means is provided for automatically energizing the lighting outlets upon battery failure.

Statement of Problem and Substantiation for Public Input

Clarification is needed to precisely what switch or wall-mounted control device is being specified in the statement, "The switch or wall mounted control device...". The current wording can be misinterpreted that this requirement applies to all battery-operated switches or wall mounted control devices, not just devices installed in the occupancies covered under 210.70(A)(B), and (C).

Website articles, such as the following, have caused system designers to believe that the requirement under 210.70 apply to all installation types and occupancies.

https://www.enocean-alliance.org/nec-code-updates-make-energy-harvesting-switches-option-wireless-light-control/.

This conclusion of market misinterpretation is based on web based statements such as:

"New updates to the National Electrical Code (NEC) in the USA mean self-powered wireless switches and wall-mounted control devices using standards such as EnOcean are now the only viable wireless switch solution for smart buildings. The new measures, which are designed to ensure the safety of battery-powered switch and wall-mounted control devices in the event of battery failure, require switches and wall-mounted control devices to be permanently connected to a constant power supply. This has effectively rendered obsolete in the USA the vast majority of wireless switches, which are battery powered. Under the 2023 edition of the NEC, switches and wall-mounted control devices can no longer rely exclusively on a battery unless a means is provided for automatically energizing the lighting outlets upon battery failure."

The above publicly-available statement provides a clear example of the need for revised wording.

Submitter Information Verification

Submitter Full Name: Wendy Russell
Organization: Electronic Theatre Controls
Affiliation: U.S. Institute for Theatre Technology
Street Address:
City:
State:
Zip:

Submittal Date: Thu May 11 16:59:35 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7966-NFPA 70-2024

Statement: The exhaustion of a battery in a control device does not pose any greater threat to safe egress than the failure of any other element of a lighting branch circuit such as a failed lamp, loss of utility power, or a tripped circuit breaker. The committee also recognizes that the automatic energization of the lighting could also create a safety issue. Additionally, the need for safe egress lighting falls within the scope of the NFPA 101.

Public Input No. 4294-NFPA 70-2023 [Article 220]

~~**Article 220** Branch-Circuit, Feeder, and Service Load Calculations~~

~~**Part I.** General~~

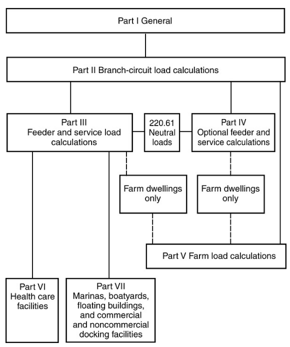
~~**220.1** Scope.~~

~~This article provides requirements for calculating branch-circuit, feeder, and service loads. Part I provides general requirements for calculation methods. Part II provides calculation methods for branch-circuit loads. Part III and Part IV provide calculation methods for feeder and service loads. Part V provides calculation methods for farm loads. Part VI provides calculation methods for health care facilities. Part VII provides calculation methods for marinas, boatyards, floating buildings, and commercial and noncommercial docking facilities.~~

~~Informational Note No. 1: See Informative Annex D for examples.~~

~~Informational Note No. 2: See Informational Note Figure 220.1 for information on the organization of this article.~~

~~**Figure Informational Note Figure 220.1 Branch-Circuit, Feeder, and Service Load Calculation Methods.**~~



~~**220.3** Other Articles for Specific-Purpose Calculations.~~

~~Table 220.3 shall provide references for specific-purpose calculation requirements not located in Chapters 5 , 6 , or 7 that amend or supplement the requirements of this article.~~

~~Table 220.3 Specific-Purpose Calculation References~~

~~Calculation Article Section (or Part) Air-conditioning and refrigerating equipment, branch-circuit conductor sizing 440 Part IV Capacitors 460 460.8 Fixed electric heating equipment for pipelines and vessels, branch-circuit sizing 427 427.4 Fixed electric space-heating equipment, branch-circuit sizing 424 424.3 Fixed outdoor electric deicing and snow-melting equipment, branch-circuit sizing 426 426.4 Fixed resistance and electrode industrial process heating equipment 425 425.4 Motors, feeder demand factor 430 430.26 Motors, multimotor and combination-load equipment 430 430.25 Motors, several motors or a motor(s) and other load(s) 430 430.24 Over 1000-volt ac and 1500-volt dc branch-circuit calculations 235 235.19 Over 1000-volt feeder calculations 215 215.2(B) Phase converters, conductors 455 455.6 Storage-type water heaters 422 422.11~~

~~**220.5** Calculations.~~

~~**(A)** Voltages.~~

~~Unless other voltages are specified, for purposes of calculating branch-circuit and feeder loads, nominal system voltages of 120, 120/240, 208Y/120, 240, 347, 480Y/277, 480, 600Y/347, and 600 volts shall be used.~~

~~**(B)** Fractions of an Ampere.~~

~~Calculations shall be permitted to be rounded to the nearest whole ampere, with decimal fractions smaller than 0.5 dropped.~~

~~**(C)** Floor Area.~~

~~The floor area for each floor shall be calculated from the outside dimensions of the building, dwelling unit, or other area involved. For dwelling units, the calculated floor area shall not include open porches or unfinished areas not adaptable for future use as a habitable room or occupiable space.~~

~~**Part II.** Branch-Circuit Load Calculations~~

~~**220.10** General.~~

~~Branch-circuit loads shall be calculated in accordance with the following sections:~~

(1) ~~220.14 for other loads — all occupancies~~

(2) ~~220.16 for additions to existing installations~~

(3) ~~220.41 for dwelling units~~

(4) ~~220.42 for lighting loads for non-dwelling occupancies~~

(5) ~~220.44 for hotel and motel occupancies~~

~~**220.11** Maximum Load.~~

~~The total load on a branch circuit shall not exceed the rating of the branch circuit nor the maximum loads specified in 220.11(A) through (C) under the conditions specified therein.~~

~~**(A)** Motor-Operated and Combination Loads.~~

~~Where a circuit supplies only motor-operated loads, the conductor sizing requirement specified in 430.22 shall apply. Where a circuit supplies only air-conditioning equipment, refrigerating equipment, or both, the requirements of 440.6 shall apply. For circuits supplying loads consisting of motor-operated utilization equipment that is fastened in place and has a motor larger than 1⁄8 hp in combination with other loads, the total calculated load shall be based on 125 percent of the largest motor load plus the sum of the other loads in accordance with 430.24 .~~

~~**(B)** Inductive and LED Lighting Loads.~~

~~For circuits supplying lighting units that have ballasts, transformers, autotransformers, or LED drivers, the calculated load shall be based on the total ampere ratings of such units and not on the total watts of the lamps.~~

~~**(C)** Electric Cooking Appliances.~~

~~Applying demand factors for ranges, wall-mounted ovens, counter-mounted cooking units, and other household cooking appliance loads in excess of 1 3⁄4 kW shall be permitted in accordance with Table 220.55 , including Notes 4, 5, and 6.~~

~~**220.14** Other Loads — All Occupancies.~~

~~Branch-circuit load calculations shall include calculation of a minimum load on each outlet as calculated in 220.14(A) through (K) and then summed to establish the load on the branch circuit.~~

~~In all occupancies, the minimum load for each outlet for general-use receptacles and outlets not used for general illumination shall not be less than that calculated in 220.14(A) through (K), with the loads shown being based on nominal branch-circuit voltages.~~

~~*Exception: The loads of outlets serving switchboards and switching frames in telephone exchanges shall be waived from the calculations.*~~

~~**(A)** Specific Appliances or Loads.~~

~~An outlet for a specific appliance or other load not covered in 220.14(B) through (K) shall be calculated based on the ampere rating of the appliance or load served.~~

~~**(B)** Electric Dryers and Electric Cooking Appliances in Dwellings and Household Cooking Appliances Used in Instructional Programs.~~

~~Load calculations shall be permitted as specified in 220.54 for electric dryers and in 220.55 for electric ranges and other cooking appliances.~~

~~**(C)** Motor Outlets.~~

~~The conductor sizing requirements specified in 430.22 , 430.24 , and 440.6 shall be used to determine the loads for motor outlets.~~

~~**(D)** Luminaires.~~

~~An outlet supplying a luminaire(s) shall be calculated based on the maximum volt-ampere rating of the equipment and lamps for which the luminaire(s) is rated.~~

~~**(E)** Heavy-Duty Lampholders.~~

~~Outlets for heavy-duty lampholders shall be calculated at a minimum of 600 volt-amperes.~~

~~**(F)** Sign and Outline Lighting.~~

~~Sign and outline lighting outlets shall be calculated at a minimum of 1200 volt-amperes for each required branch circuit specified in 600.5(A) .~~

~~**(G)** Show Windows.~~

~~Show windows shall be calculated in accordance with either of the following:~~

(1) ~~The unit load per outlet as required in other provisions of this section~~

(2) ~~At 200 volt-amperes per linear 300 mm (1 ft) of show window~~

~~**(H)** Fixed Multioutlet Assemblies.~~

~~Fixed multioutlet assemblies used in other than dwelling units or the guest rooms or guest suites of hotels or motels shall be calculated in accordance with the following:~~

(1) ~~Where appliances are unlikely to be used simultaneously, each 1.5 m (5 ft) or fraction thereof of each separate and continuous length shall be considered as one outlet of not less than 180 volt-amperes.~~

(2) ~~Where appliances are likely to be used simultaneously, each 300 mm (1 ft) or fraction thereof shall be considered as an outlet of not less than 180 volt-amperes.~~

~~For the purposes of this section, the calculation shall be permitted to be based on the portion that contains receptacles.~~

~~**(I)** Receptacle Outlets.~~

~~Except as covered in 220.41 and 220.14(J), receptacle outlets shall be calculated at not less than 180 volt-amperes for each single or for each multiple receptacle on one yoke. A single piece of equipment consisting of a multiple receptacle comprised of four or more receptacles shall be calculated at not less than 90 volt-amperes per receptacle. This provision shall not be applicable to the receptacle outlets specified in 210.11(C)(1) and (C)(2).~~

~~**(J)** Receptacle Outlets in Office Buildings.~~

~~In office buildings, the receptacle loads shall be calculated to be the larger of the following:~~

(1) ~~The calculated load from 220.14(I)~~

(2) ~~11 volt-amperes/m ^{2} (1 volt-ampere/ft ^{2})~~

~~**(K)** Other Outlets.~~

~~Other outlets not covered in 220.14(A) through (J) shall be calculated based on 180 volt-amperes per outlet.~~

~~**220.16** Loads for Additions to Existing Installations.~~

~~**(A)** Dwelling Units.~~

~~Loads added to an existing dwelling unit(s) shall comply with the following as applicable:~~

(1) ~~Loads for structural additions to an existing dwelling unit or for a previously unwired portion of an existing dwelling unit shall be calculated in accordance with 220.14 .~~

(2) ~~Loads for new circuits or extended circuits in previously wired dwelling units shall be calculated in accordance with 220.14 .~~

~~**(B)** Other Than Dwelling Units.~~

~~Loads for new circuits or extended circuits in other than dwelling units shall be calculated in accordance with either 220.42 or 220.14 , as applicable.~~

~~**Part III.** Feeder and Service Load Calculations~~

~~**220.40** General.~~

~~The calculated load of a feeder or service shall not be less than the sum of the loads on the branch circuits supplied, as determined by Part II of this article, after any applicable demand factors permitted or required by Part III, IV, V, VI, or VII have been applied.~~

> ~~Informational Note No. 1: See Informative Annex D, Examples D1(a) through D10, for examples of feeder and service load calculations.~~
>
> ~~Informational Note No. 2: See 220.11(B) for the maximum load in amperes permitted for lighting units operating at less than 100 percent power factor.~~

~~**220.41** Dwelling Units, Minimum Unit Load.~~

~~In one-family, two-family, and multifamily dwellings, the minimum unit load shall be not less than 33 volt-amperes/m ^{2} (3 volt-amperes/ft ^{2}).~~

~~Unit loads include the following lighting and receptacle outlets, and no additional load calculations shall be required:~~

(1) ~~All general-use receptacle outlets of 20-ampere rating or less, including receptacles connected to the circuits specified in 210.11(C)(3) and (C)(4)~~

(2) ~~The receptacle outlets specified in 210.52(E) and (G)~~

(3) ~~The lighting outlets specified in 210.70~~

~~The minimum lighting load shall be determined using the minimum unit load and the floor area as determined in 220.5(C) for dwelling occupancies. Motors rated less than $^1/_8$ hp and connected to a lighting circuit shall be considered part of the minimum lighting load.~~

~~**220.42** Lighting Load for Non-Dwelling Occupancies.~~

~~**(A)** General.~~

~~A unit load of not less than that specified in Table 220.42(A) for non-dwelling occupancies and the floor area determined in 220.5(C) shall be used to calculate the minimum lighting load. Motors rated less than $^1/_8$ HP and connected to a lighting~~

circuit shall be considered general lighting load.

Informational Note: The unit values of Table 220.42(A) are based on minimum load conditions and 80 percent power factor and might not provide sufficient capacity for the installation contemplated.

Table 220.42(A) General Lighting Loads by Non-Dwelling Occupancy

Type of Occupancy	Unit Load Volt-amperes/ m^2	Volt-amperes/ ft^2
Automotive facility	16	1.5
Convention center	15	1.4
Courthouse	15	1.4
Dormitory	16	1.5
Exercise center	15	1.4
Fire station	14	1.3
Gymnasium [1]	18	1.7
Health care clinic	17	1.6
Hospital	17	1.6
Hotel or motel, or apartment house without provisions for cooking by tenants [2]	18	1.7
Library	16	1.5
Manufacturing facility [3]	24	2.2
Motion picture theater	17	1.6
Museum	17	1.6
Office [4]	14	1.3
Parking garage [5]	3	0.3
Penitentiary	13	1.2
Performing arts theater	16	1.5
Police station	14	1.3
Post office	17	1.6
Religious facility	24	2.2
Restaurant [6]	16	1.5
Retail [7, 8]	20	1.9
School/university	16	1.5
Sports arena	16	1.5
Town hall	15	1.4
Transportation	13	1.2
Warehouse	13	1.2
Workshop	18	1.7

Note: The 125 percent multiplier for a continuous load as specified in 210.20(A) is included, therefore no additional multiplier shall be required when using the unit loads in this table for calculating the minimum lighting load for a specified occupancy.

[1] Armories and auditoriums are considered gymnasium-type occupancies.

[2] Lodge rooms are similar to hotels and motels.

[3] Industrial commercial loft buildings are considered manufacturing-type occupancies.

[4] Banks are office-type occupancies.

[5] Commercial (storage) garages are considered parking garage occupancies.

[6] Clubs are considered restaurant occupancies.

[7] Barber shops and beauty parlors are considered retail occupancies.

[8] Stores are considered retail occupancies.

(B) Energy Code.

Where the building is designed and constructed to comply with an energy code adopted by the local authority, the lighting load shall be permitted to be calculated using the unit values specified in the energy code where the following conditions are met:

(1) A power monitoring system is installed that will provide continuous information regarding the total general lighting load of the building.

(2) The power monitoring system will be set with alarm values to alert the building owner or manager if the lighting load exceeds the values set by the energy code. Automatic means to take action to reduce the connected load shall be permitted.

(3) The demand factors specified in 220.45 are not applied to the general lighting load.

(4) The continuous load multiplier of 125 percent shall be applied.

220.43 Office Buildings.

In office buildings, the receptacle loads shall be calculated to be the larger of the following:

(1) The calculated load from 220.14(I) after Table 220.47 demand factors have been applied

(2) 11 volt-amperes/m^2 or 1 volt-ampere/ft^2

220.44 Hotel and Motel Occupancies.

In guest rooms or guest suites of hotels and motels, the following lighting and receptacle outlets are included in the minimum unit load in Table 220.42(A), and no additional load calculations shall be required for such outlets:

(1) All general-use receptacle outlets of 20-ampere rating or less, including receptacles connected to the circuits in 210.11(C)(3) and (C)(4)

(2) The receptacle outlets specified in 210.52(E)(3)

(3) The lighting outlets specified in 210.70

220.45 General Lighting.

The demand factors specified in Table 220.45 shall apply to that portion of the total branch-circuit load calculated for general illumination. They shall not be applied in determining the number of branch circuits for general illumination.

Table 220.45 Lighting Load Demand Factors

Type of Occupancy Portion of Lighting Load to Which Demand Factor Applies

~~(Volt-Amperes) Demand~~

~~Factor (%) Dwelling units First 3000 at 100 - From 3001 to 120,000 at 35 - Remainder over 120,000 at 25 Hotels and motels, including apartment houses without provision for cooking by tenants* First 20,000 or less at 60 From 20,001 to 100,000 at 50 Remainder over 100,000 at 35 Warehouses (storage) First 12,500 or less at 100 Remainder over 12,500 at 50 All others Total volt-amperes 100~~

~~*The demand factors of this table shall not apply to the calculated load of feeders or services supplying areas in hotels and motels where the entire lighting is likely to be used at one time, as in ballrooms or dining rooms.~~

~~**220.46** Show-Window and Track Lighting.~~

~~**(A)** Show Windows.~~

~~For show-window lighting, a load of not less than 660 volt-amperes/linear meter or 200 volt-amperes/linear foot shall be included for a show window, measured horizontally along its base.~~

~~Informational Note: See 220.14(G) for branch circuits supplying show windows.~~

~~**(B)** Track Lighting.~~

~~For track lighting in other than dwelling units or guest rooms or guest suites of hotels or motels, an additional load of 150 volt-amperes shall be included for every 600 mm (2 ft) of lighting track or fraction thereof. Where multicircuit track is installed, the load shall be considered to be divided equally between the track circuits.~~

~~*Exception: If the track lighting is supplied through a device that limits the current to the track, the load shall be permitted to be calculated based on the rating of the device used to limit the current.*~~

~~**220.47** Receptacle Loads — Other Than Dwelling Units.~~

~~Receptacle loads calculated in accordance with 220.14(H) and (I) shall be permitted to be made subject to the demand factors given in Table 220.45 or Table 220.47 .~~

~~Table 220.47 Demand Factors for Non-Dwelling Receptacle Loads~~

~~Portion of Receptacle Load to Which Demand Factor Applies (Volt-Amperes) Demand Factor (%) First 10 kVA or less at 100 Remainder over 10 kVA at 50~~

~~**220.50** Motors and Air-Conditioning Equipment.~~

~~**(A)** Motors.~~

~~The conductor sizing requirements specified in 430.24 and 430.25 and the feeder demand factor calculation method specified in 430.26 shall be used to determine motor loads.~~

~~**(B)** Air-Conditioning Equipment.~~

~~The conductor sizing requirements specified in Part IV of Article 440 shall be used to determine air-conditioning loads for hermetic refrigerant motor-compressors.~~

~~**220.51** Fixed Electric Space Heating.~~

~~Fixed electric space-heating loads shall be calculated at 100 percent of the total connected load. However, in no case shall a feeder or service load current rating be less than the rating of the largest branch circuit supplied.~~

~~*Exception: If reduced loading of the conductors results from units operating on duty-cycleor intermittently, or from all units not operating at the same time, the authority having jurisdiction shall be permitted to grant permission for feeder and service conductors to have an ampacity less than 100 percent if the conductors have an ampacity for the load so determined.*~~

~~**220.52** Small-Appliance and Laundry Loads — Dwelling Unit.~~

~~**(A)** Small-Appliance Circuit Load.~~

~~In each dwelling unit, the load shall be calculated at 1500 volt-amperes for each 2-wire small-appliance branch circuit as covered by 210.11(C)(1) . Where the load is subdivided through two or more feeders, the calculated load for each shall include not less than 1500 volt-amperes for each 2-wire small-appliance branch circuit. These loads shall be permitted to be included with the general lighting load and subjected to the demand factors provided in Table 220.45 .~~

~~*Exception: The individual branch circuit permitted by 210.52(B)(1) , Exception No. 2, shall be permitted to be excluded from the calculation required by 220.52 .*~~

~~**(B)** Laundry Circuit Load.~~

~~A load of not less than 1500 volt-amperes shall be included for each 2-wire laundry branch circuit installed as covered by 210.11(C)(2) . This load shall be permitted to be included with the general lighting load and shall be subjected to the demand factors provided in Table 220.45 .~~

~~**220.53** Appliance Load — Dwelling Unit(s).~~

~~Applying a demand factor of 75 percent to the nameplate rating load of four or more appliances rated 1/4 hp or greater, or 500 watts or greater, that are fastened in place, and that are served by the same feeder or service in a one-family, two-family, or multifamily dwelling shall be permitted. This demand factor shall not apply to the following:~~

(1) ~~Household electric cooking equipment that is fastened in place~~

(2) ~~Clothes dryers~~

(3) ~~Space heating equipment~~

(4) ~~Air-conditioning equipment~~

(5) ~~Electric vehicle supply equipment (EVSE)~~

~~**220.54** Electric Clothes Dryers — Dwelling Unit(s).~~

~~The load for household electric clothes dryers in a dwelling unit(s) shall be either 5000 watts (volt-amperes) or the nameplate rating, whichever is larger, for each dryer served. The use of the demand factors in Table 220.54 shall be permitted. Where two or more single-phase dryers are supplied by a 3-phase, 4-wire feeder or service, the total load shall be calculated on the basis of twice the maximum number connected between any two phases. Kilovolt-amperes (kVA) shall be considered equivalent to kilowatts (kW) for loads calculated in this section.~~

~~Table 220.54 Demand Factors for Household Electric Clothes Dryers~~
~~Number of~~

~~Dryers Demand Factor~~

~~(%) 1–4 100 5 85 6 75 7 65 8 60 9 55 10 50 11 47 12–23 47% minus 1% for each dryer exceeding 11 24–42 35% minus 0.5% for each dryer exceeding 23 43 and over 25%~~

~~**220.55** Electric Cooking Appliances in Dwelling Units and Household Cooking Appliances Used in Instructional Programs.~~

~~The load for household electric ranges, wall-mounted ovens, counter-mounted cooking units, and other household cooking appliances individually rated in excess of 1 3/4 kW shall be permitted to be calculated in accordance with Table 220.55 . Kilovolt-amperes (kVA) shall be considered equivalent to kilowatts (kW) for loads calculated under this section.~~

~~Where two or more single-phase ranges are supplied by a 3-phase, 4-wire feeder or service, the total load shall be calculated on the basis of twice the maximum number connected between any two phases.~~

~~Table 220.55 Demand Factors and Loads for Household Electric Ranges, Wall-Mounted Ovens, Counter-Mounted Cooking Units, and Other Household Cooking Appliances over 1 3/4 kW Rating (Column C to be used in all cases except as otherwise permitted in Note 3.)~~
~~Number of Appliances Demand Factor (%) (See Notes) Column C~~

~~Maximum Demand (kW)~~

~~(See Notes)~~

~~(Not over 12 kW Rating) Column A~~

~~(Less than 3 1/2 kW Rating) Column B~~

~~(3 1/2 kW through 8 3/4 kW~~
~~Rating) 1 80 80 8 2 75 65 11 3 70 55 14 4 66 50 17 5 62 45 20 6 59 43 21 7 56 40 22 8 53 36 23 9 51 35 24 10 49 34 25 11 47 32 26 1~~
~~30 30 24 15 kW + 1 kW for each range 31–40 30 22 - 41–50 30 20 25 kW + 3/4 kW for each range 51–60 30 18 - 61 and over 30 16 -~~

~~Notes:~~

~~1. *Over 12 kW through 27 kW ranges all of same rating.* For ranges individually rated more than 12 kW but not more than 27 kW, the maximum demand in Column C shall be increased 5 percent for each additional kilowatt of rating or major fraction thereof by which the rating of individual ranges exceeds 12 kW.~~

~~2. *Over 8 3/4 kW through 27 kW ranges of unequal ratings.* For ranges individually rated more than 8 3/4 kW and of different ratings, but none exceeding 27 kW, an average value of rating shall be calculated by adding together the ratings of all ranges to obtain the total connected load (using 12 kW for any range rated less than 12 kW) and dividing by the total number of ranges. Then the maximum demand in Column C shall be increased 5 percent for each kilowatt or major fraction thereof by which this average value exceeds 12 kW.~~

~~3. *Over 1 3/4 kW through 8 3/4 kW.* In lieu of the method provided in Column C, adding the nameplate ratings of all household cooking appliances rated more than 1 3/4 kW but not more than 8 3/4 kW and multiplying the sum by the demand factors specified in Column A or Column B for the given number of appliances shall be permitted. Where the rating of cooking appliances falls under both Column A and Column B, the demand factors for each column shall be applied to the appliances for that column, and the results added together.~~

~~4. Calculating the branch-circuit load for one range in accordance with Table 220.55 shall be permitted.~~

~~5. The branch-circuit load for one wall-mounted oven or one counter-mounted cooking unit shall be the nameplate rating of the appliance.~~

~~6. The branch-circuit load for a counter-mounted cooking unit and not more than two wall-mounted ovens, all supplied from a single branch circuit and located in the same room, shall be calculated by adding the nameplate rating of the individual appliances and treating this total as equivalent to one range.~~

~~7. This table shall also apply to household cooking appliances rated over 1 3/4 kW and used in instructional programs.~~

~~Informational Note No. 1: See Informative Annex D for examples.~~

~~Informational Note No. 2: See Table 220.56 for demand factors for commercial cooking equipment.~~

~~**220.56** Kitchen Equipment — Other Than Dwelling Unit(s).~~

~~Calculating the load for commercial electric cooking equipment, dishwasher booster heaters, water heaters, and other kitchen equipment in accordance with Table 220.56 shall be permitted. Other kitchen equipment shall include equipment that is fastened in place and rated 1/4 hp or greater, or 500 watts or greater. These demand factors shall be applied to all equipment that has either thermostatic control or intermittent use as kitchen equipment. These demand factors shall not apply to space-heating, ventilating, or air-conditioning equipment.~~

~~However, in no case shall the feeder or service calculated load be less than the sum of the largest two kitchen equipment loads.~~

~~Table 220.56 Demand Factors for Kitchen Equipment — Other Than Dwelling Unit(s)~~

~~Number of Units of Equipment~~	~~Demand Factor (%)~~
~~1~~	~~100~~
~~2~~	~~100~~
~~3~~	~~90~~
~~4~~	~~80~~
~~5~~	~~70~~
~~6 and over~~	~~65~~

~~**220.57** Electric Vehicle Supply Equipment (EVSE) Load.~~

~~The EVSE load shall be calculated at either 7200 watts (volt-amperes) or the nameplate rating of the equipment, whichever is larger.~~

~~**220.60** Noncoincident Loads.~~

~~If it is unlikely that two or more noncoincident loads will be in use simultaneously, using only the largest load(s) that will be used at one time for calculating the total load of a feeder or service shall be permitted. If a motor or air-conditioning load is part of the noncoincident load and is not the largest of the noncoincident loads, 125 percent of either the motor load or air-conditioning load, whichever is larger, shall be used in the calculation.~~

~~**220.61** Feeder or Service Neutral Load.~~

~~**(A)** Basic Calculation.~~

~~The feeder or service neutral load shall be the maximum unbalance of the load determined by this article. The maximum unbalanced load shall be the maximum net calculated load between the neutral conductor and any one ungrounded conductor.~~

~~*Exception: For 3-wire, 2-phase or 5-wire, 2-phase systems, the maximum unbalanced load shall be the maximum net calculated load between the neutral conductor and any one ungrounded conductor multiplied by 140 percent.*~~

~~**(B)** Permitted Reductions.~~

~~A service or feeder supplying the following loads shall be permitted to have an additional demand factor of 70 percent applied to the amount in 220.61(B)(1) and a portion of the amount in 220.61(B)(2) .~~

~~**(1)** Household Electric Ranges, Wall-Mounted Ovens, Counter-Mounted Cooking Units, and Dryers.~~

~~A feeder or service supplying household electric ranges, wall-mounted ovens, counter-mounted cooking units, and electric dryers, where the maximum unbalanced load has been determined in accordance with Table 220.55 for ranges and Table 220.54 for dryers.~~

~~**(2)** Unbalanced Load in Excess of 200 Amperes.~~

~~That portion of the unbalanced load in excess of 200 amperes where the feeder or service is supplied from a 3-wire dc or single-phase ac system; a 4-wire, 3-phase system; a 3-wire, 2-phase system; or a 5-wire, 2-phase system.~~

~~Informational Note: See Informative Annex D, Examples D1(a), D1(b), D2(b), D4(a), and D5(a) for examples of unbalanced feeder or service neutral loads.~~

~~**(C)** Prohibited Reductions.~~

~~There shall be no reduction of the neutral or grounded conductor capacity applied to the amount in 220.61(C)(1) , or portion of the amount in (C)(2), from that determined by the basic calculation:~~

(1) ~~Any portion of a 3-wire circuit consisting of 2 ungrounded conductors and the neutral conductor of a 4-wire, 3-phase, wye-connected system~~

(2) ~~That portion consisting of nonlinear loads supplied from a 4-wire, wye-connected, 3-phase system~~

~~Informational Note: A 3-phase, 4-wire, wye-connected power system used to supply power to nonlinear loads might necessitate that the power system design allows for the possibility of high harmonic neutral conductor currents.~~

~~**220.70** Energy Management Systems (EMSs).~~

~~If an energy management system (EMS) is used to limit the current to a feeder or service in accordance with 750.30 , a single value equal to the maximum ampere setpoint of the EMS shall be permitted to be used in load calculations for the feeder or service.~~

~~The setpoint value of the EMS shall be considered a continuous load for the purposes of load calculations.~~

~~**Part IV.** Optional Feeder and Service Load Calculations~~

~~**220.80** General.~~

~~Optional feeder and service load calculations shall be permitted in accordance with Part IV.~~

~~**220.82** Dwelling Unit.~~

~~**(A)** Feeder and Service Load.~~

~~This section applies to a dwelling unit having the total connected load served by a single 120/240-volt or 208Y/120-volt set of 3-wire service or feeder conductors with an ampacity of 100 or greater. It shall be permissible to calculate the feeder and service loads in accordance with this section instead of the method specified in Part III of this article. The calculated load shall be the result of adding the loads from 220.82(B) and (C). Feeder and service-entrance conductors whose calculated load is determined by this optional calculation shall be permitted to have the neutral load determined by 220.61 .~~

~~**(B)** General Loads.~~

~~The general calculated load shall be not less than 100 percent of the first 10 kVA plus 40 percent of the remainder of the following loads:~~

(1) ~~33 volt-amperes/m ^{2} or 3 volt-amperes/ft ^{2} for general lighting and general-use receptacles. The floor area for each floor shall be calculated from the outside dimensions of the dwelling unit. The calculated floor area shall not include open porches, garages, or unused or unfinished spaces not adaptable for future use.~~

(2) ~~1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2).~~

(3) ~~The nameplate rating of the following:~~

   (4) ~~All appliances that are fastened in place, permanently connected, or located to be on a specific circuit~~

   (5) ~~Ranges, wall-mounted ovens, counter-mounted cooking units~~

   (6) ~~Clothes dryers that are not connected to the laundry branch circuit specified in 220.82(B)(2)~~

   (7) ~~Water heaters~~

(8) ~~The nameplate ampere or kVA rating of all permanently connected motors not included in 220.82(B)(3).~~

~~**(C)** Heating and Air-Conditioning Load.~~

~~The largest of the following six selections (load in kVA) shall be included:~~

(1) ~~100 percent of the nameplate rating(s) of the air conditioning and cooling.~~

(2) ~~100 percent of the nameplate rating(s) of the heat pump when the heat pump is used without any supplemental electric heating.~~

(3) ~~100 percent of the nameplate rating(s) of the heat pump compressor and 65 percent of the supplemental electric heating for central electric space-heating systems. If the heat pump compressor is prevented from operating at the same time as the supplementary heat, it does not need to be added to the supplementary heat for the total central space heating load.~~

(4) ~~65 percent of the nameplate rating(s) of electric space heating if less than four separately controlled units.~~

(5) ~~40 percent of the nameplate rating(s) of electric space heating if four or more separately controlled units.~~

(6) ~~100 percent of the nameplate ratings of electric thermal storage and other heating systems where the usual load is expected to be continuous at the full nameplate value. Systems qualifying under this selection shall not be calculated under any other selection in 220.82(C) .~~

~~**220.83** Existing Dwelling Unit.~~

~~This section shall be permitted to be used to determine if the existing service or feeder is of sufficient capacity to serve additional loads. Where the dwelling unit is served by a 120/240-volt or 208Y/120-volt, 3-wire service or feeder, calculating the total load in accordance with 220.83(A) or (B) shall be permitted.~~

~~**(A)** Where Additional Air-Conditioning Equipment or Electric Space-Heating Equipment Is Not to Be Installed.~~

~~The percentages listed in Table 220.83(A) shall be used for existing and additional new loads.~~

~~Table 220.83(A) Without Additional Air-Conditioning or Electric Space-Heating Equipment~~
~~Load (kVA) Percent of Load First 8 kVA of load at 100 Remainder of load at 40~~

~~Load calculations shall include the following:~~

(1) ~~General lighting and general-use receptacles at 33 volt-amperes/m ^{2} or 3 volt-amperes/ft ^{2} as determined by 220.42~~

(2) ~~1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)~~

(3) ~~The nameplate rating of the following:~~

   (4) ~~All appliances that are fastened in place, permanently connected, or located to be on a specific circuit~~

   (5) ~~Ranges, wall-mounted ovens, counter-mounted cooking units~~

(6) ~~Clothes dryers that are not connected to the laundry branch circuit specified in item (2)~~

(7) ~~Water heaters~~

~~**(B)** Where Additional Air-Conditioning Equipment or Electric Space-Heating Equipment Is to Be Installed.~~

~~The percentages listed in Table 220.83(B) shall be used for existing and additional new loads. The larger connected load of air conditioning or space heating, but not both, shall be used.~~

~~Table 220.83(B) With Additional Air-Conditioning or Electric Space-Heating Equipment~~
~~Load Percent of Load Air-conditioning equipment 100 Central electric space heating 100 Less than four separately~~

~~controlled space-heating units 100 First 8 kVA of all other loads 100 Remainder of all other loads 40~~

~~Other loads shall include the following:~~

(1) ~~General lighting and general-use receptacles at 33 volt-amperes/m ^{2} or 3 volt-amperes/ft ^{2} as determined by 220.42~~

(2) ~~1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)~~

(3) ~~The nameplate rating of the following:~~

(4) ~~All appliances that are fastened in place, permanently connected, or located to be on a specific circuit~~

(5) ~~Ranges, wall-mounted ovens, counter-mounted cooking units~~

(6) ~~Clothes dryers that are not connected to the laundry branch circuit specified in item (2)~~

(7) ~~Water heaters~~

~~**220.84** Multifamily Dwelling.~~

~~**(A)** Feeder or Service Load.~~

~~It shall be permissible to calculate the load of a feeder or service that supplies three or more dwelling units of a multifamily dwelling in accordance with Table 220.84(B) instead of Part III of this article if all the following conditions are met:~~

(1) ~~No dwelling unit is supplied by more than one feeder.~~

(2) ~~Each dwelling unit is equipped with electric cooking equipment.~~

~~*Exception: When the calculated load for multifamily dwellings without electric cooking in Part III of this article exceeds that calculated under Part IV for the identical load plus electric cooking (based on 8 kW per unit), the lesser of the two loads shall be permitted to be used.*~~

(3) ~~Each dwelling unit is equipped with either electric space heating or air conditioning, or both. Feeders and service conductors whose calculated load is determined by this optional calculation shall be permitted to have the neutral load determined by 220.61 .~~

~~**(B)** House Loads.~~

~~House loads shall be calculated in accordance with Part III of this article and shall be in addition to the dwelling unit loads calculated in accordance with Table 220.84(B) .~~

~~Table 220.84(B) Optional Calculations — Demand Factors for Three or More Multifamily Dwelling Units~~
~~Number of~~

~~Dwelling Units Demand Factor~~

~~(%) 3–5 45 6–7 44 8–10 43 11 42 12–13 41 14–15 40 16–17 39 18–20 38 21 37 22–23 36 24–25 35 26–27 34 28–~~

~~30 33 31 32 32–33 31 34–36 30 37–38 29 39–42 28 43–45 27 46–50 26 51–55 25 56–61 24 62 and over 23~~

~~**(C)** Calculated Loads.~~

~~The calculated load to which the demand factors of Table 220.84(B) apply shall include the following:~~

(1) ~~33 volt-amperes/m² or 3 volt-amperes/ft² for general lighting and general-use receptacles~~

(2) ~~1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)~~

(3) ~~The nameplate rating of the following:~~

  (4) ~~All appliances that are fastened in place, permanently connected, or located to be on a specific circuit~~

  (5) ~~Ranges, wall-mounted ovens, counter-mounted cooking units~~

  (6) ~~Clothes dryers that are not connected to the laundry branch circuit specified in item (2)~~

  (7) ~~Water heaters~~

(8) ~~The nameplate ampere or kVA rating of all permanently connected motors not included in item (3)~~

(9) ~~The larger of the air-conditioning load or the fixed electric space-heating load~~

~~**220.85** Two Dwelling Units.~~

~~Where two dwelling units are supplied by a single feeder or service and the calculated load under Part III of this article exceeds that for three identical units calculated under 220.84 , the lesser of the two loads shall be permitted to be used.~~

~~**220.86** Schools.~~

~~The calculation of a feeder or service load for schools shall be permitted in accordance with Table 220.86 in lieu of Part III of this article where equipped with electric space heating, air conditioning, or both. The connected load to which the demand factors of Table 220.86 apply shall include all of the interior and exterior lighting, power, water heating, cooking, other loads, and the larger of the air-conditioning load or space-heating load within the building or structure.~~

~~Feeders and service conductors whose calculated load is determined by this optional calculation shall be permitted to have the neutral load determined by 220.61 . Where the building or structure load is calculated by this optional method, feeders within the building or structure shall have ampacity as permitted in Part III of this article; however, the ampacity of an individual feeder shall not be required to be larger than the ampacity for the entire building.~~

~~This section shall not apply to portable classroom buildings.~~

~~Table 220.86 Optional Method — Demand Factors for Feeders and Service Conductors for Schools~~

~~Connected Load Demand Factor (%) Calculated Loads (VA) Total VA/m² Total VA/ft² 0–33 0–3 100 Amount × 100% Over 33–220 Over 3–20 75 (Amount × 75%) + 3 Remainder over 220 Remainder over 20 25 (Amount × 25%) + 15.75~~

~~**220.87** Determining Existing Loads.~~

~~The calculation of a feeder or service load for existing installations shall be permitted to use actual maximum demand to determine the existing load under all of the following conditions:~~

(1) ~~The maximum demand data is available for a 1-year period.~~

~~*Exception: If the maximum demand data for a 1-year period is not available, the calculated load shall be permitted to be based on the maximum demand (the highest average kilowatts reached and maintained for a 15-minute interval) continuously recorded over a minimum 30-day period using a recording ammeter or power meter connected to the highest loaded phase of the feeder or service, based on the initial loading at the start of the recording. The recording shall reflect the maximum demand of the feeder or service by being taken when the building or space is occupied and shall include by measurement or calculation the larger of the heating or cooling equipment load, and other loads that might be periodic in nature due to seasonal or similar conditions. This exception shall not be permitted if the feeder or service has a renewable energy system (i.e., solar photovoltaic or wind electric) or employs any form of peak load shaving.*~~

(2) ~~The maximum demand at 125 percent plus the new load does not exceed the ampacity of the feeder or rating of the service.~~

(3) ~~The feeder has overcurrent protection in accordance with 240.4 , and the service has overload protection in accordance with 230.90 .~~

~~**220.88** New Restaurants.~~

~~Calculation of a service or feeder load, where the feeder serves the total load, for a new restaurant shall be permitted in accordance with Table 220.88 in lieu of Part III of this article.~~

~~The overload protection of the service conductors shall be in accordance with 230.90 and 240.4 .~~

~~Feeder conductors shall not be required to be of greater ampacity than the service conductors.~~

~~Service or feeder conductors whose calculated load is determined by this optional calculation shall be permitted to have the neutral load determined by 220.61 .~~

~~Table 220.88 Optional Method — Permitted Load Calculations for Service and Feeder Conductors for New Restaurants Total Connected~~

~~Load (kVA) All Electric Restaurant Not All Electric Restaurant Calculated Loads (kVA) Calculated Loads (kVA) 0–200 80% 100% 201–325 10% (amount over 200) + 160.0 50% (amount over 200) + 200.0 326–800 50% (amount over 325) + 172.5 45% (amount over 325) + 262.5 Over 800 50% (amount over 800) + 410.0 20% (amount over 800) + 476.3~~

~~Note: Add all electrical loads, including both heating and cooling loads, to calculate the total connected load. Select the one demand factor that applies from the table, then multiply the total connected load by this single demand factor.~~

~~**Part V.** Farm Load Calculations~~

~~**220.100** General.~~

~~Farm loads shall be calculated in accordance with Part V.~~

~~**220.102** Farm Loads — Buildings and Other Loads.~~

~~**(A)** Dwelling Unit.~~

~~The feeder or service load of a farm dwelling unit shall be calculated in accordance with the provisions for dwellings in Part III or IV of this article. Where the dwelling has electric heat and the farm has electric grain-drying systems, Part IV of this article shall not be used to calculate the dwelling load where the dwelling and farm loads are supplied by a common service.~~

~~**(B)** Other Than Dwelling Unit.~~

~~Where a feeder or service supplies a farm building or other load having two or more separate branch circuits, the load for feeders, service conductors, and service equipment shall be calculated in accordance with demand factors not less than indicated in Table 220.102(B) .~~

~~Table 220.102(B) Method for Calculating Farm Loads for Other Than Dwelling Unit~~

~~Ampere Load at 240 Volts Maximum Demand Factor~~

~~(%) The greater of the following: - All loads that are expected to operate simultaneously, or 100 125 percent of the full load current of the largest motor, or - First 60 amperes of the load - Next 60 amperes of all other loads 50 Remainder of other loads 25~~

~~**220.103** Farm Loads — Total.~~

~~Where supplied by a common service, the total load of the farm for service conductors and service equipment shall be calculated in accordance with the farm dwelling unit load and demand factors specified in Table 220.103 . Where there is equipment in two or more farm equipment buildings or for loads having the same function, such loads shall be calculated in accordance with Table 220.102(B) and shall be permitted to be combined as a single load in Table 220.103 for calculating the total load.~~

~~Table 220.103 Method for Calculating Total Farm Load~~

~~Individual Loads Calculated in Accordance with Table 220.102 Demand Factor~~

~~(%) Largest load 100 Second largest load 75 Third largest load 65 Remaining loads 50~~

~~Note: To this total load, add the load of the farm dwelling unit calculated in accordance with Part III or IV of this article. Where the dwelling has electric heat and the farm has electric grain-drying systems, Part IV of this article shall not be used to calculate the dwelling load.~~

~~**Part VI.** Health Care Facilities~~

~~**220.110** Receptacle Loads.~~

~~Receptacle loads calculated in accordance with 220.14(H) and (I) and supplied by branch circuits not exceeding 150 volts to ground shall be permitted to be subjected to the demand factors provided in Table 220.110(1) and Table 220.110(2) for health care facilities.~~

~~Informational Note No. 1: See Article 100 for the definitions of patient care space categories.~~

~~Informational Note No. 2: See 220.14(I) for the calculation of receptacle outlet loads.~~

~~Table 220.110(1) Demand Factors for Receptacles Supplied by General-Purpose Branch Circuits in Category 1 and Category 2 Patient Care Spaces~~

~~Portion of Receptacle Load to Which Demand Factor Applies (Volt-Amperes) Demand Factor (%) First 5000 or less 100 From 5001 to 10,000 50 - - Remainder over 10,000 25~~

~~Table 220.110(2) Demand Factors for Receptacles Supplied by General-Purpose Branch Circuits in Category 3 and Category 4 Patient Care Spaces~~

~~Portion of Receptacle Load to Which Demand Factor Applies (Volt-Amperes) Demand Factor (%) First 10,000 or less 100 Remainder over 10,000 50~~

~~**Part VII.** Marinas, Boatyards, Floating Buildings, and Commercial and Noncommercial Docking Facilities~~

~~**220.120** Receptacle Loads.~~

~~General lighting and other loads in marinas, boatyards, floating buildings, and commercial and noncommercial docking facilities shall be calculated in accordance with Part III of this article and, in addition, the demand factors set forth in Table 220.120 shall be permitted for each service or feeder circuit supplying receptacles that provide shore power for boats. These calculations shall be permitted to be modified as indicated in Notes (1) and (2) of Table 220.120 . Where demand factors of Table 220.120 are applied, the demand factor specified in 220.61(B) shall not be permitted.~~

~~Informational Note: These demand factors could be inadequate in areas of extreme hot or cold temperatures with loaded circuits for heating, air-conditioning, or refrigerating equipment.~~

~~Table 220.120 Demand Factors for Shore Power Receptacle Loads~~
~~Number of Shore Power Receptacles Sum of the Rating of the Receptacles (%) 1–4 100 5–8 90 9–14 80 15–30 70 31–40 60 41–50 50 51–70 40 ≥71 30~~

~~Notes:~~

~~1. Where shore power accommodations provide two receptacles specifically for an individual boat slip and these receptacles have different voltages (e.g., one 30-ampere, 125-volt and one 50-ampere, 125/250-volt), only the receptacle with the larger kilowatt demand shall be required to be calculated.~~

~~2. For each shore powered pedestal being installed that includes an individual kilowatt-hour submeters for each slip and is being calculated using the criteria listed in Table 220.120, the total demand amperes shall be permitted to be multiplied by 0.9 to achieve the final demand amperes of the facility.~~

~~3. If a circuit feeding a boat hoist and shore power for the same boat slip is shared, only the load with the larger kilowatt demand shall be required to be counted in the load calculation.~~

Statement of Problem and Substantiation for Public Input

The requirements found in the current Article 220 for load calculations applies generally to all installations, and therefore is more appropriately suited for Chapter 1 of the NEC. This PI deletes Article 220 and is accompanied by another PI adding a new Article 120 to Chapter 1.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1604-NFPA 70-2023 [New Article after 210]	
Public Input No. 4329-NFPA 70-2023 [New Article after 220]	
Public Input No. 4334-NFPA 70-2023 [Article 225]	
Public Input No. 1611-NFPA 70-2023 [New Article after 225]	
Public Input No. 1613-NFPA 70-2023 [Article 235]	
Public Input No. 4311-NFPA 70-2023 [New Section after 110.79]	
Public Input No. 1604-NFPA 70-2023 [New Article after 210]	
Public Input No. 1611-NFPA 70-2023 [New Article after 225]	
Public Input No. 1613-NFPA 70-2023 [Article 235]	
Public Input No. 4311-NFPA 70-2023 [New Section after 110.79]	
Public Input No. 4329-NFPA 70-2023 [New Article after 220]	
Public Input No. 4334-NFPA 70-2023 [Article 225]	

Submitter Information Verification

Submitter Full Name: Kyle Krueger
Organization: NECA
Affiliation: NECA
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 09:51:57 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Insufficient substantiation has been provided to move Article 220 to Chapter 1. Chapters 1-4 apply generally to all electrical installations. CMP-2 acknowledges that placement of articles is within the purview of the Correlating Committee. This action represents the recommendation from CMP-2.

Public Input No. 3334-NFPA 70-2023 [New Section after 220.5]

(D) Documentation. Calculations shall be made availble to the Authorty Having Jurisdiction upon request for new installations or upon any modification to the applied load of a system.

Statement of Problem and Substantiation for Public Input

There are multiple circumstances in the NEC that documentation is made a requirement. 110.24, 230.95(C), 240.67(A), 240.86(A), 240.87(A) leap to the front of mind. With the rapid growth of ESS and EVSE installations on existing services a requirement to verify capacity to the AHJ is needed for true due diligence.

Submitter Information Verification

Submitter Full Name: Albin Kneggs
Organization: City of Dallas
Street Address:
City:
State:
Zip:

Submittal Date: Fri Sep 01 11:54:55 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Section 90.4(B) gives the AHJ the responsibility for enforcement of the Code and making interpretations of the rules. As part of these responsibilities, the AHJ may request documentation, such as load calculations.

Public Input No. 4267-NFPA 70-2023 [Section No. 220.5]

220.5 Calculations.

(A) Voltages.

Unless other voltages are specified, for purposes of calculating branch-circuit and feeder loads, nominal system voltages of 120, 120/240, 208Y/120, 240, 347, 480Y/277, 480, 600Y/347, and 600 volts shall be used.

(B) Fractions of an Ampere.

Calculations shall be permitted to be rounded to the nearest whole ampere, with decimal fractions smaller than 0.5 dropped.

(C) Floor Area.

The floor area for each floor shall be calculated from the outside dimensions of the building, dwelling unit, or other area involved. For dwelling units, the calculated floor area shall not include open porches or unfinished areas not adaptable for future use as a habitable room or occupiable space.

(D) Dc Loads.

For dc equipment, volt-amperes (VA) shall be considered equivalent to watts (W), and kilovolt-amperes (kVA) shall be considered equivalent to kilowatts (kW), for loads calculated in this Article.

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee DC Task Group consisting of Danish Zia, Jason Fisher, Randy Dollar, Larry Wildermuth, Scott Higgins, Scott Harding, Mark Earley, Jason Hopkins, Christopher Vance, Chad Kennedy and Derrick Atkins. This Public Input, along with other Public Inputs, was developed with the goal of improving usability and accuracy on requirements associated with DC circuits.

Throughout Article 220 there are requirements for utilizing “volt-ampere” ratings for conducting load calculations. However, DC rated equipment and dc loads are routinely rated in watts (W) and kilowatts (kW). For dc circuits, these are equivalent to volt-amperes (VA) and kilovolt-amperes (kVA), respectively. This new section in Article 220 would recognize the electrical power equivalency and clarify the load calculation rules as applicable to DC rated equipment and loads throughout.

Submitter Information Verification

Submitter Full Name: Danish Zia

Organization: UL Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 09:00:18 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: FR-7991-NFPA 70-2024

Statement: Throughout Article 220 there are requirements for utilizing “volt-ampere” ratings for conducting load calculations. However, dc-rated equipment and dc loads are routinely rated in watts (W) and kilowatts (kW). For dc circuits, these are equivalent to volt-amperes (VA) and kilovolt-amperes (kVA), respectively. This new sub-section for 220.5 recognizes the electrical power equivalency and clarifies the load calculation rules as applicable to DC-rated equipment and loads.

Public Input No. 2916-NFPA 70-2023 [Section No. 220.5(A)]

(A) Voltages.

Unless other voltages are specified, for purposes of calculating branch-circuit and feeder loads, nominal system voltages of 120, 120/240, 208Y/120, 240, 347, 416Y/240, 480Y/277, 480, 600Y/347, and 600 volts shall be used.

Statement of Problem and Substantiation for Public Input

Many industrial and commercial facilities, such as data centers, now use a 416Y/240 volt system. Some manufacturers call this a 415Y/240 volt system, others a 400Y/230 volt system. Adding this as a standard voltage to article 220 will assist users of the code, AHJ's and manufacturers when performing load calculations for these systems.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3131-NFPA 70-2023 [Section No. 645.5(B)]	
Public Input No. 3427-NFPA 70-2023 [Part XIV.]	

Submitter Information Verification

Submitter Full Name: Stephen Schmiechen
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 27 16:08:25 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7992-NFPA 70-2024

Statement: Many industrial and commercial facilities, such as data centers, now use a 416Y/240 volt system. Adding this as a standard voltage to Article 220 assists users of the Code when performing load calculations for these systems.

Public Input No. 3129-NFPA 70-2023 [Section No. 220.5(A)]

(A) Voltages.

Unless other voltages are specified, for purposes of calculating branch-circuit and feeder loads, nominal system voltages of 120, 120/240, 208Y/120, 240, 347, 416Y/240, 480Y/277, 480, 600Y/347, and 600 volts shall be used.

Statement of Problem and Substantiation for Public Input

416Y/240V is an increasingly common voltage system, for example in data centers that supply information technology equipment that requires 240V single phase. As such it deserves the standardization for calculations that inclusion in 220.5(A) would provide.

Submitter Information Verification

Submitter Full Name:	Wayne Whitney
Organization:	[Not Specified]
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Tue Aug 29 14:14:44 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution:	FR-7992-NFPA 70-2024
Statement:	Many industrial and commercial facilities, such as data centers, now use a 416Y/240 volt system. Adding this as a standard voltage to Article 220 assists users of the Code when performing load calculations for these systems.

Public Input No. 1039-NFPA 70-2023 [Section No. 220.5(B)]

~~(B)~~

~~Fractions~~

~~Fractions of an Ampere.~~

~~Calculations shall be permitted to be rounded to the nearest whole ampere, with decimal fractions smaller than 0.5 dropped.~~

Additional Proposed Changes

File Name	Description	Approved
NEC_2026_PI_-_Delete_Art_220.5_B_SIGNED.pdf	PI Form Signed	

Statement of Problem and Substantiation for Public Input

Moving this section to Art 110, will make it apply globally to the NEC and applicable for all articles such as Art 230, 240, 430, 440, 450 etc.
The companion PI to change the wording and add this section to Art 110 can be found in PI 1057-NFPA 70-2023

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1057-NFPA 70-2023 [New Section after 110.3]	
Public Input No. 1057-NFPA 70-2023 [New Section after 110.3]	

Submitter Information Verification

Submitter Full Name: Mark Pisani
Organization: Basf Corporation
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 12 14:20:04 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: This move could have unintended consequences for other Articles in the Code. The relocation (or not) of these requirements to Article 110 (PI 1057) is the decision of CMP 1. CMP 2 can revisit removal of the requirement from Article 220 as a PC, should this be added to Article 110 by CMP 1.

NFPA Public Input Form

NOTE: All Public Input must be received by 5:00 pm EST/EDST on the published Public Input Closing Date.

For further information on the standards-making process, please contact the Codes and Standards Administration at 617-984-7249 or visit www.nfpa.org/codes.

For technical assistance, please call NFPA at 1-800-344-3555

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Log #:

Date Rec'd:

Date **Name** Mark K Pisani **Tel. No.**

Company BASF **Email**

Street Address **City** **State** **Zip**

Please indicate organization represented (if any)

1. (a) Title of NFPA Standard National Electrical Code **NFPA No. & Year** 70-2026

(b) Section/Paragraph 220.5(B)

2. Public Input Recommends (check one): ☐ new text ☐ revised text ☒ deleted text

3. Proposed Text of Public Input (include proposed new or revised wording, or identification of wording to be deleted): [Note: Proposed text should be in legislative format; i.e., use underscore to denote wording to be inserted (inserted wording) and strike-through to denote wording to be deleted (~~deleted wording~~).]

~~B) Fractions of an Ampere.~~
~~Calculations shall be permitted to be rounded to the nearest whole ampere, with decimal fractions smaller than 0.5 dropped~~

4. Statement of Problem and Substantiation for Public Input: (Note: State the problem that would be resolved by your recommendation; give the specific reason for your Public Input, including copies of tests, research papers, fire experience, etc. If more than 200 words, it may be abstracted for publication.)

Moving this section to Art 110, will make it apply globally to the NEC and applicable for all articles such as Art 230, 240, 430, 440, 450 etc.

The companion PI to change the wording and add this section to Art 110 can be found in PI 1052-NFPA 70-2023
The related companion PI to delete the text from Art 220.5(B) is 1039-NFPA 70-2023

5. Copyright Assignment

(a) ☒ **I am the author of the text or other material (such as illustrations, graphs) proposed in the Public Input.**

(b) ☐ **Some or all of the text or other material proposed in this Public Input was not authored by me. Its source is as follows:** (please identify which material and provide complete information on its source)

I hereby grant and assign to the NFPA all and full rights in copyright in this Public Input (including both the Proposed Text and the Statement of Problem and Substantiation). I understand that I acquire no rights in any publication of NFPA in which this Public Input in this or another similar or analogous form is used. Except to the extent that I do not have authority to make an assignment in materials that I have identified in (b) above, I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this assignment.

Signature (Required) Mark K Pisani

PLEASE USE SEPARATE FORM FOR EACH PUBLIC INPUT

To: Secretary, Standards Council National Fire Protection Association
1 Batterymarch Park · Quincy, MA 02169-7471 OR
Fax to: (617) 770-3500 OR Email to: proposals_comments@nfpa.org

6/13/2023

Public Input No. 1514-NFPA 70-2023 [Section No. 220.5(B)]

(B) Fractions of an Ampere.

~~Calculations~~ Load calculations shall be permitted to be rounded to the nearest whole ampere, with decimal fractions smaller than 0.5 dropped.

Statement of Problem and Substantiation for Public Input

This sub-section applies to load calculations since it is in Article 220. Frequently, the allowance to round calculations is applied incorrectly to other calculations such as ampacity and overcurrent protection. The addition of the term "Load" makes the intent of this paragraph more clear as to when rounding up or down is permitted.

Submitter Information Verification

Submitter Full Name: John McCamish
Organization: NECA IBEW Electrical Training
Affiliation: self
Street Address:
City:
State:
Zip:
Submittal Date: Sat Jul 22 18:51:23 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7994-NFPA 70-2024
Statement: Adding the word “Load” provides clarity to this paragraph as to when rounding up or down is permitted.

Public Input No. 1389-NFPA 70-2023 [Section No. 220.5(C)]

(C) Floor Area.

The floor area for each floor shall be calculated from the outside dimensions of the building, dwelling unit, or other area involved. For dwelling units, the calculated floor area shall not include ~~open~~ detached garages, open porches or unfinished areas not adaptable for future use as a habitable room or occupiable space.

Statement of Problem and Substantiation for Public Input

Questions have arisen in educational meetings and on jobsites regarding garage locations. A garage is now required to be included in the dwelling unit floor area calculation. Many believe the floor calculation applies only to a garage attached to a dwelling unit. Others believe a detached garage should be included in the floor area calculation. Adding the text as submitted helps the enforcement community when these situations arise.

Submitter Information Verification

Submitter Full Name: Joseph Wages
Organization: Self
Street Address:
City:
State:
Zip:

Submittal Date: Wed Jul 12 15:14:34 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7995-NFPA 70-2024

Statement: Including “detached garages” to the list of areas not included in floor area calculations clears up the confusion of whether or not to include detached garages. When “garages” were removed from the requirement for the 2023 NEC, the removal of “detached garages” was not identified.

Public Input No. 1763-NFPA 70-2023 [Section No. 220.5(C)]

(C) Floor Area.

The floor area for each floor shall be calculated from the outside dimensions of the building, dwelling unit, or other area involved. For dwelling units, the calculated floor area shall not include detached garages, open porches or unfinished areas not adaptable for future use as a habitable room or occupiable space.

Statement of Problem and Substantiation for Public Input

Questions have arisen in educational meetings and on jobsites regarding garage locations. A garage is now required to be included in the dwelling unit floor area calculation. Many believe the floor calculation applies only to a garage attached to a dwelling unit. Others believe a detached garage should be included in the floor area calculation. Adding the text as submitted helps the enforcement community when these situations arise.

Submitter Information Verification

Submitter Full Name: Rudy Garza
Organization: IAEI
Street Address:
City:
State:
Zip:

Submittal Date: Tue Aug 01 13:52:39 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-7995-NFPA 70-2024

Statement: Including “detached garages” to the list of areas not included in floor area calculations clears up the confusion of whether or not to include detached garages. When “garages” were removed from the requirement for the 2023 NEC, the removal of “detached garages” was not identified.

Public Input No. 3066-NFPA 70-2023 [Section No. 220.5(C)]

(C) Floor Area.

The floor area for each floor shall be calculated from the outside dimensions of the building, dwelling unit, or other area involved. ~~For dwelling units, the calculated floor area shall not include open porches or unfinished areas not adaptable for future use as a habitable room or occupiable space.~~

Statement of Problem and Substantiation for Public Input

Deleting " For dwelling units, the calculated floor area shall not include open porches or unfinished spaces not adaptable for future use as a habitable room or occupiable space." This is a 'judgement' call on what areas to include or not include. Let's make it simple for Code users, just include all areas of a dwelling unit like we do any other occupancy.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:

Submittal Date: Tue Aug 29 10:46:29 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: By removing the text as proposed, areas such as large open porches or other unfinished areas are unnecessarily added to the floor area for load calculations. The addition of these areas is not substantiated.

Public Input No. 596-NFPA 70-2023 [Section No. 220.10]

220.10 General.

Branch-circuit loads shall be calculated in accordance with the following sections:

(1) 220.14 for other loads — all occupancies

(2) 220.16 for additions to existing installations

(3) 220.41(A) for dwelling units

(4) 220.42 for lighting loads for non-dwelling occupancies

(5) 220.44 for hotel and motel occupancies

Statement of Problem and Substantiation for Public Input

Associated change with PI-595-NFPA 70-2023, modifying subsection (A) to reflect moving 220.52 (A) and (B) into 220.41.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 595-NFPA 70-2023 [Section No. 220.41]	

Submitter Information Verification

Submitter Full Name: Steven Worsley

Organization: NECA IBEW Electrical JATC

Street Address:

City:

State:

Zip:

Submittal Date: Fri Apr 14 14:21:55 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: Relocation of these requirements does not improve usability. Multiple sections include requirements for loads in dwelling units, and multiple sections include references to Table 220.45. The suggested change does not accomplish the stated goal of locating all requirements related to dwelling units and referring to Table 220.45, into one Section.

Public Input No. 1739-NFPA 70-2023 [Section No. 220.11]

~~(B)~~

220.11 ~~Maximum Load.~~

~~The total load on a branch circuit shall not exceed the rating of the branch circuit nor the maximum loads specified in 220.11(A) through (C) under the conditions specified therein.~~

~~**(A)** Motor-Operated and Combination Loads.~~

~~Where a circuit supplies only motor-operated loads, the conductor sizing requirement specified in 430.22 shall apply. Where a circuit supplies only air-conditioning equipment, refrigerating equipment, or both, the requirements of 440.6 shall apply. For circuits supplying loads consisting of motor-operated utilization equipment that is fastened in place and has a motor larger than 1/8 hp in combination with other loads, the total calculated load shall be based on 125 percent of the largest motor load plus the sum of the other loads in accordance with 430.24 .~~

Inductive and LED Lighting Loads.

For circuits supplying lighting units that have ballasts, transformers, autotransformers, or LED drivers, the calculated load shall be based on the total ampere ratings of such units and not on the total watts of the lamps.

~~**(C)** Electric Cooking Appliances.~~

~~Applying demand factors for ranges, wall-mounted ovens, counter-mounted cooking units, and other household cooking appliance loads in excess of 1 3/4 kW shall be permitted in accordance with Table 220.55 , including Notes 4, 5, and 6.~~

Statement of Problem and Substantiation for Public Input

This is redundant section in the code. As it states in the wording in (A), go and see the articles for motors in 430.22 and 430.24 and 440.6. Those article section already exists, as with section (C) for Electric cooking equipment to apply the demand factors of table 220.55. Leaving a section for Inductive loads is required to make sure people use the actual input of the ballast, transformer, LED drivers and not the wattage of the lighting lamps.

Submitter Information Verification

Submitter Full Name: IEC National
Organization: IEC
Affiliation: Lowell Reith IEC
Street Address:
City:
State:
Zip:

Submittal Date: Mon Jul 31 14:30:28 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The language was added in the 2023 NEC to specifically address how these loads are used in the calculation of branch circuit loads. The referenced sections are calculations for services and feeders. Refer to 2023, Second Revision No. 8214.

Public Input No. 448-NFPA 70-2023 [New Section after 220.14(E)]

TITLE OF NEW CONTENT

220.14 (E) (F) and (G) shall be calculated as a continuous load {For further information, see 210.21 (A), 600.5 (C)}.

Statement of Problem and Substantiation for Public Input

This same requirement applies to sign circuits and show window lighting as well. 220.14 (F) requires signs to be calculated at a minimum of 1,200VA, but then 600.5 (C) requires it to be considered a continuous load for purposes of calculations. Why does this requirement exist for signs, and not for 220.14 (E) heavy duty lampholders and (G) show windows? 210.21 (A) calls for 750 watts if of any other type than medium base. 750W is 600VA calculated at 125%. 220.14 (E) and (F) should both be required to be calculated as continuous loads, with no other reference requirement to branch circuits to confuse the users. And show windows are a continuous load, but are not required to be calculated as such, for either a service, feeder, or branch circuit. 220.43 (A) applies to feeders, and 220. 14 (G) applies to branch circuits. Trach lighting in 220.43 (B) is not addressed in 220.14, but should also be required to be calculated as a continuous load.

Submitter Information Verification

Submitter Full Name: Chad Privratsky
Organization: CP Energy
Affiliation: IBEW
Street Address:
City:
State:
Zip:
Submittal Date: Mon Mar 13 22:46:39 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Requirements for “Continuous and Non-Continuous Loads” were located in Article 220 in the 1996 and earlier editions of the NEC. For 1999, these requirements were relocated to Articles 210 and 215, as these requirements are associated with the sizing of the conductor and overcurrent device, and not the computation of the load. While some requirements in Article 220 may indicate a multiplier of 125%, it is not the intent to apply the 125% multiplier based on the load being considered “continuous”.

Public Input No. 1505-NFPA 70-2023 [Section No. 220.14(F)]

(F) Sign and Outline Lighting.

Sign and outline lighting outlets shall be calculated at a minimum of 1200 volt-amperes for each required branch circuit specified in 600.5(A).

Exception: When the sign or outlet lighting volt-amperes is know and is less that 1200 volt-amperes, it shall be permissable to use this number in lieu of 1200 volt-amperes for calculation purposes.

Statement of Problem and Substantiation for Public Input

LED signs and lighting continue to reduce the required power that is needed to provide proper load calculations. 600.5 already requires a minimum of a 20a dedicated circuit for these outlets while most signs do not use anywhere near this type of power anymore. Under the current code, we are accounting for at least 10amps on a 120v circuit and even with a new large LED sign, the current draw may only be an amp or 2. I had to design (2) new temporary ground mounted, directional pedestal signs, that were being installed to direct traffic to the emergency room during construction. These 6' high, 4' wide signs pulled 1.3amps and .43 amps @ 120v. I had to add 20amps of calculated load to our 100 amp temporary panel which over loaded this panel from a calcualtions stand point, for permitting. We had to come up with a different solution, when these loads would have been fine to install in our temporary panel. This exception will help electrical designs be more efficient with the use of material by helping reduce load calculations, there for reducing material needed for services sizes and conductors.

Submitter Information Verification

Submitter Full Name:	IEC National
Organization:	IEC
Affiliation:	Jake Gray
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sat Jul 22 11:27:37 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The requirement for a 1200 volt-ampere allocation for signs or outline lighting has been in place for decades and may be considered outdated based on the extensive use of LED technology. CMP-2 made extensive revisions to the table for general lighting loads in 2020 (refer to First Revision No. 8075-NFPA 70-2018) based on “technology enhancements” and data from ASHRAE 90.1 (“Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings”). Consistent with the action taken in 2020, data should be provided to support a reduction in the 1200 volt-ampere value.

Public Input No. 2210-NFPA 70-2023 [Section No. 220.14(H)]

(H) Fixed Multioutlet Assemblies.

Fixed multioutlet assemblies used in other than dwelling units or the guest rooms or guest suites of hotels or motels shall be calculated in accordance with the following:

(1) Where ~~appliances are~~ loads are unlikely to be used simultaneously, each 1.5 m (5 ft) or fraction thereof of each separate and continuous length shall be considered as one outlet of not less than 180 volt-amperes.

(2) Where ~~appliances are~~ loads are likely to be used simultaneously, each 300 mm (1 ft) or fraction thereof shall be considered as an outlet of not less than 180 volt-amperes.

For the purposes of this section, the calculation shall be permitted to be based on the portion that contains receptacles.

Statement of Problem and Substantiation for Public Input

The sections of 220.14 (H) is for other than dwellings units or guest rooms or guest suites of hotels or motels. The word of appliance makes it seem like it is in a dwelling type of location, such as a kitchen. The use of the word load applies to all types of loads that could be plugged into the Fixed Multioutlet Assembly not what is considered to be an appliance.

Submitter Information Verification

Submitter Full Name: IEC National
Organization: IEC
Affiliation: Lowell Reith IEC
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 14 19:28:27 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The term “appliance” is a broad term covering many types of utilization equipment (not just for use in dwelling units) and the proposed term of “load” is not a defined term. To ensure clarity in the requirement, the term “appliance” should be maintained.

Public Input No. 593-NFPA 70-2023 [Section No. 220.14(I)]

(I) Receptacle Outlets.

~~Except as covered in 220.41 and 220.14(J) , receptacle~~ Receptacle outlets shall be calculated at not less than 180 volt-amperes for each single or for each multiple receptacle on one yoke. A single piece of equipment consisting of a multiple receptacle comprised of four or more receptacles shall be calculated at not less than 90 volt-amperes per receptacle. This provision shall not be applicable to the receptacle outlets specified in 210.11(C)(1) and (C)(2).

Statement of Problem and Substantiation for Public Input

I believe the code should be revised to have all receptacles calculated at 180VA, and 220.41 should also be revised to discontinue the ability to put all receptacles in a house on a single branch circuit. This is being done more frequently due to the high cost of the unnecessary arc fault breakers and devices. I also suggest that all requirements for arc fault protection be removed from residential construction. This requirement is just a money grab, and not necessary to protect people if the code is followed otherwise. Limiting receptacles on a circuit by calculating them at 180VA and then following the installation spacing will save home owners money, and still provide protection on not overloading a single circuit, and providing adequate receptacle coverage.

Submitter Information Verification

Submitter Full Name: Dave Magid
Organization: e1
Street Address:
City:
State:
Zip:
Submittal Date: Thu Apr 13 12:57:08 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The change that is proposed in the Public Input is not substantiated. Other statements provided with the substantiation do not have corresponding recommended changes that would address the concerns of the submitter.

Public Input No. 290-NFPA 70-2023 [Section No. 220.14(K)]

(K) Other Outlets.

Other outlets not covered in 220.14(A) through (J) shall be calculated ~~based on~~ at not less than 180 volt-amperes per outlet.

Statement of Problem and Substantiation for Public Input

Loads exist that are not covered by 220.14(A) through 220.14(J) and those loads are often greater than 180 volt-amps per outlet. However, the current wording prohibits calculating those loads at anything other than 180 volt-amps per outlet.

Submitter Information Verification

Submitter Full Name: Jason Rohe
Organization: Schnackel Engineers
Street Address:
City:
State:
Zip:

Submittal Date: Mon Feb 06 15:59:50 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8002-NFPA 70-2024

Statement: Outlets not covered by 220.14(A) through 220.14(J) may include loads that are known to be greater than 180 volt-amps per outlet. The current wording is clarified to indicate that the 180 volt-ampere per outlet is a minimum value.

Public Input No. 4255-NFPA 70-2023 [Section No. 220.14(K)]

(K) Other Outlets.

Other outlets not covered in 220.14(A) through (J) shall be calculated based on 180 volt-amperes per outlet.

Educational Occupancies (Primary and Secondary Schools) Branch circuits outlets to classrooms shall be permitted to be calculated on the basis of 120 volt-amperes per outlet.

Informational Note: The International Building Code defines Educational Group E as an occupancy characterized by the presence of six or more personsat any one time for educational purposes through the 12th grade.

Statement of Problem and Substantiation for Public Input

1. The pandemic has disrupted education communities; perhaps irreversibly. With more instructional activity offloaded onto the internet, less power is required in K-12 classrooms.
2. Phase I of the Fire Protection Research Foundation Study of branch circuit loading identifies the feasibility of this calculation
3. Phase II of a related Fire Protection Research Foundation Study confirms the findings of the Phase I study; though the scope is slightly different
4. My 30 + year career as an electrical engineer at the University of Michigan which had day care and elementary education instructional space supports the reasonableness of this option. There is nothing that stops an electrical engineer from increasing the per outlet minimum where conditions are understood.
5. The Canadian Electrical Code provides flexibility for licensed design professionals to exercise judgement in branch circuit design for all occupancy classes.
6. Light fixtures that require outlets will be replaced by power-over-ethernet lighting
7. Laptop computers require less ampere charging and many of the batteries are charged at home.

For the convenience of the committee the FPRF Report can be found on Pages 658-818 of the 2020 Public Input Report for this committee:

https://www.nfpa.org/assets/files/AboutTheCodes/70/70_A2019_NEC_P02_FD_PISubmittals.pdf

Additionally, Mazzetti Associates has taken a leadership role in rationalizing plug load in hospitals which supports the claim that the NEC 180 VA per outlet rule results in oversizing which degrades premise power chain safety and effiiciency . Here is the link

https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/Electrical/RFElectricCircuitData.pdf

At the very least this section needs to reflect a distinction between K-12 classroom electrical load and electrical load in higher education facility load. As a whole, higher education spaces align more closely with commercial occupancies. The relatively low amount of actual classroom (instructional) space is surprising.

Submitter Information Verification

Submitter Full Name:	Michael Anthony
Organization:	Standards Michigan LLC
Affiliation:	IEEE Education & Healthcare Facilities Committee
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Thu Sep 07 08:20:57 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The use of 180 volt-amps for the load calculation of receptacle outlets for general-use has been in this requirement for many years and is adequate for limiting the number of outlets per circuit. The recommended text identifies grade school buildings as the focus but did not provide substantiation for the suggested 120 volt-amps use. Educational facilities do not warrant a reduction. Building uses can change over time. The substantiation also used the recent pandemic as a reason. While uses of educational facilities may evolve as a result of the pandemic, many primary and secondary schools, which are the focus of the PI, have returned to full-time in person learning. See CMP 2 Committee Statement for 2023 PI 4014. Table 220.47 demand factors for non-dwelling unit receptacle loads may be used for educational occupancies with a 50 percent diversification of loads over 10 kVA.

Public Input No. 4209-NFPA 70-2023 [Section No. 220.16]

220.16 Loads for Additions to Existing Installations.

- ~~Loads for structural additions to an existing dwelling unit or for a previously unwired portion of an existing dwelling unit shall be calculated in accordance with 220.14 .~~

~~Loads for~~

~~**(A)** Dwelling Units.~~

~~Loads added to an existing dwelling unit(s) shall comply with the following as applicable:~~

~~**All l** oads added for structural additions, - new circuits or extended circuits in previously wired or unwired dwelling units shall be calculated in accordance with 220.14 .~~

(B) Other Than Dwelling Units.- ~~Loads for new circuits or extended circuits in other than dwelling units shall be calculated in accordance with either Part III of Article 220 or 220.~~

~~42 or 220.~~

14 , as applicable.

Statement of Problem and Substantiation for Public Input

Subsection 220.16(A) has redundant text. All added loads to a dwelling with regardless of in a new or existing portion of the dwelling, the intend is to provide the rules to calculate and add the load to the dwelling branch circuit and feeders.
Subsection 220.16(B) relates to the calculation on non-dwelling occupancies, the calculation for the feeder for the non-dwelling are located in multiple sections in Part III of Article 220. Proposed text captures the relative sections.

Submitter Information Verification

Submitter Full Name:	Mathher Abbassi
Organization:	Abbassi Electric Corp.
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Wed Sep 06 22:37:33 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The intent of this Public Input is unclear. The submitter is encouraged to submit public comment with additional information on what is being requested.

Public Input No. 827-NFPA 70-2023 [Section No. 220.16(A)]

(A) Dwelling Units.

Loads added to an existing dwelling unit(s) ~~shall comply with the following as applicable: Loads for structural additions to an existing dwelling unit or for a previously unwired portion of an existing dwelling unit shall~~ shall be calculated in accordance with 220.14 .

- ~~Loads for new circuits or extended circuits in previously wired dwelling units shall be calculated in accordance with 220.14 .~~

Statement of Problem and Substantiation for Public Input

There is no reason for this section to have a list if both list items yield the same result.

Submitter Information Verification

Submitter Full Name: Ryan Jackson
Organization: Self-employed
Street Address:
City:
State:
Zip:
Submittal Date: Mon May 15 12:39:49 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8009-NFPA 70-2024
Statement: The requirement is revised for clarity. All of 220.14 should be referenced. With this reference to the entire Section, other requirements referred to in 220.14, such as 220.41 (refer to 220.14(I)) are included.

Public Input No. 915-NFPA 70-2023 [Section No. 220.16(A)]

(A) Dwelling Units.

Loads added to an existing dwelling unit(s) shall comply with the following as applicable:

(1) Loads for structural additions to an existing dwelling unit or for a previously unwired portion of an existing dwelling unit shall be calculated in accordance with 220.~~14~~ 41 .

(2) Loads for new circuits or extended circuits in previously wired dwelling units shall be calculated in accordance with 220.14.

Statement of Problem and Substantiation for Public Input

Dwelling Units minimum unit load requirements were moved from 220.14 to 220.41 in the 2023 NEC. This proposed change reflects to proper reference to 220.41 for dwelling units.

Thank You

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 916-NFPA 70-2023 [Section No. 220.83]	

Submitter Information Verification

Submitter Full Name: Daniel Naughton
Organization: Local 103 IBEW Boston, Ma
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 01 12:09:28 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8009-NFPA 70-2024

Statement: The requirement is revised for clarity. All of 220.14 should be referenced. With this reference to the entire Section, other requirements referred to in 220.14, such as 220.41 (refer to 220.14(I)) are included.

Public Input No. 3236-NFPA 70-2023 [Section No. 220.41]

220.41 Dwelling Units, Minimum Unit Load.

In one-family, two-family, and multifamily dwellings, the minimum unit load shall be not less than either:

(1) 33 volt-amperes/m^2 (3 volt-amperes/ft^2).

(2) *33 volt-amperes/m^2 (3 volt-amperes/ft^2) minus the percent of high-efficacy light sources multiplied by 0.165 volt-amperes/m^2 (0.015 volt-amperes/ft^2) based on either a lighting audit performed in the dwelling unit or on a proposed lighting design.*

Unit loads include the following lighting and receptacle outlets, and no additional load calculations shall be required:

(1) All general-use receptacle outlets of 20-ampere rating or less, including receptacles connected to the circuits specified in 210.11(C)(3) and (C)(4)

(2) The receptacle outlets specified in 210.52(E) and (G)

(3) The lighting outlets specified in 210.70

The minimum lighting load shall be determined using the minimum unit load and the floor area as determined in 220.5(C) for dwelling occupancies. Motors rated less than ⅛ hp and connected to a lighting circuit shall be considered part of the minimum lighting load.

Statement of Problem and Substantiation for Public Input

The current minimum load for general lights and receptacles can substantially over-estimate the unit load when high-efficacy light sources (e.g., LED, CFL) are used throughout the dwelling unit. In new dwelling units, building code requirements for high-efficacy lighting are ubiquitous in the US, leading to reduced lighting loads. In addition, recent rulemaking by the US Department of Energy (DOE) also impacts the lighting density in both new and existing US dwellings. Beginning July 2023, the sale of any general service lamp (GSL) that does not meet a minimum efficacy standard of 45 lumens per watt is prohibited in the US (10 CFR 430.32(dd)). This rulemaking will drastically reduce the ongoing lighting density in new and existing US dwellings. This new federal regulation paired with the results presented below from occupied US dwellings provides a strong case for allowing a reduction in the general receptacles and lighting assumption for both new and existing dwelling service and feeder load calculations.

A currently unpublished report from LBNL funded by the US DOE reports on sub-metering in 896 occupied US dwellings. In this report, median general lights and receptacles power density was 2.3 watts/ft2, though a substantial minority of existing dwellings exceeded the threshold. The same report also analyzed lighting audit data from 2,053 existing dwellings from the NEEA RBSA (2016) field study in Pacific Northwest dwellings. Overall, the median installed lighting energy density was 1.03 watts per ft2. The lighting density was strongly dependent on the fraction of high-efficacy light sources. The median fraction of efficient lighting in the NEEA RBSA data was 53% of the installed bulbs. We found that for each percent of light sources that were high efficacy, the installed lighting density was reduced by 0.0158 watts/ft2. Based on this observed relationship, we propose adding an optional method to reduce the general lights and general receptacle loads by 0.015 watts/ft2 times the percentage of high-efficacy fixtures observed in an audit or in a proposed lighting design. Based on this approach, a dwelling with 100% efficient lighting sources would have a general lights and general receptacles load of 1.5 watts/ft2 (3-100*0.015). A dwelling with 50% efficient light sources would have 2.25 watts/ft2 (3-50*0.015). And a dwelling with 0% efficient light sources would maintain the 3 watts/ft2 value.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3028-NFPA 70-2023 [Section No. 220.83]	Contains same proposal for lighting density reductions
Public Input No. 3319-NFPA 70-2023 [Section No. 220.83]	Contains same proposal for lighting density reductions
Public Input No. 3239-NFPA 70-2023 [Section No. 220.82(B)]	Contains same proposal for lighting density reductions
Public Input No. 3242-NFPA 70-2023 [Section No. 220.84(C)]	Contains same proposal for lighting density reductions
Public Input No. 3028-NFPA 70-2023 [Section No. 220.83]	
Public Input No. 3239-NFPA 70-2023 [Section No. 220.82(B)]	
Public Input No. 3242-NFPA 70-2023 [Section No. 220.84(C)]	
Public Input No. 3319-NFPA 70-2023 [Section No. 220.83]	

Submitter Information Verification

Submitter Full Name: Brennan Less
Organization: LBNL
Street Address:
City:
State:

Zip:
Submittal Date: Wed Aug 30 15:56:53 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8013-NFPA 70-2024

Statement: The minimum load for general lights and receptacles over-estimates the load when high-efficacy light sources (e.g., LED, CFL) are used. In new dwelling units, building code requirements for high-efficacy lighting are ubiquitous in the US. In addition, recent rulemaking by the US Department of Energy (DOE) prohibits the sale of any general service lamp (GSL) that does not meet a minimum efficacy standard of 45 lumens per watt (10 CFR 430.32(dd)). This rulemaking effectively prohibits the sale of all incandescent and halogen GSL in the US.

Lawrence Berkely National Lab (LBNL) has recently reported on sub-metering in 896 occupied US dwellings showing median general lights and receptacle density of 2.3 watts/ft2, including dwellings with a variety of lighting types. Similarly, LBNL reported on lighting audit data from 2,053 existing dwellings in the Pacific Northwest. The installed lighting density was strongly dependent on the fraction of LED/CFL light sources, with an observed reduction in lighting density of 0.015 va/ft2 for each percent of LED or CFL light sources in the dwelling. 100% CFL or LED lighting reduced lighting density by 1.5 va/ft2.

The new value of 2 va/ft2 assumes approx. 80% LED or CFL lighting in the dwelling (3 va/ft2 – 0.80*0.012). Note -– The 0.015 va/ft2 from LBNL is reduced in this calculation to 0.012 va/ft2 using an 80% power factor (this is consistent with treatment of lighting loads in Table 220.42(A)).

In order to avoid impacting (reducing) the number of branch circuits serving general lights and receptacles in dwellings, 220.10 is also revised to reference a new section 220.13. This new section, located in Part II of the article, maintains branch circuit calculations at the current value of 3 va/ft2.

220.83 Existing Dwelling Unit. This section shall be permitted to be used to determine if the existing service or feeder is of sufficient capacity to serve additional loads. Where the dwelling unit is served by a 120/240-volt or by a 208Y/120-volt 3-wire service or feeder, calculating the total load in accordance with 220.83~~(A) or (B)~~ shall be permitted. The percentages listed in Table 220.83 shall be used for existing and additional new loads. The larger connected load of air-conditioning or space heating, but not both, shall be used. Noncoincident loads shall be treated in accordance with 220.60. Loads controlled by an EMS shall be treated in accordance with 220.70. Existing dwelling unit loads based on metered data shall be in accordance with 220.87.

~~(A) **Where Additional Air-Conditioning Equipment or Electric Space-Heating Equipment Is Not to Be Installed**. The percentages listed in Table 220.83(A) shall be used for existing and additional new loads.~~

Load calculations shall include the following:

1. General lighting and general-use receptacles at either of the following:
    a. 33 volt-amperes/m² or 3 volt-amperes/ft² as determined by 220.42.
    ~~1.~~b. 33 volt-amperes/m² or 3 volt-amperes/ft² minus the percent of high-efficacy light sources multiplied by 0.165 volt-amperes/m² or 0.015 volt-amperes/ft² based either on a lighting audit performed in the dwelling unit or on a proposed lighting design.
2. 1500 volt-amperes for each 2-wire, 20-ampere small appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2).
3. The nameplate rating of the following:
    a. All appliances that are fastened in place, permanently connected, or located to be on a specific circuit
    b. Ranges, wall-mounted ovens, counter-mounted cooking units
    c. Clothes dryers that are not connected to the laundry branch circuit specified in item (2)
    d. Water heaters
    e. Electric Vehicle Power Transfer System Equipment supplied by an individual branch circuit
    ~~d.~~f. Energy Storage System as configured during charging from the electric utility

~~(B) **Where Additional Air-Conditioning Equipment or Electric Space-Heating Equipment is To Be Installed**. The percentages listed in Table 220.83(B) shall be used for existing and additional new loads. The larger connected load of air-conditioning or space heating, but not both, shall be used.~~

~~Other loads shall include the following:~~

~~1. General lighting and general-use receptacles at 33 volt-amperes/m² or 3 volt-amperes/ft² as determined by 220.42.~~

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2. ~~1500 volt-amperes for each 2-wire, 20-ampere small appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2).~~
3. ~~The nameplate rating of the following:~~
    a. ~~All appliances that are fastened in place, permanently connected, or located to be on a specific circuit~~
    b. ~~Ranges, wall-mounted ovens, counter-mounted cooking units~~
    c. ~~Clothes dryers that are not connected to the laundry branch circuit specified in item (2)~~
    d. ~~Water heaters~~

Table 220.83 Existing Dwelling Unit Load Percentages

Load (kVA)	**Percent of Load**
First 8 kVA of existing and new load at	100
Remainder of existing load at	40
New Electric Vehicle Power Transfer System Equipment or Energy Storage System	80
New central electric resistance space heating	80
All other new loads	50

~~*Table 220.83(A) Without Additional Air-Conditioning or Electric Space-Heating Equipment*~~

~~**Load (kVA)**~~	~~**Percent of Load**~~
~~First 8 kVA of load at~~	~~100~~
~~Remainder of load at~~	~~40~~

~~*Table 220.83(B) With Additional Air-Conditioning or Electric Space-Heating Equipment*~~

~~**Load (kVA)**~~	~~**Percent of Load**~~
~~Air-conditioning equipment~~	~~100~~
~~Central electric space heating~~	~~100~~
~~Less than four separately controlled space-heating units~~	~~100~~
~~First 8 kVA of load at~~	~~100~~
~~Remainder of load at~~	~~40~~

220.83 Existing Dwelling Unit. This section shall be permitted to be used to determine if the existing service or feeder is of sufficient capacity to serve additional loads. Where the dwelling unit is served by a 120/240-volt or by a 208Y/120-volt 3-wire service or feeder, calculating the total load in accordance with 220.83 shall be permitted. The percentages listed in Table 220.83 shall be used for existing and additional new loads. The larger connected load of air-conditioning or space heating, but not both, shall be used. Noncoincident loads shall be treated in accordance with 220.60. Loads controlled by an EMS shall be treated in accordance with 220.70. Existing dwelling unit loads based on metered data shall be in accordance with 220.87.

Load calculations shall include the following:

1. General lighting and general-use receptacles at either of the following:
    a. 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 as determined by 220.42.
    b. 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 minus the percent of high-efficacy light sources multiplied by 0.165 volt-amperes/m^2 or 0.015 volt-amperes/ft^2 based either on a lighting audit performed in the dwelling unit or on a proposed lighting design.
2. 1500 volt-amperes for each 2-wire, 20-ampere small appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2).
3. The nameplate rating of the following:
    a. All appliances that are fastened in place, permanently connected, or located to be on a specific circuit
    b. Ranges, wall-mounted ovens, counter-mounted cooking units
    c. Clothes dryers that are not connected to the laundry branch circuit specified in item (2)
    d. Water heaters
    e. Electric Vehicle Power Transfer System Equipment supplied by an individual branch circuit
    f. Energy Storage System as configured during charging from the electric utility

Table 220.83 Existing Dwelling Unit Load Percentages

Load (kVA)	**Percent of Load**
First 8 kVA of existing and new load at	100
Remainder of existing load at	40
New Electric Vehicle Power Transfer System Equipment or Energy Storage System	80
New central electric resistance space heating	80
All other new loads	50

Public Input No. 595-NFPA 70-2023 [Section No. 220.41]

220.41 Dwelling Units~~.~~ .

(A) Minimum Unit Load.

In one-family, two-family, and multifamily dwellings, the minimum unit load shall be not less than 33 volt-amperes/m^2 (3 volt-amperes/ft^2).

Unit loads include the following lighting and receptacle outlets, and no additional load calculations shall be required:

(1) All general-use receptacle outlets of 20-ampere rating or less, including receptacles connected to the circuits specified in 210.11(C)(3) and (C)(4)

(2) The receptacle outlets specified in 210.52(E) and (G)

(3) The lighting outlets specified in 210.70

The minimum lighting load shall be determined using the minimum unit load and the floor area as determined in 220.5(C) for dwelling occupancies. Motors rated less than ⅛ hp and connected to a lighting circuit shall be considered part of the minimum lighting load.

(B) Small-Appliance Circuit Load.

In each dwelling unit, the load shall be calculated at 1500 volt-amperes for each 2-wire small-appliance branch circuit as covered by 210.11(C)(1). Where the load is subdivided through two or more feeders, the calculated load for each shall include not less than 1500 volt-amperes for each 2-wire small-appliance branch circuit. These loads shall be permitted to be included with the general lighting load and subjected to the demand factors provided in Table 220.45.

(C) Laundry Circuit Load.

A load of not less than 1500 volt-amperes shall be included for each 2-wire laundry branch circuit installed as covered in 210.11(C)(2). This load shall be permitted to be included with the general lighting load and subjected to the demand factors provided in Table 220.45.

Statement of Problem and Substantiation for Public Input

The demand factors associated with dwelling unit, specifically those that are required or permitted to be subject to Table 220.54, are spread across multiple sections. With the movement of 220.14(J) from the 2020 NEC to 220.41 in the 2023 code, there now exist multiple sections in Part III for dwelling unit loads that are subject to, or permitted to be subject to, the demand factors described in 220.45. This change would bring those calculations under one section, minimizing confusion.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 596-NFPA 70-2023 [Section No. 220.10]	Adjusts language in 220.10 to reflect modification of existing language in 220.41 to 220.41(A).

Submitter Information Verification

Submitter Full Name: Steven Worsley
Organization: NECA IBEW Electrical JATC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Apr 14 14:08:56 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Relocation of these requirements does not improve usability. Multiple sections include requirements for loads in dwelling units, and multiple sections include references to Table 220.45. The suggested change does not accomplish the stated goal of locating all requirements related to dwelling units and referring to Table 220.45, into one Section.

Public Input No. 1946-NFPA 70-2023 [Section No. 220.47]

220.47 Receptacle Loads — Other Than Dwelling Units.

Receptacle loads calculated in accordance with 220.14(H) and (I) shall be permitted to be made subject to the demand factors given in Table 220.45 or Table 220.47. Table 220.47 demand factors shall not be permitted for receptacles that supply a continuous load(s).

Table 220.47 Demand Factors for Non-Dwelling Receptacle Loads

Portion of Receptacle Load to Which Demand Factor Applies (Volt-Amperes)	Demand Factor (%)
First 10 kVA or less at	100
Remainder over 10 kVA at	50

Statement of Problem and Substantiation for Public Input

220.47 and Table 220.47 add clarity that the demand factor table is not applicable to receptacles that supply a continuous load(s). Continuous loads influence the size of conductors, overcurrent devices, etc. Receptacles connected to a continuous load should not be included in the demand factor calculations.

Submitter Information Verification

Submitter Full Name: Gary Hein
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 08 12:27:10 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: A load that operates continuously impacts the size of conductors and size of the overcurrent devices, but not the computation of the load. Demand factors for receptacle loads are not intended to be impacted by whether or not a load is continuous.

Public Input No. 2629-NFPA 70-2023 [Section No. 220.50(B)]

(B) Air-Conditioning Equipment.

The conductor sizing requirements specified in ~~Part IV of~~ Article 440, Part IV shall be used to determine air-conditioning loads for hermetic refrigerant motor-compressors.

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.
4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 23 21:22:05 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8021-NFPA 70-2024
Statement: The text is reformatted to comply with Section 4.1.4 of the NEC Style Manual.

Public Input No. 4361-NFPA 70-2023 [Section No. 220.51]

220.51 Fixed Electric Space Heating.

Fixed central electric resistance space-heating loads shall be calculated at 100 percent of the total connected load. ~~However, in~~ Fixed heat pump space-heating loads shall be calculated at 75% of the total connected load. Fixed room electric resistance space heating loads shall be calculated at 30 percent of the total connected load. In no case shall a feeder or service load current rating be less than the rating of the largest branch circuit supplied.

Exception: If reduced loading of the conductors results from units operating on duty-cycleor intermittently, or from all units not operating at the same time, the authority having jurisdiction shall be permitted to grant permission for feeder and service conductors to have an ampacity less than 100 percent if the conductors have an ampacity for the load so determined.

Statement of Problem and Substantiation for Public Input

Based on soon to be published analysis of sub-metering end-use data in 953 occupied US dwellings, we observed the following median demand factors for existing space heating loads in dwellings:

Central Electric Resistance Heating (n=81), 95%
Central Heat Pump (n=550), 72%
Room Heating (n=198), 1% (mean of 31%)

The current code does not differentiate between types of fixed electric space heating equipment. Consistent with these findings, we propose differentiating between the following: central electric resistance space heating, heat pump space heating, and room electric resistance space heating. These loads have very distinct nameplate ratings and demand factors. The assumptions used in 220.51 should be aligned with those elsewhere in section 220, for example, in proposed 220.82(C).

Note: the demand factors reported above are very conservative, because they are based on the maximum demand observed for the load over 15-minute time-steps, not on the nameplate rating. The nameplate rating(s) will always be higher than observed. Where nameplate rating(s) were known, we found they were typically 20% higher than the observed maximum demand. If the nameplate rating(s) were known, the reported demand factors would be further reduced.

Submitter Information Verification

Submitter Full Name: Brennan Less
Organization: LBNL
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 12:47:29 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The substantiation includes normal operating conditions and average demand factors; it may not take into account abnormal operating conditions and maximum demand factors. A significant reduction in demand factors could result in operation of overcurrent protection at expected operating conditions, such as from a power outage. Comparisons between application of existing requirements with the proposed requirements would be useful in understanding the impact(s) of the proposed changes.

Public Input No. 1581-NFPA 70-2023 [New Section after 220.52]

TITLE OF NEW CONTENT

Type your content here ...

220.52 (C) - A load of not less than 1500 volt-amperes shall be included for each 2-wire bathroom branch circuit installed as covered by 210.11(C)(3). This load shall be permitted to be included with the general lighting load and shall be subjected to the demand factors provided by Table 220.45.

Statement of Problem and Substantiation for Public Input

I feel 220.52 should be a mirror image of the requirements we have in Article 210.11 (C) 1-3. When we look at 220.52, there is (A) - Small Appliance Circuit Load and (B) - Laundry Circuit Load. I feel we should add a (C) to match Article 210.11 (C) 1-3. Anymore there is just as much current draw on a bathroom circuit as there is in a kitchen or laundry.

Submitter Information Verification

Submitter Full Name: Michael McLaughlin
Organization: Iowa Central Community College
Affiliation: International Association of Electrical Inspectors - Iowa Chapter
Street Address:
City:
State:
Zip:

Submittal Date: Wed Jul 26 10:02:14 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: While it could certainly be true that there could be loads similar to kitchen and laundry rooms used in a bathroom, there is not enough information provided by the submitter to understand if there is a true need to add to the additional load to the service and feeder calculations.

Public Input No. 4144-NFPA 70-2023 [Section No. 220.53]

220.53 Appliance Load — Dwelling Unit(s).

Applying a demand factor of ~~75 percent~~ 30 percent to the nameplate rating load of ~~four or more~~ appliances rated ¼ hp or greater, or 500 watts or greater, that are fastened in place, and that are served by the same feeder or service in a one-family, two-family, or multifamily dwelling shall be permitted. This demand factor shall not apply to the following:

(1) Household electric cooking equipment that is fastened in place

(2) Clothes dryers

(3) Space heating equipment

(4) Air-conditioning equipment

(5) Electric vehicle supply equipment (EVSE)

Statement of Problem and Substantiation for Public Input

Based on soon to be published analysis of sub-metering end-use data in 953 occupied US dwellings, we observed the following average demand factors for existing loads:

Hot tub (n=65), 34%
Pumps (n=107), 27%
Refrigerator/Freezer (n=708), 20%
Laundry plugs (n=92), 14%
Dishwasher (n=637), 13%
Clothes Washer (n=517), 12%
Kitchen plugs (n=1,063), 8%
Garbage Disposal (n=314), 5%

Consistent with these findings, we propose treatment of appliance loads at 30% with no minimum number of loads required for applying the demand factors. Household appliances operated by occupants were amongst the load types with the lowest demand factors.

Note: the demand factors reported above are very conservative, because they are based on the maximum demand observed for the load over 15-minute time-steps, not on the nameplate rating. The nameplate rating(s) will always be higher than observed. Where nameplate rating(s) were known, we found they were typically 20% higher than the observed maximum demand. If the nameplate rating(s) were known, the reported demand factors would be further reduced.

Submitter Information Verification

Submitter Full Name:	Brennan Less
Organization:	LBNL
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Wed Sep 06 18:41:33 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The substantiation includes normal operating conditions and average demand factors; it may not take into account abnormal operating conditions, maximum demand factors, start-up current after a power outage, and normal motor in-rush current. A significant reduction in demand factors could result in operation of overcurrent protection at expected operating conditions, such as from a power outage. Comparisons between application of existing requirements with the proposed requirements would be useful in understanding the impact(s) of the proposed changes. Based upon a more detailed demand study, consideration should be given to whether a reduction from 75 percent to 30 percent is warranted.

Public Input No. 4220-NFPA 70-2023 [Section No. 220.53]

220.53 Appliance Load — Dwelling Unit(s).

Applying a demand factor of 75 percent to the nameplate rating load of four or more appliances rated ¼ hp or greater, or 500 watts or greater, that are fastened in place, and that are served by the same feeder or service in a one-family, two-family, or multifamily dwelling shall be permitted. This demand factor shall not apply to the following:

(1) Household electric cooking equipment that is fastened in place

(2) Clothes dryers

(3) Space heating equipment

(4) Air-conditioning equipment

~~Electric~~

Informational Note: Electric vehicle supply equipment (EVSE) is not defined as an appliance and is not subject to the appliance load demand factor.

Statement of Problem and Substantiation for Public Input

Electric vehicle supply equipment (EVSE) goes not fit the definition of an appliance since it is not a utilization equipment. EVSE is equipment that supplies power to Electric Vehicle (utilization equipment) and located in Chapter 6 under special equipment. If the intent is to clarify that EVSE is not subject for the appliance load, then that is clarified by the informational note.

Submitter Information Verification

Submitter Full Name: Mathher Abbassi
Organization: Abbassi Electric Corp.
Street Address:
City:
State:
Zip:

Submittal Date: Wed Sep 06 23:18:40 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: It is yet to be determined whether EVSE's are considered an appliance. Accordingly, inclusion in the list ensures proper application of the requirement. For reference of the requested requirement, see 625.42 for ratings.

Public Input No. 1948-NFPA 70-2023 [Section No. 220.54]

220.54 Electric Clothes Dryers — Dwelling Unit(s).

The load for household electric clothes dryers in a dwelling unit(s) shall be either 5000 watts (volt-amperes) or the nameplate rating, whichever is larger, for each dryer served. The use of the demand factors in Table 220.54 shall be permitted. Where ~~two or~~ four or more single-phase dryers are supplied by a 3-phase, 4-wire feeder or service, the total load shall be calculated on the basis of twice the maximum number connected between any two phases. Kilovolt-amperes (kVA) shall be considered equivalent to kilowatts (kW) for loads calculated in this section.

Table 220.54 Demand Factors for Household Electric Clothes Dryers

Number of Dryers	Demand Factor (%)
1–4	100
5	85
6	75
7	65
8	60
9	55
10	50
11	47
12–23	47% minus 1% for each dryer exceeding 11
24–42	35% minus 0.5% for each dryer exceeding 23
43 and over	25%

Statement of Problem and Substantiation for Public Input

220.54 Change the two or more single phase dryers that are connected to a 3-phase, 4-wire feeder or service to 4 or more. There is no gain/loss by using less than 4 dryers when applying the Table 220.54 demand factors. With three dryers there will be one dryer connected between any two phases. When four single phase dryers are installed, there will be a maximum of two dryers connected between any two phases.

Submitter Information Verification

Submitter Full Name: Gary Hein
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 08 12:51:12 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The longstanding rule for both dryers and ranges (RE: 220.55) has been the two or more units, as presently stated. Balancing between phases becomes an option as soon as you have more than one unit. With two units, you can choose to apply one per phase or two per phase, but if two are applied per phase, the adder is necessary, unless the two loads are balanced, which is encouraged by the existing rule.

Public Input No. 3651-NFPA 70-2023 [Section No. 220.54]

220.54 Electric Clothes Dryers — Dwelling Unit(s).

(A) Demand Factor. The load for household electric clothes dryers in a dwelling unit(s) shall be either 5000 watts (volt-amperes) or the nameplate rating, whichever is larger, for each dryer served. The use of the demand factors in Table 220.54(A) shall be permitted.

(B) 3-Phase, 4-Wire Feeder or Service. Where two or more single-phase dryers are supplied by a 3-phase, 4-wire feeder or service, the total load shall be calculated on the basis of twice the maximum number connected between any two phases. Kilovolt-amperes (kVA) shall be considered equivalent to kilowatts (kW) for loads calculated in this section.

Table 220.~~54 Demand~~ 54(A) Demand Factors for Household Electric Clothes Dryers

Number of Dryers	Demand Factor (%)
1–4	100
5	85
6	75
7	65
8	60
9	55
10	50
11	47
12–23	47% minus 1% for each dryer exceeding 11
24–42	35% minus 0.5% for each dryer exceeding 23
43 and over	25%

Statement of Problem and Substantiation for Public Input

Breaking up 220.54 into a list item format to facilitate understanding for Code users. In accordance with NFPA Style Manual section 3.5.1.2 additional subdivisions shall be used where multiple requirements can be broken into independent requirements.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 05 12:15:29 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The requirements are clear as written.

Public Input No. 4151-NFPA 70-2023 [Section No. 220.54]

220.54 Electric Clothes Dryers — Dwelling Unit(s).

The load for household electric resistance or heat pump clothes dryers in a dwelling unit(s) shall be either 5000 watts (volt-amperes) or the nameplate rating, ~~whichever is larger, for~~ if available, for each dryer served. The use of the demand factors in Table 220.54 shall be permitted. Where two or more single-phase dryers are supplied by a 3-phase, 4-wire feeder or service, the total load shall be calculated on the basis of twice the maximum number connected between any two phases. Kilovolt-amperes (kVA) shall be considered equivalent to kilowatts (kW) for loads calculated in this section.

Table 220.54 Demand Factors for Household Electric Clothes Dryers

Number of Dryers	Demand Factor (%)
~~1–4~~ 1–5	~~100~~ 80
~~5~~	~~85~~
6	75
7	65
8	60
9	55
10	50
11	47
12–23	47% minus 1% for each dryer exceeding 11
24–42	35% minus 0.5% for each dryer exceeding 23
43 and over	25%

Statement of Problem and Substantiation for Public Input

Based on soon to be published analysis of sub-metering end-use data in 953 occupied US dwellings, we observed the following average demand factors for existing electric resistance clothes dryers:

Clothes Dryer (resistance) (n=574), mean of 64% demand factor (median of 77%)

Consistent with these findings, we propose treatment of clothes dryer loads at 80% for each of up to the first five clothes dryers connected to a service or feeder.

We also propose use of nameplate ratings for clothes driers if they are available. This is particularly important for newer technologies, such as heat pump clothes dryers, which have much lower electrical requirements than standard electric resistance units. A minimum load of 5 kW is a substantial over-estimate for these low-power, smaller clothes dryers.

Note: the demand factors reported above are very conservative, because they are based on the maximum demand observed for the load over 15-minute time-steps, not on the nameplate rating. The nameplate rating(s) will always be higher than observed. Where nameplate rating(s) were known, we found they were typically 20% higher than the observed maximum demand. If the nameplate rating(s) were known, the reported demand factors would be further reduced.

Submitter Information Verification

Submitter Full Name: Brennan Less
Organization: LBNL
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 06 18:53:26 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8044-NFPA 70-2024

Statement: The demand factor for clothes dryers is revised. The value of 80% is based on analysis shared by Lawrence Berkely National Lab (LBNL) of sub-metering end-use data in 953 occupied US dwellings. LBNL observed the following median demand factors for electric resistance clothes dryers: Clothes Dryer (resistance) (n=574), mean of 64% demand factor (median of 77%).

Public Input No. 463-NFPA 70-2023 [Section No. 220.54]

220.54 Electric Clothes Dryers ~~— Dwelling~~ In Dwelling Unit(s).

The load for household electric clothes dryers in a dwelling unit(s) shall be either 5000 watts (volt-amperes) or the nameplate rating, whichever is larger, for each dryer served. The use of the demand factors in Table 220.54 shall be permitted. Where two or more single-phase dryers are supplied by a 3-phase, 4-wire feeder or service, the total load shall be calculated on the basis of twice the maximum number connected between any two phases. Kilovolt-amperes (kVA) shall be considered equivalent to kilowatts (kW) for loads calculated in this section.

Table 220.54 Demand Factors for Household Electric Clothes Dryers

Number of Dryers	Demand Factor (%)
1–4	100
5	85
6	75
7	65
8	60
9	55
10	50
11	47
12–23	47% minus 1% for each dryer exceeding 11
24–42	35% minus 0.5% for each dryer exceeding 23
43 and over	25%

Statement of Problem and Substantiation for Public Input

Clarify that all of 220.54 applies only to electric clothes dryers in dwelling units. As it currently stands, it is possible to read the second sentence of 220.54, which refers to the demand factors in Table 220.54, as applying to any use of electric clothes dryers adjacent to dwelling units, e.g. a common laundry room in an apartment building.

Also, this adjustment of language matches the wording in the heading of 220.55.

Submitter Information Verification

Submitter Full Name: Wayne Whitney
Organization: [Not Specified]
Street Address:
City:
State:
Zip:

Submittal Date: Wed Mar 15 12:28:32 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The title of this Section is consistent with other Sections in Article 220 regarding the use of the term “Dwelling” (and not including the phrase “In Dwelling”). The first sentence in 220.54 explains that the requirement applies to “…clothes dryers in a dwelling unit(s)…”.

Public Input No. 1056-NFPA 70-2023 [Section No. 220.55]

220.55 Electric Cooking Appliances in Dwelling Units and Household Cooking Appliances Used in Instructional Programs.

The load for household electric ranges, wall-mounted ovens, counter-mounted cooking units, and other household cooking appliances individually rated in excess of 1¾ kW shall be permitted to be calculated in accordance with Table 220.55. Kilovolt-amperes (kVA) shall be considered equivalent to kilowatts (kW) for loads calculated under this section.

Where two or more single-phase ranges are supplied by a 3-phase, 4-wire feeder or service, the total load shall be calculated on the basis of twice the maximum number connected between any two phases.

Table 220.55 Demand Factors and Loads for Household Electric Ranges, Wall-Mounted Ovens, Counter-Mounted Cooking Units, and Other Household Cooking Appliances over 1¾ kW Rating (Column C to be used in all cases except as otherwise permitted in Note 3.)

Number of Appliances	Demand Factor (%) (See Notes)		Column C Maximum Demand (kW) (See Notes) (Not over 12 kW Rating)
	Column A (Less than 3½ kW Rating)	Column B (3½ kW through 8¾ kW Rating)	
1	80	80	8
2	75	65	11
3	70	55	14
4	66	50	17
5	62	45	20
6	59	43	21
7	56	40	22
8	53	36	23
9	51	35	24
10	49	34	25
11	47	32	26
12	45	32	27
13	43	32	28
14	41	32	29
15	40	32	30
16	39	28	31
17	38	28	32
18	37	28	33
19	36	28	34
20	35	28	35
21	34	26	36
22	33	26	37
23	32	26	38
24	31	26	39
25	30	26	40
26–30	30	24	15 kW + 1 kW for each range
31–40	30	22	-
41–50	30	20	25 kW + ¾ kW for each range
51–60	30	18	-
61 and over	30	16	-

Notes:

1. *Over 12 kW through 27 kW ranges all of same rating.* For ranges individually rated more than 12 kW but not more than 27 kW, the maximum demand in Column C shall be increased 5 percent for each additional kilowatt of rating or major fraction thereof by which the rating of individual ranges exceeds 12 kW.

2. *Over 8¾ kW through 27 kW ranges of unequal ratings.* For ranges individually rated more than 8¾ kW and of different ratings, but none exceeding 27 kW, an average value of rating shall be calculated by adding together the ratings of all ranges to obtain the total connected load (using 12 kW for any range rated less than 12 kW) and dividing by the total number of ranges. Then the maximum demand in Column C shall be increased 5 percent for each kilowatt or major fraction thereof by which this average value exceeds 12 kW.

3. *Over 1¾ kW through 8¾ kW.* In lieu of the method provided in Column C, adding the nameplate ratings of all household cooking appliances rated more than 1¾ kW but not more than 8¾ kW and multiplying the sum by the demand factors specified in Column A or Column B for the given number of appliances shall be permitted. Where the rating of cooking appliances falls under both Column A and Column B, the demand factors for each column shall be applied to the appliances for that column, and the results added together. It shall be permissable to use the lower of the (2) total values.

4. Calculating the branch-circuit load for one range in accordance with Table 220.55 shall be permitted.

5. The branch-circuit load for one wall-mounted oven or one counter-mounted cooking unit shall be the nameplate rating of the appliance.

6. The branch-circuit load for a counter-mounted cooking unit and not more than two wall-mounted ovens, all supplied from a single branch circuit and located in the same room, shall be calculated by adding the nameplate rating of the individual appliances and treating this total as equivalent to one range.

7. This table shall also apply to household cooking appliances rated over 1¾ kW and used in instructional programs.

Informational Note No. 1: See Informative Annex D for examples.

Informational Note No. 2: See Table 220.56 for demand factors for commercial cooking equipment.

Statement of Problem and Substantiation for Public Input

Note 3 allows a calculation in lieu of column C, but then never actually permits the use of the smaller value. In other areas of the code where 2 calculations are allowed to be compared, the code permits the "lower value" to be used, or you are instructed to use the "larger value" (ie 220.12 (K). I think this should be clarified and all assumptions removed.

Submitter Information Verification

Submitter Full Name: Chad Privratsky
Organization: IBEW 280
Street Address:
City:
State:
Zip:

Submittal Date: Mon Jun 12 21:20:33 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Note 3 provides a method in lieu of that in Column C (as stated in the Title of Table 220.55 – “Column C to be used in all cases except as other permitted in Note 3”). If opting to use the provision in Note 3, a calculation is based on the demand factors in Columns A or B, as appropriate (based on the kW rating of the appliances). Adding the statement, as proposed, would create confusion, as it would imply that Note 3 method isn’t an option (i.e., permissive rule), but a mandatory rule.

Public Input No. 3652-NFPA 70-2023 [Section No. 220.55]

220.55 Electric Cooking Appliances in Dwelling Units and Household Cooking Appliances Used in Instructional Programs.

(A) Demand Factor. The load for household electric ranges, wall-mounted ovens, counter-mounted cooking units, and other household cooking appliances individually rated in excess of 1¾ kW shall be permitted to be calculated in accordance with Table 220.55(A) . Kilovolt-amperes (kVA) shall be considered equivalent to kilowatts (kW) for loads calculated under this section.

(B) 3-Phase, 4-Wire Feeder or Service. Where two or more single-phase ranges are supplied by a 3-phase, 4-wire feeder or service, the total load shall be calculated on the basis of twice the maximum number connected between any two phases.

Table 220.~~55 Demand~~ 55(A) Demand Factors and Loads for Household Electric Ranges, Wall-Mounted Ovens, Counter-Mounted Cooking Units, and Other Household Cooking Appliances over 1¾ kW Rating (Column C to be used in all cases except as otherwise permitted in Note 3.)

Number of Appliances	**Demand Factor (%) (See Notes)**		**Column C Maximum Demand (kW) (See Notes) (Not over 12 kW Rating)**
	Column A (Less than 3½ kW Rating)	**Column B (3½ kW through 8¾ kW Rating)**	
1	80	80	8
2	75	65	11
3	70	55	14
4	66	50	17
5	62	45	20
6	59	43	21
7	56	40	22
8	53	36	23
9	51	35	24
10	49	34	25
11	47	32	26
12	45	32	27
13	43	32	28
14	41	32	29
15	40	32	30
16	39	28	31
17	38	28	32
18	37	28	33
19	36	28	34
20	35	28	35
21	34	26	36
22	33	26	37
23	32	26	38
24	31	26	39
25	30	26	40
26–30	30	24	15 kW + 1 kW for each range
31–40	30	22	-
41–50	30	20	25 kW + ¾ kW for each range
51–60	30	18	-
61 and over	30	16	-

Notes:

1. *Over 12 kW through 27 kW ranges all of same rating.* For ranges individually rated more than 12 kW but not more than 27 kW, the maximum demand in Column C shall be increased 5 percent for each additional kilowatt of rating or major fraction thereof by which the rating of individual ranges exceeds 12 kW.

2. *Over 8¾ kW through 27 kW ranges of unequal ratings.* For ranges individually rated more than 8¾ kW and of different ratings, but none exceeding 27 kW, an average value of rating shall be calculated by adding together the ratings of all ranges to obtain the total connected load (using 12 kW for any range rated less than 12 kW) and dividing by the total number of ranges. Then the maximum demand in Column C shall be increased 5 percent for each kilowatt or major fraction thereof by which this average value exceeds 12 kW.

3. *Over 1¾ kW through 8¾ kW.* In lieu of the method provided in Column C, adding the nameplate ratings of all household cooking appliances rated more than 1¾ kW but not more than 8¾ kW and multiplying the sum by the demand factors specified in Column A or Column B for the given number of appliances shall be permitted. Where the rating of cooking appliances falls under both Column A and Column B, the demand factors for each column shall be applied to the appliances for that column, and the results added together.

4. Calculating the branch-circuit load for one range in accordance with Table 220.55 shall be permitted.

5. The branch-circuit load for one wall-mounted oven or one counter-mounted cooking unit shall be the nameplate rating of the appliance.

6. The branch-circuit load for a counter-mounted cooking unit and not more than two wall-mounted ovens, all supplied from a single branch circuit and located in the same room, shall be calculated by adding the nameplate rating of the individual appliances and treating this total as equivalent to one range.

7. This table shall also apply to household cooking appliances rated over 1¾ kW and used in instructional programs.

Informational Note No. 1: See Informative Annex D for examples.

Informational Note No. 2: See Table 220.56 for demand factors for commercial cooking equipment.

Statement of Problem and Substantiation for Public Input

Breaking up 220.55 into a list item format to facilitate understanding for Code users. In accordance with NFPA Style Manual section 3.5.1.2 additional subdivisions shall be used where multiple requirements can be broken into independent requirements.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Tue Sep 05 12:18:19 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: The requirements are clear as written.

Public Input No. 4160-NFPA 70-2023 [Section No. 220.55]

220.55 Electric Cooking Appliances in Dwelling Units and Household Cooking Appliances Used in Instructional Programs.

The load for household electric ranges, wall-mounted ovens, counter-mounted cooking units, and other household cooking appliances individually rated in excess of 1¾ kW shall be permitted to be calculated in accordance with Table 220.55. Kilovolt-amperes (kVA) shall be considered equivalent to kilowatts (kW) for loads calculated under this section.

Where two or more single-phase ranges are supplied by a 3-phase, 4-wire feeder or service, the total load shall be calculated on the basis of twice the maximum number connected between any two phases.

Table 220.55 Demand Factors and Loads for Household Electric Ranges, Wall-Mounted Ovens, Counter-Mounted Cooking Units, and Other Household Cooking Appliances over 1¾ kW Rating (Column C to be used in all cases except as otherwise permitted in Note 3.)

~~66~~

Number of Appliances	**Demand Factor (%) (See Notes)** Column A (Less than 3½ kW Rating)	**Demand Factor (%) (See Notes)** Column B (3½ kW through 8¾ kW Rating)	**Column C** Maximum Demand (kW) (See Notes) (Not over 12 kW Rating)
1	~~80~~	~~80~~	~~8~~
~~2~~	~~75~~	~~65~~	~~11~~
~~3~~	~~70~~	~~55~~	~~14~~
~~4~~	-4	50	50 17
5	~~62~~ 50	45	20
6	~~59~~ 50	43	21
7	~~56~~ 50	40	22
8	~~53~~ 50	36	23
9	~~51~~ 50	35	24
10	49	34	25
11	47	32	26
12	45	32	27
13	43	32	28
14	41	32	29
15	40	32	30
16	39	28	31
17	38	28	32
18	37	28	33
19	36	28	34
20	35	28	35
21	34	26	36
22	33	26	37
23	32	26	38
24	31	26	39
25	30	26	40
26–30	30	24	15 kW + 1 kW for each range
31–40	30	22	-
41–50	30	20	25 kW + ¾ kW for each range
51–60	30	18	-
61 and over	30	16	-

Notes:

1. *Over 12 kW through 27 kW ranges all of same rating.* For ranges individually rated more than 12 kW but not more than 27 kW, the maximum demand in Column C shall be increased 5 percent for each additional kilowatt of rating or major fraction thereof by which the rating of individual ranges exceeds 12 kW.

2. *Over 8¾ kW through 27 kW ranges of unequal ratings.* For ranges individually rated more than 8¾ kW and of different ratings, but none exceeding 27 kW, an average value of rating shall be calculated by adding together the ratings of all ranges to obtain the total connected load (using 12 kW for any range rated less than 12 kW) and dividing by the total number of ranges. Then the maximum demand in Column C shall be increased 5 percent for each kilowatt or major fraction thereof by which this average value exceeds 12 kW.

3. *Over 1¾ kW through 8¾ kW.* In lieu of the method provided in Column C, adding the nameplate ratings of all household cooking appliances rated more than 1¾ kW but not more than 8¾ kW and multiplying the sum by the demand factors specified in Column A or Column B for the given number of appliances shall be permitted. Where the rating of cooking appliances falls under both Column A and Column B, the demand factors for each column shall be applied to the appliances for that column, and the results added together.

4. Calculating the branch-circuit load for one range in accordance with Table 220.55 shall be permitted.

5. The branch-circuit load for one wall-mounted oven or one counter-mounted cooking unit shall be the nameplate rating of the appliance.

6. The branch-circuit load for a counter-mounted cooking unit and not more than two wall-mounted ovens, all supplied from a single branch circuit and located in the same room, shall be calculated by adding the nameplate rating of the individual appliances and treating this total as equivalent to one range.

7. This table shall also apply to household cooking appliances rated over 1¾ kW and used in instructional programs.

Informational Note No. 1: See Informative Annex D for examples.

Informational Note No. 2: See Table 220.56 for demand factors for commercial cooking equipment.

Statement of Problem and Substantiation for Public Input

Based on soon to be published analysis of sub-metering end-use data in 953 occupied US dwellings, we observed the following average demand factors for electric cooking appliances:

Stove/Oven/Range (n=644), 28%
Microwave (n=404), 8%
Kitchen plugs (n=1,063), 8%

Cooking appliances had very low demand factors across the population of dwellings analyzed. Consistent with these findings, we propose a conservative treatment of electric cooking loads at 50% with no minimum number of loads required for applying the demand factors.

Note: the demand factors reported above are very conservative, because they are based on the maximum demand observed for the load over 15-minute time-steps, not on the nameplate rating. The nameplate rating(s) will always be higher than observed. Where nameplate rating(s) were known, we found they were typically 20% higher than the observed maximum demand. If the nameplate rating(s) were known, the reported demand factors would be further reduced.

Submitter Information Verification

Submitter Full Name: Brennan Less
Organization: LBNL
Street Address:
City:
State:
Zip:

Submittal Date: Wed Sep 06 19:07:47 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The substantiation includes normal operating conditions and average demand factors; it may not take into account abnormal operating conditions, maximum demand factors, start-up current after a power outage, and normal motor in-rush current. A significant reduction in demand factors could result in operation of overcurrent protection at expected operating conditions, such as from a power outage. Comparisons between application of existing requirements with the proposed requirements would be useful in understanding the impact(s) of the proposed changes. CMP-2 is seeking additional information on how this would impact the overall system within single-family, two-family, and multi-family dwellings.

Public Input No. 432-NFPA 70-2023 [Section No. 220.55]

220.55 Electric Cooking Appliances in Dwelling Units and Household Cooking Appliances Used in Instructional Programs.

The load for household electric ranges, wall-mounted ovens, counter-mounted cooking units, and other household cooking appliances individually rated in excess of 1¾ kW shall be permitted to be calculated in accordance with Table 220.55. Kilovolt-amperes (kVA) shall be considered equivalent to kilowatts (kW) for loads calculated under this section.

Where two or more single-phase ranges are supplied by a 3-phase, 4-wire feeder or service, the total load shall be calculated on the basis of twice the maximum number connected between any two phases.

Table 220.55 Demand Factors and Loads for Household Electric Ranges, Wall-Mounted Ovens, Counter-Mounted Cooking Units, and Other Household Cooking Appliances over 1¾ kW Rating (Column C to be used in all cases except as otherwise permitted in Note 3.)

Number of Appliances	Demand Factor (%) (See Notes)		Column C Maximum Demand (kW) (See Notes) (Not over 12 kW Rating)
	Column A (Less than 3½ kW Rating)	Column B (3½ kW through 8¾ kW Rating)	
1	80	80	8
2	75	65	11
3	70	55	14
4	66	50	17
5	62	45	20
6	59	43	21
7	56	40	22
8	53	36	23
9	51	35	24
10	49	34	25
11	47	32	26
12	45	32	27
13	43	32	28
14	41	32	29
15	40	32	30
16	39	28	31
17	38	28	32
18	37	28	33
19	36	28	34
20	35	28	35
21	34	26	36
22	33	26	37
23	32	26	38
24	31	26	39
25	30	26	40
26–30	30	24	15 kW + 1 kW for each range
31–40	30	22	-
41–50	30	20	25 kW + ¾ kW for each range
51–60	30	18	-
61 and over	30	16	-

Notes:

1. *Over 12 kW through 27 kW ranges all of same rating.* For ranges individually rated more than 12 kW but not more than 27 kW, the maximum demand in Column C shall be increased 5 percent for each additional kilowatt of rating or major fraction thereof by which the rating of individual ranges exceeds 12 kW.

2. *Over 8¾ kW through 27 kW ranges of unequal ratings.* For ranges individually rated more than 8¾ kW and of different ratings, but none exceeding 27 kW, an average value of rating shall be calculated by adding together the ratings of all ranges to obtain the total connected load (using 12 kW for any range rated less than 12 kW) and dividing by the total number of ranges. Then the maximum demand in Column C shall be increased 5 percent for each kilowatt or major fraction thereof by which this average value exceeds 12 kW.

3. *Over 1¾ kW through 8¾ kW.* ~~In lieu of the method provided in Column C, adding the~~ For ranges rated more than 1 3/4 kW but not more than 3 3/4 kW, add the nameplate ratings of all household cooking appliances rated more than 1¾ kW but not more than 8¾ kW and multiplying the sum by the demand factors specified in Column A or Column B for the given number of appliances shall be permitted. Where the rating of cooking appliances falls under both Column A and Column B, the demand factors for each column shall be applied to the appliances for that column, and the results added together.

4. Calculating the branch-circuit load for one range in accordance with Table 220.55 shall be permitted.

5. The branch-circuit load for one wall-mounted oven or one counter-mounted cooking unit shall be the nameplate rating of the appliance.

6. The branch-circuit load for a counter-mounted cooking unit and not more than two wall-mounted ovens, all supplied from a single branch circuit and located in the same room, shall be calculated by adding the nameplate rating of the individual appliances and treating this total as equivalent to one range.

7. This table shall also apply to household cooking appliances rated over 1¾ kW and used in instructional programs.

Informational Note No. 1: See Informative Annex D for examples.

Informational Note No. 2: See Table 220.56 for demand factors for commercial cooking equipment.

Statement of Problem and Substantiation for Public Input

Note 3 concerns column A and B. There is no need to say "In lieu of..."
I used the wording that is at the beginning of notes 1 and 2 to create a parallel structure.

Submitter Information Verification

Submitter Full Name:	Eric Stromberg
Organization:	Los Alamos National Laboratory
Affiliation:	Self
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sun Mar 05 11:31:18 EST 2023
Committee:	NEC-P02

Committee Statement

Resolution: Note 3 provides a method in lieu of that in Column C (as stated in the Title of Table 220.55 – “Column C to be used in all cases except as other permitted in Note 3”). The wording in Note 3 is consistent with the Title of the table and conveys the correct usage of Columns A and B.

Public Input No. 1005-NFPA 70-2023 [Section No. 220.56]

220.~~56~~ 56 Instantaneous Water Heaters and Kitchen Equipment — Other Than Dwelling Unit(s).

Calculating the load for instantaneous water heaters and commercial electric cooking equipment, dishwasher booster heaters, water heaters, and other kitchen equipment in accordance with Table 220.56 shall be permitted. Other kitchen equipment shall include equipment that is fastened in place and rated ¼ hp or greater, or 500 watts or greater. These demand factors shall be applied to all instantaneous water heaters or equipment that has either thermostatic control or intermittent use as kitchen equipment. These demand factors shall not apply to space-heating, ventilating, or air-conditioning equipment.

However, in no case shall the feeder or service calculated load be less than the sum of the largest two kitchen equipment loads.

Table 220.56 Demand Factors for Instantaneous Water Heaters and Kitchen Equipment — Other Than Dwelling Unit(s)

Number of Units of Equipment	Demand Factor (%)
1	100
2	100
3	90
4	80
5	70
6 and over	65

Statement of Problem and Substantiation for Public Input

Currently, the NEC does not clearly indicate an acceptable load factor for electric instantaneous water heaters. Due to the push to electrify facilities, the load of these devices is going to increase dramatically. This will clarify that diversity is to be applied to these loads.

Submitter Information Verification

Submitter Full Name: Eric Putnam
Organization:
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jun 09 11:39:14 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8054-NFPA 70-2024

Statement: Instantaneous water heaters have been identified in the text for clarity that these demand factors apply to all types of electric water heaters.

Public Input No. 1947-NFPA 70-2023 [New Section after 220.57]

220.58 Air Conditioners/Heat Pumps – Dwelling Units

Where two or more single-phase single air conditioning units or heat pumps are supplied by 3-phase, 4-wire feeder or service, the total load shall be calculated on the basis of twice the maximum number connected between any two phases.

Statement of Problem and Substantiation for Public Input

This change will align with how other power intense single-phase loads such as ranges (220.55) and dryers (220.54) are calculated when connected to a 3-phase, 4-wire feeder, or service.

Submitter Information Verification

Submitter Full Name: Gary Hein
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 08 12:37:02 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The proposed text for air conditioners and heat pumps is seeking similar treatment as for cooking appliances (220.55) and electric clothes dryers (220.54) without substantiation. Not all HVAC equip is a resistive load and may be subjected to motor in-rush currents.

Public Input No. 1439-NFPA 70-2023 [Section No. 220.57]

220.57 Electric Vehicle Supply Equipment (EVSE) Load.

The EVSE load shall be calculated at either 7200 watts (volt-amperes) or the nameplate rating of the equipment, whichever is larger.

<u>Note: The 125 percent multiplier for continuous load as specified in 625.41 is included therefore no additional multiplier is required</u>

Statement of Problem and Substantiation for Public Input

It is unclear if the 125% is included in the stated value
T220.42(A) states that it is included.

Submitter Information Verification

Submitter Full Name: IEC National
Organization: IEC
Affiliation: Jon Coulimore
Street Address:
City:
State:
Zip:

Submittal Date: Sun Jul 16 11:45:14 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Although the informational note is informative and adds clarity to nameplate ratings, the continuous load requirements apply to the sizing of the conductor and overcurrent device, and not to load calculations.

Public Input No. 3145-NFPA 70-2023 [Section No. 220.57]

220.57 Electric Vehicle ~~Supply Equipment (EVSE~~ Power Transfer System Equipment (EVPTSE) Load.

The ~~EVSE~~ EVPTSE load shall be calculated ~~at either~~ at the nameplate rating of the equipment when it is available and at 7200 watts (volt-amperes) ~~or~~ when the nameplate rating of the equipment ~~, whichever~~ is ~~larger.~~ not available. EVPTSE loads in service and feeder load calculations shall be permitted to be limited in accordance with 625.42(A) and (B).

Statement of Problem and Substantiation for Public Input

The current language in 220.57 requires that Low Power Level 2 electric vehicle chargers be treated at 7200 watts, while their rated power output is frequently much lower (e.g., Low Power EV Ready circuits are defined in the current CalGreenCode as 208/240v at 20 Amps). Low power level 2 charging is a minimum performance standard in the CalGreenCode and in numerous California cities. As with other loads, when the nameplate rating of the installed equipment is known, the code should rely on that value. When the nameplate rating is unknown (e.g., during pre-wiring for a future electric vehicle charging space), the 7200 watt default is a reasonable and conservative approach. Soon to be published analysis by LBNL of 15-minute, sub-metered end-uses in occupied US dwellings included 141 electric vehicle charging circuits. The median maximum demand for these circuits was 3.95 kW (mean of 5.66 kW). Allowing the use of nameplate ratings for electric vehicles in service and feeder load calculations supports the use of low-power solutions, which are particularly critical in the existing housing stock which is amperage constrained (i.e., lots of 100 Amp panels in the stock) and in disadvantaged communities that are least able to invest in electrical upgrades often required to install 7200 watt charging infrastructure. The 7200 watt assumption will contribute to unnecessary service panel upsizing throughout the housing stock, it will increase costs for those least able to bare them, and it will discourage the use of lower-power solutions that will be critical in avoiding expensive and time-consuming upgrades to the electrical distribution system.

The ability to control and limit EVPTSE loads through EMS or other adjustable settings is critical, and it should be made clear in 220.57 that these controls should be reflected in service and feeder load calculations.

Finally, we propose expanding the section title to address EVPTSE consistent with the contents of 625, rather than just EVSE.

Submitter Information Verification

Submitter Full Name: Brennan Less
Organization: LBNL
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 16:31:06 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: While we find that there is merit to changing EVSE to Electric Vehicle Power Transfer System Equipment (EVPTSE) or (EVPTS), changing the heading is inconsistent with the rest of the code, including the content in Article 625. We recommend that this be done at a global level, either through the correlating committee or a PI in the next code cycle. Changes to allow the calculation to be based on the nameplate rating of the equipment, or 7200 watts if the nameplate is not available do not account for updates to the system where a larger EVSE may be installed. Reference to 625.42(A) and (B) is not necessary as 220.70 already permits the use of Energy Management Systems and the required nameplate rating would include the information of 625.42(B).

Public Input No. 4238-NFPA 70-2023 [Section No. 220.57]

220.57 Electric Vehicle Supply Equipment (EVSE) Load.

The EVSE load shall be calculated at either 7200 watts (volt-amperes) or the nameplate rating of the equipment, whichever is larger.

Exception: If controlled by an Energy Management System, a lower value may be selected. A value of 0 VA additional load may be appropriate depending on the Energy Management System function.

Statement of Problem and Substantiation for Public Input

An EV power transfer equipment controlled by an Energy Management System may curtail the EV load to zero as the site load approaches the service disconnect size. With this type of system, it would not be appropriate to include any load from the EV power transfer equipment to the 220 load calcs.

Submitter Information Verification

Submitter Full Name: kyle breuning
Organization: Lunar
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 03:22:48 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8184-NFPA 70-2024

Statement: Section 220.70 was relocated to Article 220 Part I to reinforce that a Power Control System can be used for load calculations throughout Article 220. The new 220.7 restructures the requirements into 5 sub-sections for clarity.

Energy Management System (EMS) was renamed to Power Control System (PCS) to differentiate an EMS with overload control from an EMS without overload control. 220.7(A) refers to Part II of Article 750, which is the subject of a PI for CMP 13 to identify requirements for EMS with overload control functionality. Should CMP 13 not create part II, this action will need to be revisited.

A requirement was added that the setpoint shall be determined by “Qualified Personnel”.

Public Input No. 750-NFPA 70-2023 [Section No. 220.57]

220.57 Electric Vehicle Supply Equipment (EVSE) Load.

The EVSE load shall be calculated ~~at either 7200 watts (volt-amperes)~~ based on 30A or the nameplate rating of the equipment, whichever is larger.

Statement of Problem and Substantiation for Public Input

When this section was added to the 2023 NEC, the panel statement indicated that 7200VA was based on a 30A EVSE on a 240V circuit. However, many EVSEs are on 208Y/120V services, for which it make little sense to use a minimum load rating based on 240V. Therefore I propose the minimum be changed to 30A without regard to supply voltage.

If specifying a minimum amperage, rather than a minimum VA, is contrary to the standard practice of Article 230, then would I suggest instead that the minimum VA be reduced to 30A @ 208V, or 6,240 VA. This figure would still be sufficient for a 24A 240V EVSE, which is a standard size designed for use on 30A branch circuits.

Submitter Information Verification

Submitter Full Name: Wayne Whitney
Organization: [Not Specified]
Street Address:
City:
State:
Zip:

Submittal Date: Fri Apr 28 20:21:18 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Basing load calculations on amperes rather than watts or VA is inconsistent with other requirements throughout Article 220.

Public Input No. 1261-NFPA 70-2023 [Section No. 220.60]

220.60 Noncoincident Loads.

If it is unlikely that two or more noncoincident loads will be in use simultaneously, using only the ~~largest load(s) that will be used at one time for calculating the total~~ single load that results in the largest total load of a feeder or service shall be permitted.~~- If a motor or air-conditioning load is part of the noncoincident load and is not the largest of the noncoincident loads, 125 percent of either the motor load or air-conditioning load, whichever is larger, shall be used in the calculation.~~

Statement of Problem and Substantiation for Public Input

The 2020 and 2023 NEC revisions to this section have added language to cover some of the corner cases with noncoincident loads and load calculations, but the result has not been entirely clear, nor comprehensive. The proposed revision seeks to be both clearer and comprehensive.

If a feeder (or service) supplies two (or more) non-coincident loads A and B, then the load calculation procedure should simply be split: first consider only load A to be present and calculate the total feeder load. Then consider only load B to be present and calculate the total feeder load. Use whichever result is larger.

So that is what the proposed revision says to do. This already covers all combinations of motors loads whether they be the nominal larger or smaller of the noncoincident loads. Indeed, the following pair of examples shows that which of the two loads should be in the final answer can not be determined just by looking at the noncoincident loads in isolation, but only by considering the other feeder loads as well:

Example 1: a feeder supplies only two noncoincident loads, either (A) a 110A non-continuous, non-motor load, or (B) a 100A FLC motor load. For case A, the load is 110A. For case B, the load is 125% * 100A = 125A. Case B controls.

Example 2: in addition to the non-coincident loads A and B in Example 1, the feeder also supplies a 120A FLC motor load. Then for case A, the load is 125% * 120A + 110A = 260A. While for case B, the load is 125% * 120A + 100A = 250A. Now case A controls.

Therefore it is necessary that 220.60 include language that compares the total load for each case, rather than just comparing the individual non-coincident loads.

Submitter Information Verification

Submitter Full Name: Wayne Whitney
Organization: [Not Specified]
Street Address:
City:
State:
Zip:

Submittal Date: Sat Jul 01 12:12:39 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8181-NFPA 70-2024

Statement: Section 220.60 has been rewritten and restructured to clarify the determination and treatment of noncoincident loads.

Requirements regarding the “125 percent of either the motor load or air-conditioning load, whichever is larger” were originally added to clarify that the value included application of the motor-operated and combination loads as specified in 220.11(A) (Refer to FR 8062-NFPA 70-2018; note that 220.11(A) was 220.18(A) in the 2020 NEC). The present wording is confusing, so rather than restate the requirement, the statement is revised to refer to 220.11(A), thus maintaining the original intent of the requirement.

List items were added to specify what is considered as non-coincident loads, with feeders and services maintaining the traditional usage of “two or more loads that are unlikely to be in use simultaneously”, and a more rigorous requirement applying to branch-circuits, since those loads do not benefit from diversity of multiple loads.

Section 220.60 is also relocated to 220.6, in Part I (General), to allow the provision to apply to load calculation throughout Article 220, including branch-circuits in addition to feeders and services.

Public Input No. 1826-NFPA 70-2023 [Section No. 220.60]

220.60 Noncoincident Loads.

If it is unlikely that two or ~~more noncoincident loads~~ more loads will be in use simultaneously, using only the largest load(s) that will be used at one time for calculating the total load of a feeder or service shall be permitted. If a motor or air-conditioning load is part of the ~~noncoincident load and is not the largest of the noncoincident loads~~ smaller load , 125 percent of ~~either~~ the larger of the motor load or air-conditioning ~~load, whichever is larger, shall~~ load shall be used in the calculation.

Statement of Problem and Substantiation for Public Input

This PI is simply an attempt to make the section more readable.

Submitter Information Verification

Submitter Full Name: Eric Stromberg
Organization: Los Alamos National Laboratory
Affiliation: Self
Street Address:
City:
State:
Zip:
Submittal Date: Sat Aug 05 15:39:00 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8181-NFPA 70-2024

Statement: Section 220.60 has been rewritten and restructured to clarify the determination and treatment of noncoincident loads.

Requirements regarding the “125 percent of either the motor load or air-conditioning load, whichever is larger” were originally added to clarify that the value included application of the motor-operated and combination loads as specified in 220.11(A) (Refer to FR 8062-NFPA 70-2018; note that 220.11(A) was 220.18(A) in the 2020 NEC). The present wording is confusing, so rather than restate the requirement, the statement is revised to refer to 220.11(A), thus maintaining the original intent of the requirement.

List items were added to specify what is considered as non-coincident loads, with feeders and services maintaining the traditional usage of “two or more loads that are unlikely to be in use simultaneously”, and a more rigorous requirement applying to branch-circuits, since those loads do not benefit from diversity of multiple loads.

Section 220.60 is also relocated to 220.6, in Part I (General), to allow the provision to apply to load calculation throughout Article 220, including branch-circuits in addition to feeders and services.

Public Input No. 2049-NFPA 70-2023 [Section No. 220.60]

220.60 Noncoincident Loads.

If it is unlikely that two or more noncoincident loads will be in use simultaneously, using only the largest load(s) that will be used at one time for calculating the total load of a feeder or service shall be permitted. ~~If a motor or air-conditioning load is part of the noncoincident load and is not the largest of the noncoincident loads, 125 percent of either the motor load or air-conditioning load, whichever is larger, shall be used in the calculation.~~

Statement of Problem and Substantiation for Public Input

The proposed deletion was added to the code in 2020. Article 220 and 220.60 address loads not the sizes of feeders or services. The added sentence doesn't define what the "the" is in "the calculation" so it could be construed that the intent of this is to increase the motor full load amps by 125%, when the intent of the code is to require 125% in the feeder or service sizing calculation. The addition of this sentence is also problematic in that it singles out motor loads as part of the non-coincident load discussion, and does not mention many of the other types of loads that require their feeders and services to be sized at 125% (ie continuous loads). There is no reason to expect that the other provisions of the code would not apply to largest load so this sentence may and should be deleted.

Submitter Information Verification

Submitter Full Name:	James Degnan
Organization:	King County Metro Transit
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Fri Aug 11 12:27:41 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: FR-8181-NFPA 70-2024

Statement: Section 220.60 has been rewritten and restructured to clarify the determination and treatment of noncoincident loads.

Requirements regarding the “125 percent of either the motor load or air-conditioning load, whichever is larger” were originally added to clarify that the value included application of the motor-operated and combination loads as specified in 220.11(A) (Refer to FR 8062-NFPA 70-2018; note that 220.11(A) was 220.18(A) in the 2020 NEC). The present wording is confusing, so rather than restate the requirement, the statement is revised to refer to 220.11(A), thus maintaining the original intent of the requirement.

List items were added to specify what is considered as non-coincident loads, with feeders and services maintaining the traditional usage of “two or more loads that are unlikely to be in use simultaneously”, and a more rigorous requirement applying to branch-circuits, since those loads do not benefit from diversity of multiple loads.

Section 220.60 is also relocated to 220.6, in Part I (General), to allow the provision to apply to load calculation throughout Article 220, including branch-circuits in addition to feeders and services.

Public Input No. 3024-NFPA 70-2023 [Section No. 220.60]

220.60 Noncoincident Loads.

If ~~it is unlikely that~~ two or more ~~noncoincident loads will be in use simultaneously, using only the largest load(s) that will be used at one time for calculating~~ loads do not operate simultaneously, either due to use of control hardware or to expected seasonal or daily usage patterns, it shall be permitted to use only the largest of these loads in calculating the total load of a feeder or service ~~shall be permitted~~ . If a motor or air-conditioning load is part of the noncoincident load ~~and is not the largest of the noncoincident loads, 125 percent~~ , 125 percent of either the motor load or the air-conditioning load ~~, whichever is larger,~~ shall be used to determine the largest noncoincident load to be used in ~~the calculation~~ calculating the total load of the feeder or service .

Statement of Problem and Substantiation for Public Input

Section 220.60 provides an important option for designers to exclude the smaller of any loads that will not operate coincidentally in service and feeder load calculations. Currently, the allowance is for loads “unlikely” to be coincident, yet it does not explicitly allow for loads that are controlled to be noncoincident. We propose additional language in section 220.60 that clearly allows the use of controls. An example of this would be a receptacle sharing device (e.g., NeoCharge) that allows two 240v appliances to be simultaneously plugged into one 240v receptacle, and onboard controls allow only one device to be energized at a time. A common use case is an EV charger sharing a receptacle with a clothes dryer, and the EV charger would be paused when the dryer is in use. These devices are common, and they allow the safe and immediate provision of electric vehicle charging. We also propose additional language that specifies conditions that would make two loads “unlikely” to operate coincidentally (e.g., seasonal or daily usage patterns). Finally, the last sentence of the current 220.60 is unclear. The current language says that if a motor or air conditioning load is the smaller of noncoincident loads, then it must be included in the “calculation” at 125%. It is not clear what the “calculation” is. Is it the calculation of which noncoincident load is larger, or is it the calculation of the service or feeder load? Or some other calculation? Also, are these loads at 125% included in addition to or in place of the other load that was originally deemed to be larger? We have proposed clarifying language, but we also support NFPA revising this section for the desired clarity.

Submitter Information Verification

Submitter Full Name: Brennan Less
Organization: LBNL
Street Address:
City:
State:
Zip:

Submittal Date: Mon Aug 28 18:24:08 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8181-NFPA 70-2024

Statement: Section 220.60 has been rewritten and restructured to clarify the determination and treatment of noncoincident loads.

Requirements regarding the “125 percent of either the motor load or air-conditioning load, whichever is larger” were originally added to clarify that the value included application of the motor-operated and combination loads as specified in 220.11(A) (Refer to FR 8062-NFPA 70-2018; note that 220.11(A) was 220.18(A) in the 2020 NEC). The present wording is confusing, so rather than restate the requirement, the statement is revised to refer to 220.11(A), thus maintaining the original intent of the requirement.

List items were added to specify what is considered as non-coincident loads, with feeders and services maintaining the traditional usage of “two or more loads that are unlikely to be in use simultaneously”, and a more rigorous requirement applying to branch-circuits, since those loads do not benefit from diversity of multiple loads.

Section 220.60 is also relocated to 220.6, in Part I (General), to allow the provision to apply to load calculation throughout Article 220, including branch-circuits in addition to feeders and services.

Public Input No. 309-NFPA 70-2023 [Section No. 220.60]

220.60 Noncoincident Loads.

If it is unlikely that two or more noncoincident loads will be in use simultaneously, using only the largest load(s) that will be used at one time for calculating the total load of a feeder or service shall be permitted. ~~If a motor or air-conditioning load is part of~~ If one of the noncoincident ~~load and~~ loads is ~~not the largest of the noncoincident loads, 125 percent of either the motor load or air-conditioning load, whichever is larger,~~ the largest motor load served by the feeder or service, 125% of the motor load value shall be used in ~~the calculation~~ determining whether such load is the largest of the noncoincident loads .

Statement of Problem and Substantiation for Public Input

There is a fair amount of confusion among industry professionals as to the intent of the second sentence of NFPA70 220.60, as it is written. Assuming the intent is to capture the extra 25% of the largest motor load on the feeder or service (even if it is the smaller of the noncoincident loads), then the current wording does not clearly address that issue. I'm hoping this new wording I have proposed adequately takes care of the extra 25% of the largest motor with simplicity and clarity. Also, I omitted "air-conditioning" since every air-conditioning load is a motor load and it was a redundancy, adding to the confusion. If an air-conditioning load did not have a motor, it would not be relevant to the point at all.

However, if the intent of the the current wording is not to capture that extra 25% of the the largest motor load, then further clarification and explanation is needed from the NFPA. As it stands, there is no way anyone can be confident in their own interpretation of the intent behind the sentence in question. This requested clarification is vital for accurate calculations, adequate field installations and for exam makers/takers. Thank you for your consideration.

James Reinhardt
Master Electrician
TX, WA, OR

Submitter Information Verification

Submitter Full Name:	James Reinhardt
Organization:	Electric Unlimited
Affiliation:	Owner
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Thu Feb 09 09:21:32 EST 2023
Committee:	NEC-P02

Committee Statement

Resolution: FR-8181-NFPA 70-2024

Statement: Section 220.60 has been rewritten and restructured to clarify the determination and treatment of noncoincident loads.

Requirements regarding the “125 percent of either the motor load or air-conditioning load, whichever is larger” were originally added to clarify that the value included application of the motor-operated and combination loads as specified in 220.11(A) (Refer to FR 8062-NFPA 70-2018; note that 220.11(A) was 220.18(A) in the 2020 NEC). The present wording is confusing, so rather than restate the requirement, the statement is revised to refer to 220.11(A), thus maintaining the original intent of the requirement.

List items were added to specify what is considered as non-coincident loads, with feeders and services maintaining the traditional usage of “two or more loads that are unlikely to be in use simultaneously”, and a more rigorous requirement applying to branch-circuits, since those loads do not benefit from diversity of multiple loads.

Section 220.60 is also relocated to 220.6, in Part I (General), to allow the provision to apply to load calculation throughout Article 220, including branch-circuits in addition to feeders and services.

Public Input No. 3996-NFPA 70-2023 [Section No. 220.60]

220.60 Noncoincident Loads.

If it is unlikely that two or more noncoincident loads will be in use simultaneously, using only the largest load(s) that will be used at one time for calculating the total load of a feeder or service shall be permitted. ~~If a motor or air-conditioning load is part of the noncoincident load and is not the largest of the noncoincident loads, 125 percent of either the motor load or air-conditioning load, whichever is larger, shall be used in the calculation.~~

Statement of Problem and Substantiation for Public Input

The wording of this code currently requires using the smaller non-coincident load in the calculation if it is a motor of HVAC load. I believe the intent is to use the motor load if factoring by 125% makes it the larger noncoincident load, however the wording does not support that. Factoring motors at 125% for load calculations is covered elsewhere, eliminating this sentence would eliminate the confusion caused by the current language.

Submitter Information Verification

Submitter Full Name: Matthew Grover
Organization: Kings Electric Services
Street Address:
City:
State:
Zip:

Submittal Date: Wed Sep 06 13:07:08 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8181-NFPA 70-2024

Statement: Section 220.60 has been rewritten and restructured to clarify the determination and treatment of noncoincident loads.

Requirements regarding the “125 percent of either the motor load or air-conditioning load, whichever is larger” were originally added to clarify that the value included application of the motor-operated and combination loads as specified in 220.11(A) (Refer to FR 8062-NFPA 70-2018; note that 220.11(A) was 220.18(A) in the 2020 NEC). The present wording is confusing, so rather than restate the requirement, the statement is revised to refer to 220.11(A), thus maintaining the original intent of the requirement.

List items were added to specify what is considered as non-coincident loads, with feeders and services maintaining the traditional usage of “two or more loads that are unlikely to be in use simultaneously”, and a more rigorous requirement applying to branch-circuits, since those loads do not benefit from diversity of multiple loads.

Section 220.60 is also relocated to 220.6, in Part I (General), to allow the provision to apply to load calculation throughout Article 220, including branch-circuits in addition to feeders and services.

Public Input No. 4235-NFPA 70-2023 [Section No. 220.60]

220.60 Noncoincident Loads.

If it is unlikely that two or more noncoincident loads will be in use simultaneously, using only the largest load(s) that will be used at one time for calculating the total load of a feeder or service shall be permitted. If a motor or air-conditioning load is part of the noncoincident load and is not the largest of the noncoincident loads, 125 percent of either the motor load or air-conditioning load, whichever is larger, shall be used in the calculation.

Where 1 or more loads are controlled by a single listed Energy Management System (Article 750), those loads shall be deemed noncoincident loads, and treated as such for the purposes of Article 220.

Statement of Problem and Substantiation for Public Input

220 load calculations give allowance for an Energy Management System to control an entire site, but load calcs do not yet accommodate for Energy Management Systems that controls only a handful of loads at a site. As just 1 example, an Energy Management System might force the sum of 2 loads to equal a specific amperage, and curtail those loads as needed to achieve that.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4237-NFPA 70-2023 [Section No. 220.82(B)]	
Public Input No. 4498-NFPA 70-2023 [Section No. 220.84(C)]	

Submitter Information Verification

Submitter Full Name: kyle breuning
Organization: Lunar Energy
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 03:10:15 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8181-NFPA 70-2024

Statement: Section 220.60 has been rewritten and restructured to clarify the determination and treatment of noncoincident loads.

Requirements regarding the “125 percent of either the motor load or air-conditioning load, whichever is larger” were originally added to clarify that the value included application of the motor-operated and combination loads as specified in 220.11(A) (Refer to FR 8062-NFPA 70-2018; note that 220.11(A) was 220.18(A) in the 2020 NEC). The present wording is confusing, so rather than restate the requirement, the statement is revised to refer to 220.11(A), thus maintaining the original intent of the requirement.

List items were added to specify what is considered as non-coincident loads, with feeders and services maintaining the traditional usage of “two or more loads that are unlikely to be in use simultaneously”, and a more rigorous requirement applying to branch-circuits, since those loads do not benefit from diversity of multiple loads.

Section 220.60 is also relocated to 220.6, in Part I (General), to allow the provision to apply to load calculation throughout Article 220, including branch-circuits in addition to feeders and services.

Public Input No. 4298-NFPA 70-2023 [Section No. 220.60]

220.60 Noncoincident Loads.

~~If it is unlikely that two or more noncoincident loads will be in use simultaneously, using only the largest load(s) that will be used at one time for calculating the~~ The total load of a feeder or service shall be permitted ~~. If~~ to be calculated using only the largest load of two or more noncoincident loads. If a motor or air-conditioning load is part of the noncoincident load and is not the largest of the noncoincident loads, 125 percent of either the motor load or air-conditioning load, whichever is larger, shall be used in the calculation. Noncoincident loads shall be considered to be one of the following:

1. Two or more loads that are unlikely to be in use simultaneously

2. Two or more loads that are prevented from being in use simultaneously by listed equipment

Statement of Problem and Substantiation for Public Input

This public input is part of a series of changes submitted on behalf of a task group appointed by the NEC Correlating Committee. This task group was appointed to clarify the requirements for energy management systems that include controls to prevent the overload of conductors and equipment. The members of the task group are Derrick Atkins, Greg Ball, Doug Burket, Mark Cook, Jason Fisher, Matthew Grover, Rebekah Hren, Pete Jackson, Robert Jordan, Robert Osborne, Charles Picard, Laura Stevens, Tim Windey, Timothy Zgonena

The addition of section 220.70 in the 2023 edition of NFPA-70 has raised questions by users of this Code as to if section 220.60 was still needed, or at a minimum, how 220.60 and 220.70 were related. Since historically section 220.60 has been utilized for a wide variety of applications, including some where active load management equipment was not used like in many heating and cooling systems, there is a need to maintain a simple allowance for noncoincident load adjustments in load calculations that is not dependent on active controls alone. To improve the usability of this Code, we recommend the rewrite of this section to better clarify that this section does not either require or restrict the use of active load management equipment to meet these requirements. This is necessary to continue to provide recognition for equipment employing simple interlocked switching, etc. that otherwise might be interpreted to only fall under section 220.70.

Submitter Information Verification

Submitter Full Name: Chad Kennedy
Organization: Schneider Electric
Street Address:
City:
State:
Zip:

Submittal Date: Thu Sep 07 10:15:17 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8181-NFPA 70-2024

Statement: Section 220.60 has been rewritten and restructured to clarify the determination and treatment of noncoincident loads.

Requirements regarding the “125 percent of either the motor load or air-conditioning load, whichever is larger” were originally added to clarify that the value included application of the motor-operated and combination loads as specified in 220.11(A) (Refer to FR 8062-NFPA 70-2018; note that 220.11(A) was 220.18(A) in the 2020 NEC). The present wording is confusing, so rather than restate the requirement, the statement is revised to refer to 220.11(A), thus maintaining the original intent of the requirement.

List items were added to specify what is considered as non-coincident loads, with feeders and services maintaining the traditional usage of “two or more loads that are unlikely to be in use simultaneously”, and a more rigorous requirement applying to branch-circuits, since those loads do not benefit from diversity of multiple loads.

Section 220.60 is also relocated to 220.6, in Part I (General), to allow the provision to apply to load calculation throughout Article 220, including branch-circuits in addition to feeders and services.

Public Input No. 83-NFPA 70-2023 [Section No. 220.60]

220.60 Noncoincident Loads.

If it is unlikely that two or more noncoincident loads will be in use simultaneously, using only the largest load(s) that will be used at one time for calculating the total load of a feeder or service shall be permitted. If a motor or air-conditioning load is part of the noncoincident load and is not the largest of the noncoincident loads, 125 percent of either the motor load or air-conditioning load, whichever is larger, shall be used in the calculation <u>when comparing noncoincident loads</u> .

Statement of Problem and Substantiation for Public Input

Greetings Folks ,

We are almost there when it comes to 220.60. In reading the public inputs and public comments along with CMP statements I believe the intent of 220.60 is to ensure that the largest motor or air-conditioning load is captured to align with 220.50, where applicable. Now, to me this code rule is broken into two parts:

1) when comparing any noncoincident loads, simple take the larger of the loads that can't be run simultaneously. This is fairly straight forward and is easy to apply in a building with multiple loads that are not to be run simultaneously. However, we always seem to want to use the examples of AC vs Heat in dwelling units to illustrate this example, which brings us to the second sentence in this code rule.

2) If you are comparing the nonconcident loads and the one that is the lessor of those loads being considered happens to have the largest motor or air conditioner (motor) in the dwelling, we will use dwelling for the example, then you are required to take that largest motor or air compresser, which will serve to see that 220.50 is met, and take that largest motor or air-conditioning load at 125%.

Now, what it doesn't tell you is you already did one calculation, the one to determine which load was the larger and lessor of the noncoincident loads.

In fact, the only way you can even apply the last sentence is to estiablish which of the noncoincident loads are the larger or lessor, makes sense right?

So, what the last sentence is doing is asking the user to RE-DO the original comparison calculation again and take that lessor of the noncoincident loads, that in our example happens to indeed have the largest motor or air-conditioning load in the dwelling at 125%, plus the sum of all the other loads associated, like condensor fans, air handlers and so forth, and then compare the new values against the previous larger noncoincident load.

Now, if the original "lessor" of the noncoincident loads with the largest motor or air conditer load now happens to overtake the load that was originally the larger noncoincident load then you use the new load that contained the 125%.

That is literally what the code is saying. By adding the few words at the end I have added will make it just a little clearer to the user what they have to do.

Why is this important to be clear, and please feel free to correct me and educate me in your panel response because I love to learn also, what happens if you have an 8-story building with 8 units overall. Let's assume the classic Heat versus Air Conditioning example, and assume they are designed not to be on simultaneously. Since 220.50 only requires the largest motor or air conditioning equipment to be taken at 125% (per 430 and 440 repectfully) you would not need to take that additional 25% for all floors if for example the Heat was greater than the AC, but the AC had the largest motor, then you take the AC values at 125% and the sum of other assocaited loads for the first floor and the heat on the remaining 7 floors since originally the heats value was greater than the AC.

There are some folks who would say in the above 8-unit situation that you take the 125% for each AC unit x 8 and apply that to your service calculation. Sadly, in my opinion that is not correct, you only take (1) at 125% and the others you compare at 100% as stated in 220.50. yes, I know we are talking about 220.60 but if you read the public inputs and comments you will see its an attempt to bring in 220.50.

I do find it quite ironic that when doing an Optional Method Calculation under Part IV of Article 220 we simply take the AC vs Heat and choose whichever is larger and the resulting service calculation is always less using the optional method. yes, I know 220.60 is not just for the AC vs Heat situation but it is the best to use in discussion this section.

Again, if I am off base with this please educate me as I am always willing to learn from the wisdom of the Code Making Panels.

Submitter Information Verification

Submitter Full Name: Paul Abernathy
Organization: Fast Trax System | Electrical Code Academy, Inc.
Street Address:
City:
State:

Zip:

Submittal Date: Mon Jan 09 16:28:47 EST 2023

Committee: NEC-P02

Committee Statement

Resolution: FR-8181-NFPA 70-2024

Statement: Section 220.60 has been rewritten and restructured to clarify the determination and treatment of noncoincident loads.

Requirements regarding the “125 percent of either the motor load or air-conditioning load, whichever is larger” were originally added to clarify that the value included application of the motor-operated and combination loads as specified in 220.11(A) (Refer to FR 8062-NFPA 70-2018; note that 220.11(A) was 220.18(A) in the 2020 NEC). The present wording is confusing, so rather than restate the requirement, the statement is revised to refer to 220.11(A), thus maintaining the original intent of the requirement.

List items were added to specify what is considered as non-coincident loads, with feeders and services maintaining the traditional usage of “two or more loads that are unlikely to be in use simultaneously”, and a more rigorous requirement applying to branch-circuits, since those loads do not benefit from diversity of multiple loads.

Section 220.60 is also relocated to 220.6, in Part I (General), to allow the provision to apply to load calculation throughout Article 220, including branch-circuits in addition to feeders and services.

Public Input No. 1827-NFPA 70-2023 [Section No. 220.61(A)]

(A) Basic Calculation.

The feeder or service neutral load shall be the maximum unbalance of the load determined by this article. The maximum unbalanced load shall be the maximum net calculated load between the neutral conductor and any one ungrounded conductor. <u>Purely line to line loads may be omitted from the neutral calculation.</u>

Exception: For 3-wire, 2-phase or 5-wire, 2-phase systems, the maximum unbalanced load shall be the maximum net calculated load between the neutral conductor and any one ungrounded conductor multiplied by 140 percent.

Statement of Problem and Substantiation for Public Input

I see much confusion in the calculation of neutral loads. I see where the line to line load is multiplied by 70% and this is taken as the neutral load. There is no need to consider line to line loads but, somehow, this is not well understood. For example, on a three phase, 400 amp, system, if there is 200 amps worth of line to line, then only 200 amps is available for single phase loads. If the loads are 70, 70, and 60, the maximum imbalance is 70 amps. Adding the language to omit line to line loads should make this more understandable.

Submitter Information Verification

Submitter Full Name:	Eric Stromberg
Organization:	Los Alamos National Laboratory
Affiliation:	Self
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sat Aug 05 15:55:50 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The requirement specifies that the neutral load is the maximum unbalance of the load. For line-to-line loads, there is no unbalance, and therefore the text is unnecessary.

Public Input No. 3071-NFPA 70-2023 [Section No. 220.61(B)]

(B) Permitted Reductions.

A service or feeder supplying the following loads shall be permitted ~~to have an additional demand factor of 70 percent applied to the amount in~~ in accordance with 220.61(B)(1) and ~~a portion of the amount in~~ 220.61(B)(2).

(1) Household Electric Ranges, Wall-Mounted Ovens, Counter-Mounted Cooking Units, and Dryers.

A demand factor of 70 percent shall be applied to the feeder or service supplying household electric ranges, wall-mounted ovens, counter-mounted cooking units, and electric dryers, where the maximum unbalanced load has been determined in accordance with Table 220.55 for ranges and Table 220.54 for dryers.

(2) Unbalanced Load in Excess of 200 Amperes.

~~That~~ A demand factor of 70 percent shall be applied to the portion of the unbalanced load in excess of 200 amperes where the feeder or service is supplied from a 3-wire dc or single-phase ac system; a 4-wire, 3-phase system; a 3-wire, 2-phase system; or a 5-wire, 2-phase system.

Informational Note: See Informative Annex D, Examples D1(a), D1(b), D2(b), D4(a), and D5(a) for examples of unbalanced feeder or service neutral loads.

Statement of Problem and Substantiation for Public Input

No technical edits were made to this rule. The text edits are intended to make the requirement easier to read and clarify that the intent is that we apply a 70 percent demand factor for ranges, dryers, and ovens, then we apply an additional 70 percent for anything over 200A.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 10:55:19 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8064-NFPA 70-2024
Statement: The 70 percent demand factor is relocated to sub-sections (1) and (2) for improved clarity.

Public Input No. 1540-NFPA 70-2023 [Section No. 220.61(B) [Excluding any Sub-Sections]]

A service or feeder supplying the following loads shall be permitted to have an additional demand factor of 70 percent applied to the amount in 220.61(B)(1) and ~~a portion of~~ the amount in 220.61(B)(2).

Statement of Problem and Substantiation for Public Input

The 70% may be applied to both the range and dryer neutral conductors and the amount over 200 amperes for the service or feeder. The way the text currently reads in regards to the service or feeder neutral, it states "A service or feeder supplying the following loads shall be permitted to have an additional demand factor of 70 percent applied to the amount in 220.61(B)(1) and a portion of the amount in 220.61(B)(2)" The last part "portion of the amount in 220.61(B)(2)" is referring to the portion stated in B(2). It therefore states a portion of the portion. If so how much of a portion of the portion? This was a result of a change that occurred in the 2023 edition, seeking to clarify that the 70% demand factor is permitted to be applied to both (B)(1) and (B)(2), this seems primarily editorial in nature and this PI does not change the intent of the subsection.

Submitter Information Verification

Submitter Full Name: John McCamish
Organization: NECA IBEW Electrical Training
Affiliation: Self
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jul 24 17:30:14 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8064-NFPA 70-2024
Statement: The 70 percent demand factor is relocated to sub-sections (1) and (2) for improved clarity.

Public Input No. 3025-NFPA 70-2023 [Section No. 220.70]

220.70 Energy Management Systems (EMSs).

If an energy management system (EMS) is used to limit the current to a service, feeder, or ~~service~~ branch circuit in accordance with 750.30, ~~a single value~~ the control setpoint of the EMS selected by qualified personnel shall be less than or equal to the ~~maximum ampere setpoint~~ rating of the overcurrent protection for the service, feeder, or branch circuit. When an EMS controls all loads connected to a service, feeder, or branch circuit, the total load on the service, feeder, or branch circuit shall be permitted to be ~~used in load calculations for the feeder or service.The setpoint value of the EMS shall be considered a continuous load for the purposes of load calculations~~ the control setpoint of the EMS. When an EMS controls less than all of the loads connected to a service, feeder, or branch circuit, the loads that are controlled by the EMS shall be permitted to be excluded from the total load calculation for the service, feeder, or branch circuit .

Statement of Problem and Substantiation for Public Input

The current 220.70 is unclear in its treatment of EMS that manage some but not all loads connected to a service or feeder. This is a common application of EMS. Many EMS control the large connected loads, such as HVAC, water heating, etc. But they may not control all large loads, and they do not generally control all loads. In this situation, the EMS cannot ensure the service or feeder setpoint will be met, because uncontrolled loads may cause an overcurrent condition. The present section 220.70 leaves treatment of this scenario unclear. We have proposed requirements for both of these conditions: (1) EMS controls all connected loads and (2) EMS controls some the connected loads. When all loads are controlled, then the EMS setpoint can be used in place of a traditional load calculation. When only some loads are controlled, the controlled loads shall be excluded from the load calculations. This provides clear guidance for implementation of this article in real world conditions.

Article 220.70 also currently only applies to service and feeder loads, but we argue that it should also apply to individual branch circuits that are controlled by EMS. For example, some EMS control only a single branch circuit based on the metered demand of the service or feeder. The setpoint of the EMS in this case is not an appropriate replacement for service or feeder load calculations. This configuration simply means that the individual branch circuit being controlled can be excluded from service and feeder load calculations, as long as the set point is less than the rating of the service or feeder overcurrent protection.

The words “maximum ampere setpoint” in the present 220.70 could be interpreted as being the maximum value that can be selected in an EMS, rather than the value that has been selected by the qualified personnel. To clarify, we propose the term “control setpoint of the EMS selected by qualified personnel”.

Finally, we argue that controlled loads should not be treated as continuous for the purpose of load calculations. This margin of safety is not necessary and it has potential negative impacts on those using EMS for load control. If the EMS setpoint is allowed to be the rated capacity of the overcurrent protection (as proposed), the EMS will de-energize loads when that setpoint is reached or approached. We are unaware of any reason that a combination of loads connected to a single service would operate coincidentally, solely because they are controlled by an EMS. Other continuous loads are treated as such because of their inherent operational behavior. This is not an inherent operation behavior of an EMS. Load controlled by an EMS will continue to turn on-and-off dynamically based on demand. The non-continuous nature of EMS operation is supported by soon to be published analysis by LBNL of 15-minute end-use sub-metering in 958 occupied US dwellings, which showed that only 11% (n=108) of dwellings ever recorded a load shed event based on an 80A control setpoint. Events were typically short in duration, with 87% of the 10,460 events lasting one hour or less.

Submitter Information Verification

Submitter Full Name:	Brennan Less
Organization:	LBNL
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Aug 28 18:40:33 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: FR-8184-NFPA 70-2024

Statement: Section 220.70 was relocated to Article 220 Part I to reinforce that a Power Control System can be used for load calculations throughout Article 220. The new 220.7 restructures the requirements into 5 sub-sections for clarity.

Energy Management System (EMS) was renamed to Power Control System (PCS) to differentiate an EMS with overload control from an EMS without overload control. 220.7(A) refers to Part II of Article 750, which is the subject of a PI for CMP 13 to identify requirements for EMS with overload control functionality. Should CMP 13 not create part II, this action will need to be revisited.

A requirement was added that the setpoint shall be determined by “Qualified Personnel”.

Public Input No. 4302-NFPA 70-2023 [Section No. 220.70]

220.70 Energy Management Systems ~~(EMSs~~ with Overload Control (EMS-OC).

If an ~~energy management system (EMS)~~ EMS-OC is used to ~~limit the current~~ provide overload control to a feeder or service in accordance with Article 750 ~~.30~~ , Part II, a single value equal to the ~~maximum ampere~~ current setpoint of the EMS shall be permitted to be used in load calculations for the feeder or service.

The setpoint value of the EMS shall be considered a continuous load for the purposes of load calculations.

Statement of Problem and Substantiation for Public Input

This public input is part of a series of changes submitted on behalf of a task group appointed by the NEC Correlating Committee. This task group was appointed to clarify the requirements for energy management systems that include controls to prevent the overload of conductors and equipment. The members of the task group are: Derrick Atkins, Greg Ball, Doug Burket, Mark Cook, Jason Fisher, Matthew Grover, Rebekah Hren, Pete Jackson, Robert Jordan, Robert Osborne, Charles Picard, Laura Stevens, Tim Windey, Timothy Zgonena.

The requirements in this section are revised to align with the proposed structure of Article 750 into parts and to clarify that the EMS function is used to provide overload control.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4291-NFPA 70-2023 [Article 750]	

Submitter Information Verification

Submitter Full Name: Chad Kennedy
Organization: Schneider Electric
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 10:21:35 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8184-NFPA 70-2024

Statement: Section 220.70 was relocated to Article 220 Part I to reinforce that a Power Control System can be used for load calculations throughout Article 220. The new 220.7 restructures the requirements into 5 sub-sections for clarity.

Energy Management System (EMS) was renamed to Power Control System (PCS) to differentiate an EMS with overload control from an EMS without overload control. 220.7(A) refers to Part II of Article 750, which is the subject of a PI for CMP 13 to identify requirements for EMS with overload control functionality. Should CMP 13 not create part II, this action will need to be revisited.

A requirement was added that the setpoint shall be determined by “Qualified Personnel”.

Public Input No. 4357-NFPA 70-2023 [Section No. 220.70]

220.~~70~~ ~~Energy~~ 70 Power Circuit Management ~~Systems~~ (~~EMSs~~ PCM) .

If ~~an energy management system (EMS) is~~ Power Circuit Management (PCM) is used to limit the current to a feeder or service in accordance with 750.30, a single value equal to the maximum ampere setpoint of the ~~EMS~~ PCM device or system shall be permitted to be used in load calculations for the feeder or service.

The setpoint value of the ~~EMS~~ PCM device or system shall be considered a continuous load for the purposes of load calculations.

Statement of Problem and Substantiation for Public Input

Activities, such as the electrification of the transportation sector and replacement of gas-fired appliance with all electric appliances, coupled with widespread adoption of on-site storage and generation, will place significant new demands on the premises wiring systems covered by the NEC. These activities are complicated by the need to facilitate this shift in energy generation, storage, and use, with an existing (and aging) infrastructure.

An emerging trend is to leverage the technology offered by “Energy Management Systems” to manage these complex electrical systems in a way that prevents overloading of the premises wiring system. These types of systems require functional reliability in order to prevent overloading of the premises wiring, as well as utility owned assets serving the facility. Energy management systems (EMS) historically have not been evaluated for functional reliability to address electrical overload.

While other PI’s may address this need for a more robust “Energy Management System”, this must co-exist with the realization that there is still a place for the traditional Energy Management devices that are not being relied upon for these functions and should not be mandated to meet functional safety requirements.

Recognizing that these existing products will continue to exist in the marketplace, a new term is needed to differentiate between the historic EMS application of energy optimization for appliance control versus electrical overload and/or grid interconnection applications where safety is paramount. With this in mind, this PI focuses on introducing the term Power Circuit Management (PCM) where functional reliability has been applied.

This PI utilizes the new term that is proposed in a Related PI (refer to “Related PI’s”) to mark the distinction between “Energy Management” and “PCM”. As described above, the requirement for this section should reflect the more robust requirements for “PCM”.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4331-NFPA 70-2023 [New Definition after Definition: Powder Filling “q”.]	Related due to addition of new PCM definition / term
Public Input No. 4332-NFPA 70-2023 [Definition: Energy Management System (EMS).]	Related due to addition of new PCM definition / term
Public Input No. 4335-NFPA 70-2023 [Section No. 750.30]	Related due to addition of new PCM definition / term
Public Input No. 4360-NFPA 70-2023 [Section No. 625.42(A)]	Related due to addition of new PCM definition / term
Public Input No. 4362-NFPA 70-2023 [Section No. 700.4(B)]	Related due to addition of new PCM definition / term
Public Input No. 4364-NFPA 70-2023 [Section No. 701.4(C)]	Related due to addition of new PCM definition / term
Public Input No. 4366-NFPA 70-2023 [Section No. 702.4(A)(2)]	Related due to addition of new PCM definition / term
Public Input No. 4367-NFPA 70-2023 [Section No. 705.13]	Related due to addition of new PCM definition / term
Public Input No. 4372-NFPA 70-2023 [Section No. 750.6]	Related due to addition of new PCM definition / term
Public Input No. 4331-NFPA 70-2023 [New Definition after Definition: Powder Filling “q”.]	
Public Input No. 4332-NFPA 70-2023 [Definition: Energy Management System (EMS).]	
Public Input No. 4335-NFPA 70-2023 [Section No. 750.30]	
Public Input No. 4360-NFPA 70-2023 [Section No. 625.42(A)]	
Public Input No. 4362-NFPA 70-2023 [Section No. 700.4(B)]	
Public Input No. 4364-NFPA 70-2023 [Section No. 701.4(C)]	

Public Input No. 4366-NFPA 70-2023 [Section No. 702.4(A)(2)]
Public Input No. 4367-NFPA 70-2023 [Section No. 705.13]
Public Input No. 4372-NFPA 70-2023 [Section No. 750.6]

Submitter Information Verification

Submitter Full Name: Scott Picco
Organization: UL Solutions
Street Address:
City:
State:
Zip:

Submittal Date: Thu Sep 07 12:40:08 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8184-NFPA 70-2024

Statement: Section 220.70 was relocated to Article 220 Part I to reinforce that a Power Control System can be used for load calculations throughout Article 220. The new 220.7 restructures the requirements into 5 sub-sections for clarity.

Energy Management System (EMS) was renamed to Power Control System (PCS) to differentiate an EMS with overload control from an EMS without overload control. 220.7(A) refers to Part II of Article 750, which is the subject of a PI for CMP 13 to identify requirements for EMS with overload control functionality. Should CMP 13 not create part II, this action will need to be revisited.

A requirement was added that the setpoint shall be determined by “Qualified Personnel”.

Public Input No. 2282-NFPA 70-2023 [New Section after 220.82]

220.82 Dwelling Units

(D) EVSE Loads. Level 2 Electric Vehicle Supply Equipment Loads shall be considered to be continuous loads and shall be calculated at 100 percent in accordance with the product ratings and shall not be less than determined by 220.57, unless the overall rating of the installation can be limited through controls as permitted by 625.42(A) or (B).

Additional Proposed Changes

File Name	Description	Approved
2026_public_input_Article_220.82_D_8-16-23-NJ.docx	The 2023 version of NFPA 70 (NEC) article 220, Part VI - Optional Feeder and Service Load Calculations in article 220.82 Dwelling Unit, paragraphs (A), (B), and (C) currently do not specifically address the inclusion of EVSE equipment loads. This document is intended to propose and substantiate a revision to and an addition to article 220.82(all) to include EVSE load(s).	

Statement of Problem and Substantiation for Public Input

Substantiation for Change:

The 2023 version of NFPA 70 (NEC) article 220, Part VI - Optional Feeder and Service Load Calculations in article 220.82 Dwelling Unit, paragraphs (A), (B), and (C) currently do not specifically address the inclusion of EVSE equipment loads.

This proposes a revision of article 220.82(A) to include adding a new paragraph (D) which is to include EVSE loads into the Optional Feeder and Service Load Calculation – This corresponds with Public Input No. 2407-NFPA 70-2023.

Per 2023 NEC Article 220, Part III. Feeder and Service Load Calculations:
• Article 220.53 Appliance Load – Dwelling Unit(s). This demand factor shall not apply to: (5) Electric Vehicle Supply Equipment (EVSE).
• Article 220.57 Electric Vehicle Supply Equipment (EVSE) Load. The EVSE load shall be calculated at either 7200 watts (volt-amperes) or the nameplate rating of the equipment, whichever is larger.

Also, per 2023 NEC article 625:
• Article 625.42 Rating. The EVSE shall have sufficient rating to supply the load served. Electric vehicle charging loads shall be considered to be continuous loads for the purposes of this article. Service and feeder shall be sized in accordance with the product ratings, unless the overall rating of the installation can be limited through controls as permitted by 625.42(A) or (B).
• (A) Energy Management System (EMS).
Where an EMS in accordance with 750.30 provides load management of EVSE, the maximum equipment load on a service and feeder shall be the maximum load permitted by the EMS. The EMS shall be permitted to be integral to one piece of equipment or integral to a listed system consisting of more than one piece of equipment. When one or more pieces of equipment are provided with an integral load management control, the system shall be marked to indicate this control is provided.
• (B) EVSE with Adjustable Settings.
EVSE with restricted access to an ampere adjusting means complying with 750.30(C) shall be permitted. If adjustments have an impact on the rating label, those changes shall be in accordance with manufacturer's instructions, and the adjusted rating shall appear on the rating label with sufficient durability to withstand the environment involved. EVSE as referenced shall be permitted to have ampere ratings that are equal to the adjusted current setting.

Therefore, regarding article 220, Part VI for Optional Feeder and Service Load Calculations – article 220.82(all) for a Dwelling Unit.

o Due to the operating characteristics of EVSE – the EVSE load should NOT be considered as a 220.82(B) General Load.
o Due to the operating characteristics of EVSE – the EVSE load should NOT be considered in the scope of 220.82(C) Heating and Air-Conditioning Load.
>>> Due to the operating characteristics of EVSE – the EVSE load should be considered additional to 220.82(B) General Loads and 220.82(C) Heating and Air-Conditioning Load – since, in many parts of the USA, EVSE loads will be coincidental to the General Loads and to the Heating and Air-Conditioning load of a Dwelling Unit, unless the EVSE load is limited through controls as permitted by 625.42(A) or (B).

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2407-NFPA 70-2023 [Section No. 220.82(A)]	This addition to article 220.82(all) corresponds to the revision proposed in PI 2407-NFPA 70-2023.
Public Input No. 2407-NFPA 70-2023 [Section No. 220.82(A)]	

Submitter Information Verification

Submitter Full Name: Edmund T Ned Johns
Organization: Generac Power Systems, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 15 16:04:18 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8079-NFPA 70-2024

Statement: EVSE are becoming more commonplace and represent a significant load. As such, a new sub-section (D) is added to refer back to 220.57, which provides requirements for calculating the load attributed to EVSE.

2026 Public Input Form

Name: Ned Johns **Email:**	**2023 NEC Section Number:** 220.82 (A), (B), and (C)	**Proposed NEW Section Number:** **220.82(D)**

Type of Change: *(New, revision, etc.)*

Revision of 220.82(A) and adding a new paragraph 220.82(D) to include EVSE Loads into the Optional Feeder and Service Load calculation for a Dwelling Unit..

Proposed Code Language:

220.82 Dwelling Unit

(A) Feeder and Service Load.
This section applies to a dwelling unit having the total connected load served by a single 120/240-volt or 208Y/120-volt set of 3-wire service or feeder conductors with an ampacity of 100 or greater. It shall be permissible to calculate the feeder and service loads in accordance with this section instead of the method specified in Part III of this article. The calculated load shall be the result of adding the loads from **220.82(B), (C)** and **(D)**. Feeder and service-entrance conductors whose calculated load is determined by this optional calculation shall be permitted to have the neutral load determined by **220.61**.

(B) General Loads (No Change proposed)

(C) Heating and Air-Conditioning Loads (No Change proposed)

NEW
(D) EVSE Loads. Level 2 Electric Vehicle Supply Equipment loads shall be considered to be continuous loads and shall be calculated at 100 percent in accordance with the product ratings and shall not be less than determined by 220.57, unless the overall rating of the installation can be limited through controls as permitted by 625.42(A) or (B).

Substantiation for Change:

The 2023 version of NFPA 70 (NEC) article 220, Part VI - Optional Feeder and Service Load Calculations in article 220.82 Dwelling Unit, paragraphs (A), (B), and (C) currently do not specifically address the inclusion of EVSE equipment loads.

This proposes a revision of article 220.82(A) to include adding a new paragraph (D) which is **to include EVSE loads** into the Optional Feeder and Service Load Calculation – ***This corresponds with Public Input No. 2282-NFPA 70-2023.***

Per 2023 NEC Article 220, Part III. Feeder and Service Load Calculations:
- **Article 220.53 Appliance Load – Dwelling Unit(s).** This demand factor shall not apply to: (5) Electric Vehicle Supply Equipment (EVSE).
- **Article 220.57 Electric Vehicle Supply Equipment (EVSE) Load.** The EVSE load shall be calculated at either 7200 watts (volt-amperes) or the nameplate rating of the equipment, whichever is larger.

Also, per 2023 NEC article 625:
- **Article 625.42 Rating.** The EVSE shall have sufficient rating to supply the load served. Electric vehicle charging loads shall be considered to be continuous loads for the purposes of this article. Service and feeder shall be sized in accordance with the product ratings, unless the overall rating of the installation can be limited through controls as permitted by 625.42(A) or (B).
- **(A) Energy Management System (EMS)**.
  Where an EMS in accordance with 750.30 provides load management of EVSE, the maximum equipment load on a service and feeder shall be the maximum load permitted by the EMS. The EMS shall be permitted to be integral to one piece of equipment or integral to a listed system consisting of more than one piece of equipment. When one or more pieces of equipment are provided with an integral load management control, the system shall be marked to indicate this control is provided.
- **(B) EVSE with Adjustable Settings.**
  EVSE with restricted access to an ampere adjusting means complying with 750.30(C) shall be permitted. If adjustments have an impact on the rating label, those changes shall be in accordance with manufacturer's instructions, and the adjusted rating shall appear on the rating label with sufficient durability to withstand the environment involved. EVSE as referenced shall be permitted to have ampere ratings that are equal to the adjusted current setting.

Therefore, regarding article 220, Part VI for Optional Feeder and Service Load Calculations – article 220.82(all) for a Dwelling Unit.

- Due to the operating characteristics of EVSE – the EVSE load should NOT be considered as a 220.82(B) General Load.
- Due to the operating characteristics of EVSE – the EVSE load should NOT be considered in the scope of 220.82(C) Heating and Air-Conditioning Load.

>>> Due to the operating characteristics of EVSE – the EVSE load should be considered additional to 220.82(B) General Loads and 220.82(C) Heating and Air-Conditioning Load – since, ***in many parts of the USA, EVSE loads will be coincidental to the General Loads and to the Heating and Air-Conditioning load of a Dwelling Unit, unless the EVSE load is limited through controls as permitted by 625.42(A) or (B).***

Notes:

The 2023 version of NFPA 70 (NEC) article 220, Part VI - Optional Feeder and Service Load Calculations in article 220.82 Dwelling Unit, paragraphs (A), (B), and (C) currently do not specifically address the inclusion of EVSE equipment loads. This document is intended to propose and substantiate a revision to and an addition to article 220.82(all) to include EVSE load(s).

Public Input No. 2407-NFPA 70-2023 [Section No. 220.82(A)]

(A) Feeder and Service Load.

This section applies to a dwelling unit having the total connected load served by a single 120/240-volt or 208Y/120-volt set of 3-wire service or feeder conductors with an ampacity of 100 or greater. It shall be permissible to calculate the feeder and service loads in accordance with this section instead of the method specified in Part III of this article. The calculated load shall be the result of adding the loads from 220.82(B) ~~and~~ , (C) and (D) . Feeder and service-entrance conductors whose calculated load is determined by this optional calculation shall be permitted to have the neutral load determined by 220.61.

Additional Proposed Changes

File Name	Description	Approved
2026_public_input_Article_220.82_D_8-16-23-NJ.docx	The 2023 version of NFPA 70 (NEC) article 220, Part VI - Optional Feeder and Service Load Calculations in article 220.82 Dwelling Unit, paragraphs (A), (B), and (C) currently do not specifically address the inclusion of EVSE equipment loads. This document is intended to propose and substantiate a revision to and an addition to article 220.82(all) to include EVSE load(s).	

Statement of Problem and Substantiation for Public Input

Substantiation for Change:

The 2023 version of NFPA 70 (NEC) article 220, Part VI - Optional Feeder and Service Load Calculations in article 220.82 Dwelling Unit, paragraphs (A), (B), and (C) currently do not specifically address the inclusion of EVSE equipment loads.

This proposes a revision of article 220.82(A) to include adding a new paragraph (D) which is to include EVSE loads into the Optional Feeder and Service Load Calculation – This corresponds with Public Input No. 2282-NFPA 70-2023.

Per 2023 NEC Article 220, Part III. Feeder and Service Load Calculations:
• Article 220.53 Appliance Load – Dwelling Unit(s). This demand factor shall not apply to: (5) Electric Vehicle Supply Equipment (EVSE).
• Article 220.57 Electric Vehicle Supply Equipment (EVSE) Load. The EVSE load shall be calculated at either 7200 watts (volt-amperes) or the nameplate rating of the equipment, whichever is larger.

Also, per 2023 NEC article 625:
• Article 625.42 Rating. The EVSE shall have sufficient rating to supply the load served. Electric vehicle charging loads shall be considered to be continuous loads for the purposes of this article. Service and feeder shall be sized in accordance with the product ratings, unless the overall rating of the installation can be limited through controls as permitted by 625.42(A) or (B).
• (A) Energy Management System (EMS).
Where an EMS in accordance with 750.30 provides load management of EVSE, the maximum equipment load on a service and feeder shall be the maximum load permitted by the EMS. The EMS shall be permitted to be integral to one piece of equipment or integral to a listed system consisting of more than one piece of equipment. When one or more pieces of equipment are provided with an integral load management control, the system shall be marked to indicate this control is provided.
• (B) EVSE with Adjustable Settings.
EVSE with restricted access to an ampere adjusting means complying with 750.30(C) shall be permitted. If adjustments have an impact on the rating label, those changes shall be in accordance with manufacturer's instructions, and the adjusted rating shall appear on the rating label with sufficient durability to withstand the environment involved. EVSE as referenced shall be permitted to have ampere ratings that are equal to the adjusted current setting.

Therefore, regarding article 220, Part VI for Optional Feeder and Service Load Calculations – article 220.82(all) for a Dwelling Unit.

o Due to the operating characteristics of EVSE – the EVSE load should NOT be considered as a 220.82(B) General Load.
o Due to the operating characteristics of EVSE – the EVSE load should NOT be considered in the scope of 220.82(C) Heating and Air-Conditioning Load.
>>> Due to the operating characteristics of EVSE – the EVSE load should be considered additional to 220.82(B) General Loads and 220.82(C) Heating and Air-Conditioning Load – since, in many parts of the USA, EVSE loads will be coincidental to the General Loads and to the Heating and Air-Conditioning load of a Dwelling Unit, unless the EVSE load is limited through controls as permitted by 625.42(A) or (B).

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2282-NFPA 70-2023 [New Section after 220.82]	A proposed revision of and addition to article 220.82(all)
Public Input No. 2282-NFPA 70-2023 [New Section after 220.82]	

Submitter Information Verification

Submitter Full Name: Edmund T Ned Johns
Organization: Generac Power Systems, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 16 16:57:34 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8081-NFPA 70-2024
Statement: A reference to the new sub-section (D) is added.

2026 Public Input Form

Name: Ned Johns **Email:** Ned.johns@generac.com	**2023 NEC Section Number:** 220.82 (A), (B), and (C)	**Proposed NEW Section Number:** **220.82(D)**

Type of Change: *(New, revision, etc.)*

Revision of 220.82(A) and adding a new paragraph 220.82(D) to include EVSE Loads into the Optional Feeder and Service Load calculation for a Dwelling Unit..

Proposed Code Language:

220.82 Dwelling Unit

(A) Feeder and Service Load.
This section applies to a dwelling unit having the total connected load served by a single 120/240-volt or 208Y/120-volt set of 3-wire service or feeder conductors with an ampacity of 100 or greater. It shall be permissible to calculate the feeder and service loads in accordance with this section instead of the method specified in Part III of this article. The calculated load shall be the result of adding the loads from **220.82(B), (C)** and **(D)**. Feeder and service-entrance conductors whose calculated load is determined by this optional calculation shall be permitted to have the neutral load determined by **220.61**.

(B) General Loads (No Change proposed)

(C) Heating and Air-Conditioning Loads (No Change proposed)

NEW
(D) EVSE Loads. Level 2 Electric Vehicle Supply Equipment loads shall be considered to be continuous loads and shall be calculated at 100 percent in accordance with the product ratings and shall not be less than determined by 220.57, unless the overall rating of the installation can be limited through controls as permitted by 625.42(A) or (B).

Substantiation for Change:

The 2023 version of NFPA 70 (NEC) article 220, Part VI - Optional Feeder and Service Load Calculations in article 220.82 Dwelling Unit, paragraphs (A), (B), and (C) currently do not specifically address the inclusion of EVSE equipment loads.

This proposes a revision of article 220.82(A) to include adding a new paragraph (D) which is **to include EVSE loads** into the Optional Feeder and Service Load Calculation – ***This corresponds with Public Input No. 2282-NFPA 70-2023.***

Per 2023 NEC Article 220, Part III. Feeder and Service Load Calculations:

- **Article 220.53 Appliance Load – Dwelling Unit(s).** This demand factor shall not apply to: (5) Electric Vehicle Supply Equipment (EVSE).
- **Article 220.57 Electric Vehicle Supply Equipment (EVSE) Load.** The EVSE load shall be calculated at either 7200 watts (volt-amperes) or the nameplate rating of the equipment, whichever is larger.

Also, per 2023 NEC article 625:

- **Article 625.42 Rating.** The EVSE shall have sufficient rating to supply the load served. Electric vehicle charging loads shall be considered to be continuous loads for the purposes of this article. Service and feeder shall be sized in accordance with the product ratings, unless the overall rating of the installation can be limited through controls as permitted by 625.42(A) or (B).
- **(A) Energy Management System (EMS)**.
  Where an EMS in accordance with 750.30 provides load management of EVSE, the maximum equipment load on a service and feeder shall be the maximum load permitted by the EMS. The EMS shall be permitted to be integral to one piece of equipment or integral to a listed system consisting of more than one piece of equipment. When one or more pieces of equipment are provided with an integral load management control, the system shall be marked to indicate this control is provided.
- **(B) EVSE with Adjustable Settings.**
  EVSE with restricted access to an ampere adjusting means complying with 750.30(C) shall be permitted. If adjustments have an impact on the rating label, those changes shall be in accordance with manufacturer's instructions, and the adjusted rating shall appear on the rating label with sufficient durability to withstand the environment involved. EVSE as referenced shall be permitted to have ampere ratings that are equal to the adjusted current setting.

Therefore, regarding article 220, Part VI for Optional Feeder and Service Load Calculations – article 220.82(all) for a Dwelling Unit.

- Due to the operating characteristics of EVSE – the EVSE load should NOT be considered as a 220.82(B) General Load.
- Due to the operating characteristics of EVSE – the EVSE load should NOT be considered in the scope of 220.82(C) Heating and Air-Conditioning Load.

>>> Due to the operating characteristics of EVSE – the EVSE load should be considered additional to 220.82(B) General Loads and 220.82(C) Heating and Air-Conditioning Load – since, ***in many parts of the USA, EVSE loads will be coincidental to the General Loads and to the Heating and Air-Conditioning load of a Dwelling Unit, unless the EVSE load is limited through controls as permitted by 625.42(A) or (B).***

Notes:

The 2023 version of NFPA 70 (NEC) article 220, Part VI - Optional Feeder and Service Load Calculations in article 220.82 Dwelling Unit, paragraphs (A), (B), and (C) currently do not specifically address the inclusion of EVSE equipment loads. This document is intended to propose and substantiate a revision to and an addition to article 220.82(all) to include EVSE load(s).

Public Input No. 457-NFPA 70-2023 [Section No. 220.82(A)]

(A) Feeder and Service Load.

This section applies to ~~a~~ any dwelling unit having the total connected load served by a single 120/240-volt or 208Y/120-volt set of 3-wire service or feeder conductors with an ampacity of 100 or greater. It shall be permissible to calculate the feeder and service loads in accordance with this section instead of the method specified in Part III of this article. The calculated load for each such dwelling unit shall be the result of adding the loads from 220.82(B) and (C). Feeder and service-entrance conductors whose calculated load is determined by this optional calculation shall be permitted to have the neutral load determined by 220.61.

Statement of Problem and Substantiation for Public Input

Clarify that the results of the optional method in 220.82 carry upstream to a feeder or service supplying more than one qualifying dwelling unit, simply by adding the 220.82 calculated load of each dwelling unit. It is, after all, not possible for the load on a feeder or service to be greater than the sum of the loads on all feeders it supplies.

Submitter Information Verification

Submitter Full Name: Wayne Whitney
Organization: [Not Specified]
Street Address:
City:
State:
Zip:

Submittal Date: Tue Mar 14 20:39:44 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The recommended revisions do not add clarity.

Public Input No. 1886-NFPA 70-2023 [Section No. 220.82(B)]

(B) General Loads.

The general calculated load shall be not less than 100 percent of the first 10 kVA plus 40 percent of the remainder of the following loads:

(1) 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 for general lighting and general-use receptacles. The floor area for each floor shall be calculated from the outside dimensions of the dwelling unit. The calculated floor area shall not include open porches, ~~garages,~~ or ~~unused or~~ unfinished ~~spaces~~ areas not adaptable for future use as a habitable room or occupiable space .

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2).

(3) The nameplate rating of the following:

- (4) All appliances that are fastened in place, permanently connected, or located to be on a specific circuit
- (5) Ranges, wall-mounted ovens, counter-mounted cooking units
- (6) Clothes dryers that are not connected to the laundry branch circuit specified in 220.82(B)(2)
- (7) Water heaters

(8) The nameplate ampere or kVA rating of all permanently connected motors not included in 220.82(B)(3).

Statement of Problem and Substantiation for Public Input

If this change is not made, there are conflicting requirements between 220.5(C) and this section. Is a garage to be counted or not? What does need to be considered as future occupiable space? There needs to be a resolution to this problem.

Submitter Information Verification

Submitter Full Name: Roger Zieg
Organization: NTT
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 07 09:22:37 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8082-NFPA 70-2024

Statement: In response to data provided by Lawrence Berkeley National Labs (Refer to Committee Statement related to First Revision in Section 220.41), the requirement of 3 VA per ft2 is reduced to 2 VA per ft2.

Additionally, the treatment of the first 10 kW of load at 100% is reduced to 8 kW at 100%, based on analysis performed by Lawrence Berkely National Lab (LBNL) on sub-metering data from 942 occupied US dwellings. LBNL assessed the connected loads in these homes (based on observed maximum power demand for each branch circuit) and compared this with the metered maximum power demand for the whole dwelling. The report demonstrates that the 8 kW value leads to accurate load calculations in 95% of dwellings, where the predicted load is greater than the metered load. The 10 kW assumption performs similarly, while negatively impacting homes with fewer loads by overestimating their loads.

Lastly, inconsistencies have emerged between 220.5(C) and 220.82(B)(1). The description of the floor area should match between these two sub-sections, but due to changes in 220.5(C), that alignment has been lost. Rather than repeat the text from 220.5(C), a reference to that sub-section is provided.

Public Input No. 3067-NFPA 70-2023 [Section No. 220.82(B)]

(B) General Loads.

The general calculated load shall be not less than 100 percent of the first 10 kVA plus 40 percent of the remainder of the following loads:

(1) 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 for general lighting and general-use receptacles. The floor area for each floor shall be calculated from the outside dimensions of the dwelling unit. The calculated floor area shall ~~not include open porches, garages, or unused or unfinished spaces not adaptable for future use.~~ be determined in accordance with 220.5(C).

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2).

(3) The nameplate rating of the following:

(4) All appliances that are fastened in place, permanently connected, or located to be on a specific circuit

(5) Ranges, wall-mounted ovens, counter-mounted cooking units

(6) Clothes dryers that are not connected to the laundry branch circuit specified in 220.82(B)(2)

(7) Water heaters

(8) The nameplate ampere or kVA rating of all permanently connected motors not included in 220.82(B)(3).

Statement of Problem and Substantiation for Public Input

Revising text for consistency between both the standard method dwelling unit load calculation in Part III of Article 220 and the optional method dwelling unit load calculation in Part IV of Article 220. Adding the reference to 220.5(C) to provide guidance for Code users on how to calculate the floor area of a dwelling unit.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 10:47:38 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8082-NFPA 70-2024

Statement: In response to data provided by Lawrence Berkeley National Labs (Refer to Committee Statement related to First Revision in Section 220.41), the requirement of 3 VA per ft2 is reduced to 2 VA per ft2.

Additionally, the treatment of the first 10 kW of load at 100% is reduced to 8 kW at 100%, based on analysis performed by Lawrence Berkely National Lab (LBNL) on sub-metering data from 942 occupied US dwellings. LBNL assessed the connected loads in these homes (based on observed maximum power demand for each branch circuit) and compared this with the metered maximum power demand for the whole dwelling. The report demonstrates that the 8 kW value leads to accurate load calculations in 95% of dwellings, where the predicted load is greater than the metered load. The 10 kW assumption performs similarly, while negatively impacting homes with fewer loads by overestimating their loads.

Lastly, inconsistencies have emerged between 220.5(C) and 220.82(B)(1). The description of the floor area should match between these two sub-sections, but due to changes in 220.5(C), that alignment has been lost. Rather than repeat the text from 220.5(C), a reference to that sub-section is provided.

Public Input No. 3204-NFPA 70-2023 [Section No. 220.82(B)]

(B) General Loads.

The general calculated load shall be not less than 100 percent of the first 10 kVA plus 40 percent of the remainder of the following loads:

(1) 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 for general lighting and general-use receptacles. The floor area for each floor shall be calculated from the outside dimensions of the dwelling unit. The calculated floor area shall not include open porches, garages, or unused or unfinished spaces not adaptable for future use.

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2).

(3) The nameplate rating of the following:

- (4) All appliances that are fastened in place, permanently connected, or located to be on a specific circuit
- (5) Ranges, wall-mounted ovens, counter-mounted cooking units
- (6) Clothes dryers that are not connected to the laundry branch circuit specified in 220.82(B)(2)
- (7) Water heaters (both of the storage-type tanks and tankless type)
- (8) Electric Vehicle Supply Equipment (EVSE)

(9) The nameplate ampere or kVA rating of all permanently connected motors or utilization equipment not included in 220.82(B)(3).

Statement of Problem and Substantiation for Public Input

Adding list item e. for 'Electric Vehicles' to the dwelling unit optional method load because electric vehicles are a common load on most residential homes and should be calculated under 220.82(B) demand factors. Revising list item (4) for all other utilization equipment to be calculated under 220.82(B) demand factors: for example, a welding machine in a residential home.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:

Submittal Date: Wed Aug 30 11:04:28 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8079-NFPA 70-2024

Statement: EVSE are becoming more commonplace and represent a significant load. As such, a new sub-section (D) is added to refer back to 220.57, which provides requirements for calculating the load attributed to EVSE.

Public Input No. 3239-NFPA 70-2023 [Section No. 220.82(B)]

(B) General Loads.

The general calculated load shall be not less than 100 percent of the first ~~10 kVA~~ 8 kVA plus 40 percent of the remainder of the following loads:

(1) ~~33 volt-amperes/m ^{2} or 3 volt-amperes/ft ^{2} for general~~ General lighting and general-use receptacles at either of the following . The floor area for each floor shall be calculated from the outside dimensions of the dwelling unit. The calculated floor area shall not include open porches, garages, or unused or unfinished spaces not adaptable for future use.

(2) 33 volt-amperes/m ^{2} or 3 volt-amperes/ft ^{2}

(3) 33 volt-amperes/m ^{2} or 3 volt-amperes/ft ^{2} minus the percent of high-efficacy light sources multiplied by 0.165 volt-amperes/m ^{2} or 0.015 volt-amperes/ft ^{2} based on a lighting audit performed in the dwelling unit *or on a proposed lighting design*

(4) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2).

(5) The nameplate rating of the following:

(6) All appliances that are fastened in place, permanently connected, or located to be on a specific circuit

(7) Ranges, wall-mounted ovens, counter-mounted cooking units

(8) Clothes dryers that are not connected to the laundry branch circuit specified in 220.82(B)(2)

(9) Water heaters

(10) The nameplate ampere or kVA rating of all permanently connected motors not included in 220.82(B)(3).

Statement of Problem and Substantiation for Public Input

The current minimum load for general lights and receptacles can be substantially over-estimated when high-efficacy light sources (e.g., LED, CFL) are used throughout the dwelling unit. In new dwelling units, building code requirements for high-efficacy lighting are ubiquitous in the US, leading to reduced lighting loads. In addition, recent rulemaking by the US Department of Energy (DOE) also impacts the lighting density in both new and existing US dwellings. Beginning July 2023, the sale of any general service lamp (GSL) that does not meet a minimum efficacy standard of 45 lumens per watt is prohibited in the US (10 CFR 430.32(dd)). This rulemaking will drastically reduce the ongoing lighting density in new and existing US dwellings. This new federal regulation paired with the results presented below from occupied US dwellings provides a strong case for allowing a reduction in the general receptacles and lighting assumption for both new and existing dwelling service and feeder load calculations.

A currently unpublished report from LBNL funded by the US DOE reports on sub-metering in 896 occupied US dwellings. In this report, median general lights and receptacles power density was 2.3 watts/ft2, though a substantial minority of existing dwellings exceeded the threshold. The same report also analyzes lighting audit data from 2,053 existing dwellings from the NEEA RBSA (2016) field study in Pacific Northwest dwellings. Overall, the median installed lighting energy density was 1.03 watts per ft2. The lighting density was strongly dependent on the fraction of high-efficacy light sources. The median fraction of efficient lighting in the NEEA RBSA data was 53% of the installed bulbs. We found that for each percent of light sources that were high efficacy, the installed lighting density was reduced by 0.0158 watts/ft2. Based on this observed relationship, we propose adding an optional method to reduce the general lights and general receptacle loads by 0.015 watts/ft2 times the percentage of high-efficacy fixtures observed in an audit or in a proposed lighting design. Based on this approach, a dwelling with 100% efficient lighting sources would have a general lights and general receptacles load of 1.5 watts/ft2 (3-100*0.015). A dwelling with 50% efficient light sources would have 2.25 watts/ft2 (3-50*0.015). And a dwelling with 0% efficient light sources would maintain the 3 watts/ft2 value.

Finally, the treatment of the first 10 kW of load at 100% should be reduced to 8 kW at 100% based on analysis performed by LBNL on sub-metering data from 942 occupied US dwellings. LBNL assessed the connected loads in these homes (based on observed maximum power demand for each branch circuit) and compared this with the metered maximum power demand for the whole dwelling. We demonstrate that the 8 kW value leads to accurate load calculations in 95% of dwellings, where the predicted load is greater than the metered load. The 10 kW assumption performs similarly, while negatively impacting low-load homes by over-estimating their loads. This value should be aligned with the value used for existing dwellings in 220.83.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3028-NFPA 70-2023 [Section No. 220.83]	Contains same proposal for lighting density reductions
Public Input No. 3319-NFPA 70-2023 [Section No. 220.83]	Contains same proposal for lighting density reductions
Public Input No. 3236-NFPA 70-2023 [Section No. 220.41]	Contains same proposal for lighting density reductions

Public Input No. 3242-NFPA 70-2023 [Section No. 220.84(C)]	Contains same proposal for lighting density reductions
Public Input No. 3028-NFPA 70-2023 [Section No. 220.83]	
Public Input No. 3236-NFPA 70-2023 [Section No. 220.41]	
Public Input No. 3242-NFPA 70-2023 [Section No. 220.84(C)]	
Public Input No. 3319-NFPA 70-2023 [Section No. 220.83]	

Submitter Information Verification

Submitter Full Name: Brennan Less
Organization: LBNL
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 30 16:40:55 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8082-NFPA 70-2024

Statement: In response to data provided by Lawrence Berkeley National Labs (Refer to Committee Statement related to First Revision in Section 220.41), the requirement of 3 VA per ft2 is reduced to 2 VA per ft2.

Additionally, the treatment of the first 10 kW of load at 100% is reduced to 8 kW at 100%, based on analysis performed by Lawrence Berkely National Lab (LBNL) on sub-metering data from 942 occupied US dwellings. LBNL assessed the connected loads in these homes (based on observed maximum power demand for each branch circuit) and compared this with the metered maximum power demand for the whole dwelling. The report demonstrates that the 8 kW value leads to accurate load calculations in 95% of dwellings, where the predicted load is greater than the metered load. The 10 kW assumption performs similarly, while negatively impacting homes with fewer loads by overestimating their loads.

Lastly, inconsistencies have emerged between 220.5(C) and 220.82(B)(1). The description of the floor area should match between these two sub-sections, but due to changes in 220.5(C), that alignment has been lost. Rather than repeat the text from 220.5(C), a reference to that sub-section is provided.

Public Input No. 4237-NFPA 70-2023 [Section No. 220.82(B)]

(B) General Loads.

The general calculated load shall be not less than 100 percent of the first 10 kVA plus 40 percent of the remainder of the following loads:

(1) 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 for general lighting and general-use receptacles. The floor area for each floor shall be calculated from the outside dimensions of the dwelling unit. The calculated floor area shall not include open porches, garages, or unused or unfinished spaces not adaptable for future use.

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2).

(3) The nameplate rating of the following:

- (4) All appliances that are fastened in place, permanently connected, or located to be on a specific circuit
- (5) Ranges, wall-mounted ovens, counter-mounted cooking units
- (6) Clothes dryers that are not connected to the laundry branch circuit specified in 220.82(B)(2)
- (7) Water heaters

(8) The nameplate ampere or kVA rating of all permanently connected motors not included in 220.82(B)(3).

(9) Maximum load of an Energy Management System controlling any number of noncoincident loads

Statement of Problem and Substantiation for Public Input

The Optional Load calcs should specifically allow for the use of an Energy Management System. The Energy Management System might be controlling loads on the entire site, or the Energy Management System may only be controlling a handful of loads on a given site, and curtailing those loads based on thresholds either at a site level, a circuit level, or other limit.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4235-NFPA 70-2023 [Section No. 220.60]	definition of coincident loads
Public Input No. 4488-NFPA 70-2023 [Section No. 220.83(A)]	

Submitter Information Verification

Submitter Full Name: kyle breuning
Organization: Lunar Energy
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 03:21:17 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8184-NFPA 70-2024

Statement: Section 220.70 was relocated to Article 220 Part I to reinforce that a Power Control System can be used for load calculations throughout Article 220. The new 220.7 restructures the requirements into 5 sub-sections for clarity.

Energy Management System (EMS) was renamed to Power Control System (PCS) to differentiate an EMS with overload control from an EMS without overload control. 220.7(A) refers to Part II of Article 750, which is the subject of a PI for CMP 13 to identify requirements for EMS with overload control functionality. Should CMP 13 not create part II, this action will need to be revisited.

A requirement was added that the setpoint shall be determined by “Qualified Personnel”.

Public Input No. 643-NFPA 70-2023 [Section No. 220.82(B)]

(B) General Loads.

The general calculated load shall be not less than 100 percent of the first 10 kVA plus 40 percent of the remainder of the following loads:

(1) 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 for general lighting and general-use receptacles. The floor area for each floor shall be calculated from the outside dimensions of the dwelling unit. The calculated floor area shall not include open ~~porches, garages, or~~ porches or unused or unfinished spaces not adaptable for future use as habitable or occupiable space .

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2).

(3) The nameplate rating of the following:

(4) All appliances that are fastened in place, permanently connected, or located to be on a specific circuit

(5) Ranges, wall-mounted ovens, counter-mounted cooking units

(6) Clothes dryers that are not connected to the laundry branch circuit specified in 220.82(B)(2)

(7) Water heaters

(8) The nameplate ampere or kVA rating of all permanently connected motors not included in 220.82(B)(3).

Statement of Problem and Substantiation for Public Input

This PI is intended only to change item (1) to correlate with the 2023 changes made in 220.5(C).

Submitter Information Verification

Submitter Full Name: Ryan Jackson
Organization: Self-employed
Street Address:
City:
State:
Zip:
Submittal Date: Mon Apr 17 12:17:23 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8082-NFPA 70-2024

Statement: In response to data provided by Lawrence Berkeley National Labs (Refer to Committee Statement related to First Revision in Section 220.41), the requirement of 3 VA per ft2 is reduced to 2 VA per ft2.

Additionally, the treatment of the first 10 kW of load at 100% is reduced to 8 kW at 100%, based on analysis performed by Lawrence Berkely National Lab (LBNL) on sub-metering data from 942 occupied US dwellings. LBNL assessed the connected loads in these homes (based on observed maximum power demand for each branch circuit) and compared this with the metered maximum power demand for the whole dwelling. The report demonstrates that the 8 kW value leads to accurate load calculations in 95% of dwellings, where the predicted load is greater than the metered load. The 10 kW assumption performs similarly, while negatively impacting homes with fewer loads by overestimating their loads.

Lastly, inconsistencies have emerged between 220.5(C) and 220.82(B)(1). The description of the floor area should match between these two sub-sections, but due to changes in 220.5(C), that alignment has been lost. Rather than repeat the text from 220.5(C), a reference to that sub-section is provided.

Public Input No. 838-NFPA 70-2023 [Section No. 220.82(B)]

(B) General Loads.

The general calculated load shall be not less than 100 percent of the first 10 kVA plus 40 percent of the remainder of the following loads:

(1) 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 for general lighting and general-use receptacles. The floor area for each floor shall be calculated from the outside dimensions of the dwelling unit. The calculated floor area shall not include open ~~porches, garages, or unused or unfinished spaces~~ porches or unfinished areas not adaptable for future use as a habitable room or occupiable space .

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2).

(3) The nameplate rating of the following:

(4) All appliances that are fastened in place, permanently connected, or located to be on a specific circuit

(5) Ranges, wall-mounted ovens, counter-mounted cooking units

(6) Clothes dryers that are not connected to the laundry branch circuit specified in 220.82(B)(2)

(7) Water heaters

(8) The nameplate ampere or kVA rating of all permanently connected motors not included in 220.82(B)(3).

Statement of Problem and Substantiation for Public Input

During the 2023 NEC revision cycle, CMP-2 chose to make revisions at 220.5(C). This 2023 NEC revision removed "garages" from the areas not to be included in the calculated floor areas of dwelling units. This 2023 NEC revision also revised "unused or unfinished spaces not adaptable for future use" to "unfinished areas not adaptable for future use as a habitable room or occupiable space." I suspect CMP-2 would want the Code language at 220.5(C) and 220.82(B)(1) to match each other. This Public Input would allow these to section to reflect the same Code language and remove confusion for the user of the Code.

Submitter Information Verification

Submitter Full Name: L. Keith Lofland
Organization: (Retired)
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 17 11:08:59 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8082-NFPA 70-2024

Statement: In response to data provided by Lawrence Berkeley National Labs (Refer to Committee Statement related to First Revision in Section 220.41), the requirement of 3 VA per ft2 is reduced to 2 VA per ft2.

Additionally, the treatment of the first 10 kW of load at 100% is reduced to 8 kW at 100%, based on analysis performed by Lawrence Berkely National Lab (LBNL) on sub-metering data from 942 occupied US dwellings. LBNL assessed the connected loads in these homes (based on observed maximum power demand for each branch circuit) and compared this with the metered maximum power demand for the whole dwelling. The report demonstrates that the 8 kW value leads to accurate load calculations in 95% of dwellings, where the predicted load is greater than the metered load. The 10 kW assumption performs similarly, while negatively impacting homes with fewer loads by overestimating their loads.

Lastly, inconsistencies have emerged between 220.5(C) and 220.82(B)(1). The description of the floor area should match between these two sub-sections, but due to changes in 220.5(C), that alignment has been lost. Rather than repeat the text from 220.5(C), a reference to that sub-section is provided.

Public Input No. 4169-NFPA 70-2023 [Section No. 220.82(C)]

(C) Heating and Air-Conditioning Load.

The largest of the following six selections (load in kVA) shall be included:

(1) - ~~100 percent~~ 100 percent of the nameplate rating(s) of central electric resistance space heating.

(2) 75 percent of the nameplate rating(s) of the air conditioning and cooling.

(3) - ~~100 percent~~ 75 percent of the nameplate rating(s) of the heat pump when the heat pump is used without any supplemental electric heating.

(4) - ~~100 percent~~ 75 percent of the nameplate rating(s) of the heat pump compressor and ~~65 percent~~ 100 percent of the supplemental electric heating for central electric space-heating systems. If the heat pump compressor is prevented from operating at the same time as the supplementary heat, it does not need to be added to the supplementary heat for the total central space heating load.

(5) - ~~65 percent~~ 30 percent of the nameplate rating(s) of room electric space heating- ~~if less than four separately controlled units~~ .

(6) ~~40 percent of the nameplate rating(s) of electric space heating if four or more separately controlled units.~~

(7) 100 percent of the nameplate ratings of electric thermal storage and other heating systems where the usual load is expected to be continuous at the full nameplate value. Systems qualifying under this selection shall not be calculated under any other selection in 220.82(C).

Statement of Problem and Substantiation for Public Input

Based on soon to be published analysis of sub-metering end-use data in 953 occupied US dwellings, we observed the following median demand factors for existing space heating and cooling loads in dwellings:

Central Electric Resistance Heating (n=81), 95%
Air Handler (n=691), 79%
Central Cooling (n=376), 75%
Central Heat Pump (n=550), 72%
Room Cooling (n=8), 16% (mean of 33%)
Room Heating (n=198), 1% (mean of 31%)

Consistent with these findings, we propose changing the demand factors associated with space heating and cooling loads. The current code does not differentiate between electric resistance room heaters and central electric resistance space heating (i.e., electric furnace). This is problematic, because we observed very different behavior between these load types, and in particular, central electric resistance space heating was often a very large load (10-11 kW) with very high demand factor (95%), while room heaters were small with very low demand factors. Current code would substantially under-predict the load for central electric resistance space heating, treating it at 65%. We propose adding the category of Central electric resistance space heating to 220.82(c), and we propose clarifying that items 4 and 5 apply to room heaters. Heat pump equipment had substantially lower demand factors, which we propose treating at 75%. Ductless heat pumps (not listed above) had particularly low demand factors (mean 29%). Central Cooling behaved similarly to heat pumps, which is unsurprising, since they are fundamentally the same technology. Backup resistance electric heat paired with heat pumps was not metered in our work, but we propose treating that equipment similarly to central electric resistance space heating (i.e., at 100%). Finally, room heaters showed very low demand factors across the board, and for this reason, we proposed eliminating differential treatment based on the number of room heaters and overall lowered the associated demand factors.

Note: the demand factors reported above are very conservative, because they are based on the maximum demand observed for the load over 15-minute time-steps, not on the nameplate rating. The nameplate rating(s) will always be higher than observed. Where nameplate rating(s) were known, we found they were typically 20% higher than the observed maximum demand. If the nameplate rating(s) were known, the reported demand factors would be further reduced.

Submitter Information Verification

Submitter Full Name: Brennan Less
Organization: LBNL
Street Address:
City:
State:
Zip:

Submittal Date: Wed Sep 06 19:20:09 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The substantiation includes normal operating conditions and average demand factors; it may not take into account abnormal operating conditions, maximum demand factors, start-up current after a power outage, and normal motor in-rush current. A significant reduction in demand factors could result in operation of overcurrent protection at expected operating conditions, such as from a power outage. Comparisons between application of existing requirements with the proposed requirements would be useful in understanding the impact(s) of the proposed changes. CMP-2 is seeking additional information on how this would impact the overall system within single-family, two-family, and multi-family dwellings.

Public Input No. 3028-NFPA 70-2023 [Section No. 220.83]

220.83 Existing Dwelling Unit.

This section shall be permitted to be used to determine if the existing service or feeder is of sufficient capacity to serve additional loads. Where the dwelling unit is served by a 120/240-volt or 208Y/120-volt, 3-wire service or feeder, calculating the total load in accordance with 220.83(A) or (B) shall be permitted.

~~(A) Where Additional Air-Conditioning Equipment or Electric Space-Heating Equipment Is Not to Be Installed.~~

~~The~~

The total load shall be calculated using the percentages listed in Table 220.83

~~(A) shall be used for~~

for existing and additional new loads. The larger connected load of air-conditioning or space heating, but not both, shall be used. Noncoincident loads shall be treated in accordance with 220.60. Loads controlled by an EMS shall be treated in accordance with 220.70.

Table 220.83 ~~(A) Without Additional Air-Conditioning or Electric Space-Heating Equipment~~ Existing Dwelling Unit Load Percentages

Load (kVA)	Percent of Load
First 8 kVA of existing and new load at	100
Remainder of existing load at	40
New Electric Vehicle Power Transfer System Equipment or Energy Storage System	80
New central electric resistance space heating	80
All other new loads	50

(A) Load Based on Nameplate Ratings.

Load calculations shall include the following:

~~The percentages listed in Table~~

(1) General lighting and general-use receptacles at either of the following:

- (2) 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 as determined by 220.42
- (3) 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 minus the percent of high-efficacy light sources multiplied by 0.165 volt-amperes/m^2 or 0.015 volt-amperes/ft^2 based on either a lighting audit performed in the dwelling unit or on a proposed lighting design

(4) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)

(5) The nameplate rating of the following:

- (6) All appliances that are fastened in place, permanently connected, or located to be on a specific circuit
- (7) Ranges, wall-mounted ovens, counter-mounted cooking units
- (8) Clothes dryers that are not connected to the laundry branch circuit specified in item 220.83 (A)(2)
- (9) Water heaters

~~(B) Where Additional Air-Conditioning Equipment or Electric Space-Heating Equipment Is to Be Installed.~~

(1)

- a. Electric Vehicle Power Transfer System Equipment supplied by an individual branch circuit
- b. Energy Storage System as configured during charging from the electric utility

(B) Load Based on Metered Data.

The total load shall be the existing load calculated in 220.83(B)

~~shall be used for existing and additional new loads. The larger connected load of air conditioning or space heating, but not both, shall be used.~~

~~Table 220.83(B) With Additional Air-Conditioning or Electric Space-Heating Equipment~~

~~Load Percent of Load Air-conditioning equipment 100 Central electric space heating 100 Less than four separately~~

~~controlled space-heating units 100 First 8 kVA of all other loads 100 Remainder of all other loads 40~~

~~Other loads shall include the following:~~

(1) ~~General lighting and general-use receptacles at 33 volt-amperes/m² or 3 volt-amperes/ft² as determined by 220.42~~

(2) ~~1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)~~

(3) ~~The nameplate rating of the following:~~

- (4) ~~All appliances that are fastened in place, permanently connected, or located to be on a specific circuit~~
- (5) ~~Ranges, wall-mounted ovens, counter-mounted cooking units~~
- (6) ~~Clothes dryers that are not connected to the laundry branch circuit specified in item (2)~~
- (7) ~~Water heaters~~

(1) multiplied by 125 percent, plus the change in load calculated in 220.83(B)(2).

(1) The existing load on the feeder or service shall be the maximum metered kVA under the following conditions.

- (2) M etered data shall be collected when the dwelling unit is occupied.
- (3) Metered data shall be collected using a recording ammeter, power meter or electric utility consumption meter.
- (4) M etered data shall be averaged over consecutive, non-rolling 15 minute or 60 minute time intervals. The existing load using 15 minute time averaged metered data shall be the maximum kVA recorded for any 15 minute time interval. The existing load using 60 minute time averaged metered data shall be the maximum kVA recorded for any 60 minute time interval adjusted by one of the following:
  - (5) For maximum average kVA less than or equal to 7.5, the adjusted existing load shall be 2.2 kVA + maximum average kVA x 1.4.
  - (6) F or maximum average kVA greater than 7.5, the adjusted existing load shall be 5.2 kVA + maximum average kVA.
- (7) Metered data shall be for a minimum period of either one year or 30 days. If the 30 day minimum period is used, all of the following shall apply:
  - (8) The recording shall include by measurement or calculation the larger of the heating or cooling equipment load and other loads that might be periodic in nature due to seasonal or similar conditions.
  - (9) M etered data for a feeder or service with one or more electric power production sources operating in parallel with a primary source from an electric utility shall represent the total demand of connected loads using either of the following:
    - (10) At each time interval, the metered data shall be the imported power from the electric utility plus the output(s) of all other electric power production sources.
    - (11) A t each time interval, the metered data shall be the imported power from the electric utility plus the nameplate rated output(s) of all other electric power production sources. See 690.8 for Solar Photovoltaic (PV) Systems and 706.30 for Energy Storage Systems.
  - (12) A feeder or service that employs peak load reduction shall be permitted to use 220.83(B) if the peak load reduction is managed by an Energy Management System in accordance with 750.30.

(13) The change in service or feeder load when adding new loads shall be calculated using items 220.83(B)(2)(1-3). Accounting for existing loads being replaced or removed in 220.83(B)(2)(2-3) shall be permitted.

- (14) Sum the nameplate rating(s) of any new load(s) being installed.
- (15) Sum the nameplate rating(s) of any existing load(s) being replaced or removed.

(16) <u>Calculate the change in load as the new load(s) being installed minus the existing load(s) being replaced or removed. If the existing load from 220.83(B)(1) multiplied by 125 percent is less than 8 kVA, the change in load shall be treated at 100 percent until 8 kVA is reached. All remaining change in load shall be treated using the percentages listed for new loads in Table 220.83.</u>

Additional Proposed Changes

File Name	Description	Approved
nfpa_v1_220.83_strikethrough_copy_final.docx	Redline strikethrough copy of proposed revisions to 220.83.	
nfpa_v1_220.83_clean_copy_final.docx	Clean copy of proposed revisions to 220.83.	

Statement of Problem and Substantiation for Public Input

Millions of existing US dwelling units are going to undergo the electrification of fuel-fired end-uses in the coming decades. The use of load management tools, electric vehicle charging, renewable energy systems and energy storage systems are also increasing. The National Electric Code must provide an existing dwelling unit load calculation that is clear, flexible, accurate and able to be consistently and safely applied at-scale by stakeholders including governments, utilities, contractors and property owners. Load calculations for existing dwelling units commonly use either 220.83 or 220.87. We propose addressing both by merging the two paths into a new section 220.83. The new 220.83(A) addresses nameplate-based calculations and the new 220.83(B) addresses metering-based calculations (derived from 220.87).

Our proposed revisions target either improving the accuracy of load calculations for existing dwellings, or ensuring that calculation procedures and assumptions are clear and able to be consistently and safely applied. Based on our analysis, the current version of 220.83 over-estimates loads for general lighting and general receptacles. Related analyses suggest that treatment of new HVAC loads at 100% demand factor is not necessary and also results in substantial over-estimates of load. Based on feedback from industry and practitioners, section 220.87 reads unclearly, which results in inconsistent interpretation of the requirements and assumptions of this compliance path. Clarity is lacking around the following items: (a) appropriate time-step for data, (b) type of electrical data (demand vs. consumption metering), (c) and accounting for new loads. For example, an exception in this code section clearly allows the use of 15-minute average consumption data in determining the existing load when less than 1-year of data is available, but it does not specify what the default time-step of the data is outside of that exception (i.e., 15-minutes, hourly, daily?). The lack of clarity leads to confusion and inconsistent application and interpretation. Similarly, any new loads added via 220.87 do not clearly have a demand factor assumption applied, which again leads to inconsistent interpretation. Does this lack of a specification mean that a 100% assumption applies? Or that one can use demand factors from elsewhere in section 220? These elements need to be clarified in a way that applies distinctly to existing dwellings, and not to all building typologies.

Our proposed changes are based on industry feedback and detailed analysis of data sourced from thousands of occupied US dwellings. We have demonstrated adequate performance of the proposed existing dwelling electrical load calculations at a >95% design level, based on nearly 18,000 individual branch circuits and end-use loads. The results of these analyses will be published in an upcoming US DOE report authored by LBNL. A hard copy summarizing the results has been mailed to NFPA for use with this submittal. A summary of proposed changes and key supporting analysis results include:

We propose adding an optional method to reduce general lights and general receptacles loads based on an audit of the existing dwelling or proposed lighting design. The multiplier used to reduce the default value (0.015 w/ft2 x percent high-efficacy light sources) is based on an analysis of lighting audit data from over 2,000 existing dwellings in the Pacific Northwest, where lighting density varied strongly by the installed percentage of high-efficacy bulbs. This change is also supported by recent DOE rulemaking (10 CFR 430.32(dd)) that will effectively ban the sale of incandescent light bulbs for general purpose lamps as of July 2023.

We propose eliminating treatment of new HVAC loads at 100% demand factor and deleting current section 220.83(B). This is based on analysis of 8,529 individually sub-metered end-uses, where we found median demand factors for new loads being added to existing dwellings were <65% for all end-use categories, including HVAC and EVPTSE. HVAC end-uses were found to impact maximum dwelling demand similarly to other large loads (at around 50% of their nameplate rating). This is also based on analysis of metering data from 9,093 existing Vermont dwellings that installed cold climate heat pumps. We observed only a 5% demand factor across this population of dwellings, with new heat pumps rated at an average of 3.6 kW increasing whole dwelling maximum demand by only 0.2 kW. Just under half of the dwellings had reduced whole dwelling maximum demand after installation of a cold climate heat pump. Taken together, these results strongly support treating new HVAC loads as all other new loads are treated and eliminating the current section 220.83(B).

Based on the same analysis, we propose placing special demand factors for select load categories that showed high demand factors in our analysis, or that commonly led to under-predictions by the code. These include Central Electric Resistance Space Heating, EVPTSE and Energy Storage Systems, all of which we propose treating at 80% demand factor when they are added to an existing dwelling.

We also propose the same demand factors be used for new loads being added to existing dwelling units, whether the calculation is based on nameplate ratings or on metered data. This ensures consistent treatment of new loads being added through either compliance path. It also aligns with the reality of how dwelling maximum demand changes when new loads are added. To demonstrate, we performed example load calculations based on metering data (proposed in Section 220.83(B)) for each of the 8,529 sub-metered circuits and the 9,093 Vermont dwellings noted above. The proposed calculation procedure using 50% demand factor to account for new loads was effective in 99% of sub-metered circuits and in 96% of Vermont dwellings that added cold climate heat pumps. The use of the 80% demand factor for select loads would further improve these results.

We propose clear specification around the methods for gathering and analyzing dwelling metering data for deriving a load calculation. Most importantly, the proposed method targets 15-minute maximum demand data, but it allows the use of 60-minute data, if it is adjusted according to proposed values. In 11,940 existing US dwellings, we adjusted 60-minute maximum demand according to the proposed values and found that actual 15-minute maximum demand exceeded the prediction in only 1% of dwellings. This allowance for 60-minute data is particularly important, because it allows the nation's smart meter infrastructure to be used to generate automatic existing load calculations for dwellings. Without our proposed adjustment, use of 60-minute data will under-predict actual demand in many dwellings.

Finally, we propose compliance paths for existing dwellings to use metering data if they have less than one year of data and use multiple power production sources (e.g, PV, ESS) or peak load reduction strategies. Rather than excluding these dwellings from using metering data, additional requirements are specified that ensure accurate load calculations.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3303-NFPA 70-2023 [Section No. 220.87]	Associated changes in 220.87 that depend on proposed changes in 220.83
Public Input No. 3236-NFPA 70-2023 [Section No. 220.41]	Contains same proposal for lighting density reductions
Public Input No. 3239-NFPA 70-2023 [Section No. 220.82(B)]	Contains same proposal for lighting density reductions
Public Input No. 3242-NFPA 70-2023 [Section No. 220.84(C)]	Contains same proposal for lighting density reductions
Public Input No. 3319-NFPA 70-2023 [Section No. 220.83]	Contains same proposal for lighting density reductions
Public Input No. 3236-NFPA 70-2023 [Section No. 220.41]	
Public Input No. 3239-NFPA 70-2023 [Section No. 220.82(B)]	
Public Input No. 3242-NFPA 70-2023 [Section No. 220.84(C)]	
Public Input No. 3303-NFPA 70-2023 [Section No. 220.87]	

Submitter Information Verification

Submitter Full Name: Brennan Less
Organization: LBNL
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 28 19:34:42 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8188-NFPA 70-2024

Statement: 220.83 differentiates when adding or not adding new HVAC equipment. This is not justified based on analysis of 8,529 individually sub-metered end-uses in existing dwellings reported by Lawrence Berkeley National Lab (LBNL). Most new HVAC equipment added to dwellings contributes much less than 100% of its nameplate rating to dwelling maximum demand. In contrast, other loads are currently allowed to be added using 220.83 at 40%, but their contributions are substantially underestimated (for example, EVSE, water heaters and clothes dryers). LBNL also reported analysis of metering data from 9,093 existing Vermont dwellings that installed cold climate heat pumps. They observed only a 5% demand factor across this population of dwellings, with new heat pumps rated at an average of 3.6 kW, increasing whole dwelling maximum demand by only 0.2 kW.

Consistent with these findings, 220.83 is revised as follows:

• Differential treatment when adding new HVAC is eliminated, condensing 220.83(A) and 220.83(B) into a single section 220.83, with a single Table 220.83 for load percentages.

• General lights and general receptacles loads are reduced from 3 to 2 va/ft2, consistent with other revisions (see 220.41).

• Treatment of existing loads remains the same (first 8 kVA at 100%, remainder at 40%).

• All new loads being added to existing dwellings is treated at a more conservative 50% demand factor, which is consistent with median values observed in sub-metering data for water heating, clothes dryers and a variety of HVAC loads.

• Two notable exceptions are treated with higher demand factors of 80%—EVSE and Central Electric Resistance Space Heating—because sub-metering showed they were large loads with the highest demand factors.

220.83 Existing Dwelling Unit. This section shall be permitted to be used to determine if the existing service or feeder is of sufficient capacity to serve additional loads. Where the dwelling unit is served by a 120/240-volt or by a 208Y/120-volt 3-wire service or feeder, calculating the total load in accordance with 220.83(A) or (B) shall be permitted. The total load shall be calculated using percentages listed in Table 220.83 for existing and additional new loads. The larger connected load of air conditioning or space heating, but not both, shall be used. Noncoincident loads shall be treated in accordance with 220.60. Loads controlled by EMS shall be treated in accordance with 220.70.

(A) ~~**Where Additional Air-Conditioning Equipment or Electric Space-Heating Equipment Is Not to Be Installed**~~**Load Based on Nameplate Ratings**. ~~The percentages listed in Table 220.83(A) shall be used for existing and additional new loads.~~

Load calculations shall include the following:

1. General lighting and general-use receptacles at either of the following:
   a. 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 as determined by 220.42.
   ~~1.~~b. 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 minus the percent of high-efficacy light sources multiplied by 0.165 volt-amperes/m^2 or 0.015 volt-amperes/ft^2 based on either a lighting audit performed in the dwelling unit or a proposed lighting design.
2. 1500 volt-amperes for each 2-wire, 20-ampere small appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2).
3. The nameplate rating of the following:
   a. All appliances that are fastened in place, permanently connected, or located to be on a specific circuit
   b. Ranges, wall-mounted ovens, counter-mounted cooking units
   c. Clothes dryers that are not connected to the laundry branch circuit specified in item (2)
   d. Water heaters
   e. Electric Vehicle Power Transfer System Equipment supplied by an individual branch circuit
   ~~d.~~f. Energy Storage System as configured during charging from the electric utility

~~(B)~~ ~~**Where Additional Air-Conditioning Equipment or Electric Space-Heating Equipment is To Be Installed**~~~~. The percentages listed in Table 220.83(B) shall be used for existing and additional new loads. The larger connected load of air-conditioning or space heating, but not both, shall be used.~~

~~Other loads shall include the following:~~

~~1. General lighting and general-use receptacles at 33 volt-amperes/m² or 3 volt-amperes/ft² as determined by 220.42.~~

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2. ~~1500 volt-amperes for each 2-wire, 20-ampere small appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2).~~
3. ~~The nameplate rating of the following:~~
    a. ~~All appliances that are fastened in place, permanently connected, or located to be on a specific circuit~~
    b. ~~Ranges, wall-mounted ovens, counter-mounted cooking units~~
    c. ~~Clothes dryers that are not connected to the laundry branch circuit specified in item (2)~~
    d. ~~Water heaters~~

(B) **Load Based on Metered Data**. The total load shall be the existing load calculated in 220.83(B)(1) multiplied by 125 percent, plus the change in load calculated in 220.83(B)(2).

1. The existing load on the feeder or service shall be the maximum metered kVA under the following conditions:
    a. Metered data shall be collected when the dwelling unit is occupied.
    b. Metered data shall be collected using a recording ammeter, power meter or electric utility consumption meter.
    c. Metered data shall be averaged over consecutive, non-rolling 15 minute or 60 minute time intervals. The existing load using 15 minute time averaged metered data shall be the maximum kVA recorded for any 15 minute time interval. The existing load using 60 minute time averaged metered data shall be the maximum kVA recorded for any 60 minute time interval adjusted by one of the following:
        i. For maximum average kVA less than or equal to 7.5, the adjusted existing load shall be 2.2 kVA + maximum average kVA x 1.4.
        ii. For maximum average kVA greater than 7.5, the adjusted existing load shall be 5.2 kVA + maximum average kVA.
    d. Metered data shall be for a minimum period of either one year or 30 days. If the 30 day minimum period is used, all of the following shall apply:
        i. The recording shall include by measurement or calculation the larger of the heating or cooling equipment load and other loads that might be periodic in nature due to seasonal or similar conditions.
        ii. Metered data for a feeder or service with one or more electric power production sources operating in parallel with a primary source from an electric utility shall represent the total demand of connected loads using either of the following:
            1. At each time interval, the metered data shall be the imported power from the electric utility plus the output(s) of all other electric power production sources.
            2. At each time interval, the metered data shall be the imported power from the electric utility plus the nameplate rated output(s) of all other electric power production sources. See 690.8 for Solar Photovoltaic (PV) Systems and 706.30 for Energy Storage Systems.

iii. A feeder or service that employs peak load reduction shall be permitted to use 220.83(B) if the peak load reduction is managed by an Energy Management System in accordance with 750.30.

2. The change in service or feeder load when adding new loads shall be calculated using items 220.83(B)(2)(a-c). Accounting for existing loads being replaced or removed in 220.83(B)(2)(b-c) shall be permitted.
   a. Sum the nameplate rating(s) of any new load(s) being installed.
   b. Sum the nameplate rating(s) of any existing load(s) being replaced or removed.
   c. Calculate the change in load as the new load(s) being installed minus the existing load(s) being replaced or removed. If the existing load from 220.83(B)(1) multiplied by 125 percent is less than 8 kVA, the change in load shall be treated at 100 percent until 8 kVA is reached. All remaining change in load shall be treated using the percentages listed for new loads in Table 220.83.

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Table 220.83 Existing Dwelling Unit Load Percentages

Load (kVA)	**Percent of Load**
First 8 kVA of existing and new load at	100
Remainder of existing load at	40
New Electric Vehicle Power Transfer System Equipment or Energy Storage System	80
New central electric resistance space heating	80
All other new loads	50

~~*Table 220.83(A) Without Additional Air-Conditioning or Electric Space-Heating Equipment*~~

~~**Load (kVA)**~~	~~**Percent of Load**~~
~~First 8 kVA of load at~~	~~100~~
~~Remainder of load at~~	~~40~~

~~*Table 220.83(B) With Additional Air-Conditioning or Electric Space-Heating Equipment*~~

~~**Load (kVA)**~~	~~**Percent of Load**~~
~~Air-conditioning equipment~~	~~100~~
~~Central electric space heating~~	~~100~~
~~Less than four separately controlled space-heating units~~	~~100~~

~~First 8 kVA of load at~~	~~100~~
~~Remainder of load at~~	~~40~~

220.83 Existing Dwelling Unit. This section shall be permitted to be used to determine if the existing service or feeder is of sufficient capacity to serve additional loads. Where the dwelling unit is served by a 120/240-volt or by a 208Y/120-volt 3-wire service or feeder, calculating the total load in accordance with 220.83(A) or (B) shall be permitted. The total load shall be calculated using percentages listed in Table 220.83 for existing and additional new loads. The larger connected load of air conditioning or space heating, but not both, shall be used. Noncoincident loads shall be treated in accordance with 220.60. Loads controlled by EMS shall be treated in accordance with 220.70.

(A) **Load Based on Nameplate Ratings**.

Load calculations shall include the following:

1. General lighting and general-use receptacles at either of the following:
    a. 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 as determined by 220.42.
    b. 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 minus the percent of high-efficacy light sources multiplied by 0.165 volt-amperes/m^2 or 0.015 volt-amperes/ft^2 based on either a lighting audit performed in the dwelling unit or a proposed lighting design.
2. 1500 volt-amperes for each 2-wire, 20-ampere small appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2).
3. The nameplate rating of the following:
    a. All appliances that are fastened in place, permanently connected, or located to be on a specific circuit
    b. Ranges, wall-mounted ovens, counter-mounted cooking units
    c. Clothes dryers that are not connected to the laundry branch circuit specified in item (2)
    d. Water heaters
    e. Electric Vehicle Power Transfer System Equipment supplied by an individual branch circuit
    f. Energy Storage System as configured during charging from the electric utility

(B) **Load Based on Metered Data**. The total load shall be the existing load calculated in 220.83(B)(1) multiplied by 125 percent, plus the change in load calculated in 220.83(B)(2).

1. The existing load on the feeder or service shall be the maximum metered kVA under the following conditions:
    a. Metered data shall be collected when the dwelling unit is occupied.
    b. Metered data shall be collected using a recording ammeter, power meter or electric utility consumption meter.
    c. Metered data shall be averaged over consecutive, non-rolling 15 minute or 60 minute time intervals. The existing load using 15 minute time averaged metered data shall be the maximum kVA recorded for any 15 minute time interval. The existing load using 60 minute time averaged metered data shall be the maximum kVA recorded for any 60 minute time interval adjusted by one of the following:

        i. For maximum average kVA less than or equal to 7.5, the adjusted existing load shall be 2.2 kVA + maximum average kVA x 1.4.
        ii. For maximum average kVA greater than 7.5, the adjusted existing load shall be 5.2 kVA + maximum average kVA.
    d. Metered data shall be for a minimum period of either one year or 30 days. If the 30 day minimum period is used, all of the following shall apply:
        i. The recording shall include by measurement or calculation the larger of the heating or cooling equipment load and other loads that might be periodic in nature due to seasonal or similar conditions.
        ii. Metered data for a feeder or service with one or more electric power production sources operating in parallel with a primary source from an electric utility shall represent the total demand of connected loads using either of the following:
            1. At each time interval, the metered data shall be the imported power from the electric utility plus the output(s) of all other electric power production sources.
            2. At each time interval, the metered data shall be the imported power from the electric utility plus the nameplate rated output(s) of all other electric power production sources. See 690.8 for Solar Photovoltaic (PV) Systems and 706.30 for Energy Storage Systems.
        iii. A feeder or service that employs peak load reduction shall be permitted to use 220.83(B) if the peak load reduction is managed by an Energy Management System in accordance with 750.30.
2. The change in service or feeder load when adding new loads shall be calculated using items 220.83(B)(2)(a-c). Accounting for existing loads being replaced or removed in 220.83(B)(2)(b-c) shall be permitted.
    a. Sum the nameplate rating(s) of any new load(s) being installed.
    b. Sum the nameplate rating(s) of any existing load(s) being replaced or removed.
    c. Calculate the change in load as the new load(s) being installed minus the existing load(s) being replaced or removed. If the existing load from 220.83(B)(1) multiplied by 125 percent is less than 8 kVA, the change in load shall be treated at 100 percent until 8 kVA is reached. All remaining change in load shall be treated using the percentages listed for new loads in Table 220.83.

Table 220.83 Existing Dwelling Unit Load Percentages

Load (kVA)	**Percent of Load**
First 8 kVA of existing and new load at	100
Remainder of existing load at	40
New Electric Vehicle Power Transfer System Equipment or Energy Storage System	80

New central electric resistance space heating	80
All other new loads	50

Public Input No. 308-NFPA 70-2023 [Section No. 220.83]

220.83 Existing Dwelling Unit.

This section shall be permitted to be used to determine if the existing service or feeder is of sufficient capacity to serve additional loads. Where the dwelling unit is served by a 120/240-volt or 208Y/120-volt, 3-wire service or feeder, calculating the total load in accordance with 220.83(A) or (B) shall be permitted.

(A) ~~Where Additional Air~~ Where Air -Conditioning Equipment or Electric Space-Heating Equipment Is Not ~~to Be Installed~~ Present .

The percentages listed in Table 220.83(A) shall be used for existing and additional new loads.

Table 220.83(A) Without Additional Air-Conditioning or Electric Space-Heating Equipment

Load (kVA)	Percent of Load
First 8 kVA of load at	100
Remainder of load at	40

Load calculations shall include the following:

(1) General lighting and general-use receptacles at 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 as determined by 220.42

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)

(3) The nameplate rating of the following:

(4) All appliances that are fastened in place, permanently connected, or located to be on a specific circuit

(5) Ranges, wall-mounted ovens, counter-mounted cooking units

(6) Clothes dryers that are not connected to the laundry branch circuit specified in item (2)

(7) Water heaters

(B) Where ~~Additional~~ Air-Conditioning Equipment or Electric Space-Heating Equipment ~~Is to Be Installed~~ Is Present .

The percentages listed in Table 220.83(B) shall be used for existing and additional new loads. The larger connected load of air conditioning or space heating, but not both, shall be used.

Table 220.83(B) With Additional Air-Conditioning or Electric Space-Heating Equipment

Load	Percent of Load
Air-conditioning equipment	100
Central electric space heating	100
Less than four separately controlled space-heating units	100
First 8 kVA of all other loads	100
Remainder of all other loads	40

Other loads shall include the following:

(1) General lighting and general-use receptacles at 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 as determined by 220.42

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)

(3) The nameplate rating of the following:

(4) All appliances that are fastened in place, permanently connected, or located to be on a specific circuit

(5) Ranges, wall-mounted ovens, counter-mounted cooking units

(6) Clothes dryers that are not connected to the laundry branch circuit specified in item (2)

(7) Water heaters

Statement of Problem and Substantiation for Public Input

The sole difference in the computations in 220.83(A) and 220.83(B) is that 220.83(B) specifies a 100% factor for any Air-Conditioning Equipment or Electric Space-Heating Equipment. Under 220.83(A), any such equipment would end up with a 40% factor. The current dividing line between 220.83(A) and 220.83(B) is based only on what new equipment is being installed.

So consider a two stage series of improvements to a dwelling unit, two separate projects under two separate permits, perhaps a year apart. The final stage may have a load calculation that differs depending on what order the improvements are done, even as the final installed result is the same. If all of the Air-Conditioning Equipment or Electric Space-Heating Equipment is added as part of the first stage, and the second stage contains no such equipment, the final load calculation will be subject to 220.83(A) and include only a 40% factor for the Air-Conditioning Equipment or Electric Space-Heating Equipment. Conversely, if the second stage improvement does include additional Air-Conditioning Equipment or Electric Space-Heating Equipment, then the final load calculation will be subject to 220.83(B) and include a 100% factor for the Air-Conditioning Equipment or Electric Space-Heating Equipment.

This difference in load calculation results for identical final configurations of equipment makes zero sense. Therefore I propose that the dividing line between 220.83(A) and 220.83(B) should be based on what equipment is present, not what equipment is being installed.

Please note that if this proposal is accepted, 220.83 may be further simplified by eliminating the A/B divide and just specifying the computation in 220.83(B) for all cases. I kept my proposal minimal for clarity.

Submitter Information Verification

Submitter Full Name: Wayne Whitney
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Feb 08 12:35:49 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8188-NFPA 70-2024

Statement: 220.83 differentiates when adding or not adding new HVAC equipment. This is not justified based on analysis of 8,529 individually sub-metered end-uses in existing dwellings reported by Lawrence Berkeley National Lab (LBNL). Most new HVAC equipment added to dwellings contributes much less than 100% of its nameplate rating to dwelling maximum demand. In contrast, other loads are currently allowed to be added using 220.83 at 40%, but their contributions are substantially underestimated (for example, EVSE, water heaters and clothes dryers). LBNL also reported analysis of metering data from 9,093 existing Vermont dwellings that installed cold climate heat pumps. They observed only a 5% demand factor across this population of dwellings, with new heat pumps rated at an average of 3.6 kW, increasing whole dwelling maximum demand by only 0.2 kW.

Consistent with these findings, 220.83 is revised as follows:

• Differential treatment when adding new HVAC is eliminated, condensing 220.83(A) and 220.83(B) into a single section 220.83, with a single Table 220.83 for load percentages.

• General lights and general receptacles loads are reduced from 3 to 2 va/ft2, consistent with other revisions (see 220.41).

• Treatment of existing loads remains the same (first 8 kVA at 100%, remainder at 40%).

• All new loads being added to existing dwellings is treated at a more conservative 50% demand factor, which is consistent with median values observed in sub-metering data for water heating, clothes dryers and a variety of HVAC loads.

• Two notable exceptions are treated with higher demand factors of 80%—EVSE and Central Electric Resistance Space Heating—because sub-metering showed they were large loads with the highest demand factors.

Public Input No. 3319-NFPA 70-2023 [Section No. 220.83]

220.83 Existing Dwelling Unit.

This section shall be permitted to be used to determine if the existing service or feeder is of sufficient capacity to serve additional loads. Where the dwelling unit is served by a 120/240-volt or 208Y/120-volt, 3-wire service or feeder, calculating the total load in accordance with 220.~~83(A) or (B)~~ 83 shall be permitted.

~~**(A)** Where Additional Air-Conditioning Equipment or Electric Space-Heating Equipment Is Not to Be Installed.~~

The percentages listed in Table 220.83

~~(A)~~

shall be used for existing and additional new loads.

~~Table 220.83(A) Without Additional Air-Conditioning or Electric Space-Heating Equipment~~

The larger connected load of air-conditioning or space heating, but not both, shall be used. Noncoincident loads shall be treated in accordance with 220.60. Loads controlled by an EMS shall be treated in accordance with 220.70. Existing dwelling unit loads based on metered data shall be in accordance with 220.87.

Table 220.83 *Existing Dwelling Unit Load Percentages*

Load (kVA)	Percent of Load
First 8 kVA of existing and new load at	100
Remainder of existing load at	40
New Electric Vehicle Power Transfer System Equipment or Energy Storage System	80
New central electric resistance space heating	80
All other new loads	50

Load calculations shall include the following:

(1) General lighting and general-use receptacles at either of the following:

(2) 33 volt-amperes/m ^{2} or 3 volt-amperes/ft ^{2} as determined by 220.42

~~1500 volt~~

(3)

(1) 33 volt -amperes

~~for each~~

(4)

(1) /m ^{2}

~~-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)~~

(5) ~~The nameplate rating of the following:~~

(6) ~~All appliances that are fastened in place, permanently connected, or located to be on a specific circuit~~

(7) ~~Ranges, wall-mounted ovens, counter-mounted cooking units~~

(8) ~~Clothes dryers that are not connected to the laundry branch circuit specified in item (2)~~

(9) ~~Water heaters~~

~~(B) Where Additional Air-Conditioning Equipment or Electric Space-Heating Equipment Is to Be Installed.~~

~~The percentages listed in Table 220.83(B) shall be used for existing and additional new loads. The larger connected load of air conditioning or space heating, but not both, shall be used.~~

~~Table 220.83(B) With Additional Air-Conditioning or Electric Space-Heating Equipment~~

~~Load Percent of Load Air-conditioning equipment 100 Central electric space heating 100 Less than four separately~~

~~controlled space-heating units 100 First 8 kVA of all other loads 100 Remainder of all other loads 40~~

~~Other loads shall include the following:~~

~~General lighting and general-use receptacles at 33 volt-amperes/m ^{2} or 3 volt-amperes/ft ^{2} as determined by 220.42~~

(1)

(1) ~~or 3 volt-amperes/ft ^{2} minus the percent of high-efficacy light sources multiplied by 0.165 volt-amperes/m ^{2} or 0.015 volt-amperes/ft ^{2} based either on a lighting audit performed in the dwelling unit or on a proposed lighting design~~

(2) ~~1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)~~

(3) ~~The nameplate rating of the following:~~

(4) ~~All appliances that are fastened in place, permanently connected, or located to be on a specific circuit~~

(5) ~~Ranges, wall-mounted ovens, counter-mounted cooking units~~

(6) ~~Clothes dryers that are not connected to the laundry branch circuit specified in item (2)~~

(7) ~~Water heaters~~

(8) ~~E lectric Vehicle Power Transfer System Equipment supplied by an individual branch circuit~~

(9) ~~Energy Storage System as configured during charging from the electric utility~~

Additional Proposed Changes

File Name	Description	Approved

nfpa_v2_220.83_strikethrough_copy.docx	Redline strikethrough copy of proposed changes to 220.83.
nfpa_v2_220.83_clean_copy.docx	Clean copy of proposed changes to 220.83

Statement of Problem and Substantiation for Public Input

Millions of existing US dwelling units are going to undergo the electrification of fuel-fired end-uses in the coming decades. The use of load management tools, electric vehicle charging, renewable energy systems and energy storage systems are also increasing. The National Electric Code must provide an existing dwelling unit load calculation that is clear, flexible, accurate and able to be consistently and safely applied at-scale by stakeholders including governments, utilities, contractors and property owners. Our proposed revisions target either improving the accuracy of load calculations for existing dwellings, or ensuring that calculation procedures and assumptions are clear and able to be consistently and safely applied.

Proposed changes are based on industry feedback and detailed analysis of data sourced from thousands of occupied US dwellings. We have demonstrated adequate performance of the proposed existing dwelling electrical load calculations at a >95% design level, based on nearly 18,000 individual branch circuits and end-use loads. The results of these analyses will be published in an upcoming US DOE report authored by LBNL. A hard copy summarizing the results has been mailed to NFPA for use with this submittal. A summary of proposed changes and key supporting analysis results include:

We propose adding an optional method to reduce general lights and general receptacles loads based on an audit of the existing dwelling or proposed lighting design. The multiplier used to reduce the default value (0.015 w/ft2 x percent high-efficacy light sources) is based on an analysis of lighting audit data from over 2,000 existing dwellings in the Pacific Northwest, where lighting density varied strongly by the installed percentage of high-efficacy bulbs. This change is also supported by recent DOE rulemaking (10 CFR 430.32(dd)) that will effectively ban the sale of incandescent light bulbs for general purpose lamps as of July 2023.

We propose eliminating treatment of new HVAC loads at 100% demand factor and deleting current section 220.83(B). This is based on analysis of 8,529 individually sub-metered end-uses, where we found median demand factors for new loads being added to existing dwellings were <65% for all end-use categories, including HVAC and EVPTSE. HVAC end-uses were found to impact maximum dwelling demand similarly to other large loads (at around 50% of their nameplate rating). This is also based on analysis of metering data from 9,093 existing Vermont dwellings that installed cold climate heat pumps. We observed only a 5% demand factor across this population of dwellings, with new heat pumps rated at an average of 3.6 kW increasing whole dwelling maximum demand by only 0.2 kW. Just under half of the dwellings had reduced whole dwelling maximum demand after installation of a cold climate heat pump. Taken together, these results strongly support treating new HVAC loads as all other new loads are treated and eliminating the current section 220.83(B).

Based on the same analysis, we propose placing special demand factors for select load categories that showed high demand factors in our analysis, or that commonly led to under-predictions by the code. These include Central Electric Resistance Space Heating, EVPTSE and Energy Storage Systems, all of which we propose treating at 80% demand factor when they are added to an existing dwelling.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3236-NFPA 70-2023 [Section No. 220.41]	Contains same proposal for lighting density reductions
Public Input No. 3239-NFPA 70-2023 [Section No. 220.82(B)]	Contains same proposal for lighting density reductions
Public Input No. 3242-NFPA 70-2023 [Section No. 220.84(C)]	Contains same proposal for lighting density reductions
Public Input No. 3320-NFPA 70-2023 [Section No. 220.87]	Corresponding changes in 220.87 that depend on proposed changes in 220.83
Public Input No. 3028-NFPA 70-2023 [Section No. 220.83]	
Public Input No. 3236-NFPA 70-2023 [Section No. 220.41]	
Public Input No. 3239-NFPA 70-2023 [Section No. 220.82(B)]	
Public Input No. 3242-NFPA 70-2023 [Section No. 220.84(C)]	
Public Input No. 3320-NFPA 70-2023 [Section No. 220.87]	

Submitter Information Verification

Submitter Full Name: Brennan Less
Organization: LBNL
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 31 19:31:54 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: FR-8188-NFPA 70-2024

Statement: 220.83 differentiates when adding or not adding new HVAC equipment. This is not justified based on analysis of 8,529 individually sub-metered end-uses in existing dwellings reported by Lawrence Berkeley National Lab (LBNL). Most new HVAC equipment added to dwellings contributes much less than 100% of its nameplate rating to dwelling maximum demand. In contrast, other loads are currently allowed to be added using 220.83 at 40%, but their contributions are substantially underestimated (for example, EVSE, water heaters and clothes dryers). LBNL also reported analysis of metering data from 9,093 existing Vermont dwellings that installed cold climate heat pumps. They observed only a 5% demand factor across this population of dwellings, with new heat pumps rated at an average of 3.6 kW, increasing whole dwelling maximum demand by only 0.2 kW.

Consistent with these findings, 220.83 is revised as follows:

• Differential treatment when adding new HVAC is eliminated, condensing 220.83(A) and 220.83(B) into a single section 220.83, with a single Table 220.83 for load percentages.

• General lights and general receptacles loads are reduced from 3 to 2 va/ft2, consistent with other revisions (see 220.41).

• Treatment of existing loads remains the same (first 8 kVA at 100%, remainder at 40%).

• All new loads being added to existing dwellings is treated at a more conservative 50% demand factor, which is consistent with median values observed in sub-metering data for water heating, clothes dryers and a variety of HVAC loads.

• Two notable exceptions are treated with higher demand factors of 80%—EVSE and Central Electric Resistance Space Heating—because sub-metering showed they were large loads with the highest demand factors.

Public Input No. 916-NFPA 70-2023 [Section No. 220.83]

220.83 Existing Dwelling Unit.

This section shall be permitted to be used to determine if the existing service or feeder is of sufficient capacity to serve additional loads. Where the dwelling unit is served by a 120/240-volt or 208Y/120-volt, 3-wire service or feeder, calculating the total load in accordance with 220.83(A) or (B) shall be permitted.

(A) Where Additional Air-Conditioning Equipment or Electric Space-Heating Equipment Is Not to Be Installed.

The percentages listed in Table 220.83(A) shall be used for existing and additional new loads.

Table 220.83(A) Without Additional Air-Conditioning or Electric Space-Heating Equipment

Load (kVA)	Percent of Load
First 8 kVA of load at	100
Remainder of load at	40

Load calculations shall include the following:

(1) - ~~General lighting and general-use receptacles at~~ Minimum unit load at 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 as determined by 220.~~42~~ 41

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)

(3) The nameplate rating of the following:

(4) All appliances that are fastened in place, permanently connected, or located to be on a specific circuit

(5) Ranges, wall-mounted ovens, counter-mounted cooking units

(6) Clothes dryers that are not connected to the laundry branch circuit specified in item (2)

(7) Water heaters

(B) Where Additional Air-Conditioning Equipment or Electric Space-Heating Equipment Is to Be Installed.

The percentages listed in Table 220.83(B) shall be used for existing and additional new loads. The larger connected load of air conditioning or space heating, but not both, shall be used.

Table 220.83(B) With Additional Air-Conditioning or Electric Space-Heating Equipment

Load	Percent of Load
Air-conditioning equipment	100
Central electric space heating	100
Less than four separately controlled space-heating units	100
First 8 kVA of all other loads	100
Remainder of all other loads	40

Other loads shall include the following:

(1) - ~~General lighting and general-use receptacles at 33 volt-~~ Minimum unit load at 33 volt- amperes/m^2 or 3 volt-amperes/ft^2 as determined by 220.~~42~~ 41

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)

(3) The nameplate rating of the following:

(4) All appliances that are fastened in place, permanently connected, or located to be on a specific circuit

(5) Ranges, wall-mounted ovens, counter-mounted cooking units

(6) Clothes dryers that are not connected to the laundry branch circuit specified in item (2)

(7) Water heaters

Statement of Problem and Substantiation for Public Input

Section 220.83 covers Dwelling Units
Sections 220.83(A)(1) and (B)(1) directs the user to 220.42 which covers Non-Dwelling Occupancies

The proper reference should be 220.41 in both sections

"General lighting and general-use receptacles" is replaced by "Minimum unit load" to reflect the language in 220.41 and the changes made in the 2023 NEC

Thank You

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 915-NFPA 70-2023 [Section No. 220.16(A)]	

Submitter Information Verification

Submitter Full Name: Daniel Naughton
Organization: Local 103 IBEW Boston, Ma
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 01 12:43:56 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8188-NFPA 70-2024

Statement: 220.83 differentiates when adding or not adding new HVAC equipment. This is not justified based on analysis of 8,529 individually sub-metered end-uses in existing dwellings reported by Lawrence Berkeley National Lab (LBNL). Most new HVAC equipment added to dwellings contributes much less than 100% of its nameplate rating to dwelling maximum demand. In contrast, other loads are currently allowed to be added using 220.83 at 40%, but their contributions are substantially underestimated (for example, EVSE, water heaters and clothes dryers). LBNL also reported analysis of metering data from 9,093 existing Vermont dwellings that installed cold climate heat pumps. They observed only a 5% demand factor across this population of dwellings, with new heat pumps rated at an average of 3.6 kW, increasing whole dwelling maximum demand by only 0.2 kW.

Consistent with these findings, 220.83 is revised as follows:

• Differential treatment when adding new HVAC is eliminated, condensing 220.83(A) and 220.83(B) into a single section 220.83, with a single Table 220.83 for load percentages.

• General lights and general receptacles loads are reduced from 3 to 2 va/ft2, consistent with other revisions (see 220.41).

• Treatment of existing loads remains the same (first 8 kVA at 100%, remainder at 40%).

• All new loads being added to existing dwellings is treated at a more conservative 50% demand factor, which is consistent with median values observed in sub-metering data for water heating, clothes dryers and a variety of HVAC loads.

• Two notable exceptions are treated with higher demand factors of 80%—EVSE and Central Electric Resistance Space Heating—because sub-metering showed they were large loads with the highest demand factors.

Public Input No. 4488-NFPA 70-2023 [Section No. 220.83(A)]

(A) Where Additional Air-Conditioning Equipment or Electric Space-Heating Equipment Is Not to Be Installed.

The percentages listed in Table 220.83(A) shall be used for existing and additional new loads.

Table 220.83(A) Without Additional Air-Conditioning or Electric Space-Heating Equipment

Load (kVA)	Percent of Load
First 8 kVA of load at	100
Remainder of load at	40

Load calculations shall include the following:

(1) General lighting and general-use receptacles at 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 as determined by 220.42

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)

(3) The nameplate rating of the following:

(4) All appliances that are fastened in place, permanently connected, or located to be on a specific circuit

(5) Ranges, wall-mounted ovens, counter-mounted cooking units

(6) Clothes dryers that are not connected to the laundry branch circuit specified in item (2)

(7) Water heaters

(8) Maximum load of an Energy Management System controlling any number of noncoincident loads

Statement of Problem and Substantiation for Public Input

All sections of the Optional Load Calcs should have specific allowance for loads controlled by an Energy Management System

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4237-NFPA 70-2023 [Section No. 220.82(B)]	repeating comment for both new and existing dwelling units
Public Input No. 4491-NFPA 70-2023 [Section No. 220.83(B)]	

Submitter Information Verification

Submitter Full Name: kyle breuning

Organization: Lunar Energy

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 16:26:33 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: FR-8184-NFPA 70-2024

Statement: Section 220.70 was relocated to Article 220 Part I to reinforce that a Power Control System can be used for load calculations throughout Article 220. The new 220.7 restructures the requirements into 5 sub-sections for clarity.

Energy Management System (EMS) was renamed to Power Control System (PCS) to differentiate an EMS with overload control from an EMS without overload control. 220.7(A) refers to Part II of Article 750, which is the subject of a PI for CMP 13 to identify requirements for EMS with overload control functionality. Should CMP 13 not create part II, this action will need to be revisited.

A requirement was added that the setpoint shall be determined by “Qualified Personnel”.

Public Input No. 850-NFPA 70-2023 [Section No. 220.83(A)]

(A) Where Additional Air-Conditioning Equipment or Electric Space-Heating Equipment Is Not to Be Installed.

The percentages listed in Table 220.83(A) shall be used for existing and additional new loads.

Table 220.83(A) Without Additional Air-Conditioning or Electric Space-Heating Equipment

Load (kVA)	Percent of Load
First 8 kVA of load at	100
Remainder of load at	40

Load calculations shall include the following:

(1) General lighting and general-use receptacles at 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 as determined by 220.~~42~~ 41

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)

(3) The nameplate rating of the following:

(4) All appliances that are fastened in place, permanently connected, or located to be on a specific circuit

(5) Ranges, wall-mounted ovens, counter-mounted cooking units

(6) Clothes dryers that are not connected to the laundry branch circuit specified in item (2)

(7) Water heaters

Statement of Problem and Substantiation for Public Input

220.83(A) deals with existing dwelling units where additional air-conditioning equipment or electric space-heating equipment will not be installed. 220.83(A)(1) deals with load calculations and references the 3 VA (watts) per square foot for a general lighting load. For this 3 VA (watts) per square foot, this section references 220.42. A closer look at 220.42 finds that this section deals with “Lighting Loads for Non-Dwelling Units” with no reference to the 3 VA (watts) per square foot for a dwelling anywhere in the section. During the 2023 NEC revision cycle, I believe CMP-2 was attempting to point the User of the Code to 220.41 (Dwelling Units, Minimum Unit Load) rather than 220.42. Section 220.41 is where the User of the Code would find the 3 VA (watts) per square foot for dwelling units. Section 220.41 was new for the 2023 NEC where it was moved from 220.14(J).

Submitter Information Verification

Submitter Full Name: L. Keith Lofland
Organization: (Retired)
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 18 00:11:39 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8188-NFPA 70-2024

Statement: 220.83 differentiates when adding or not adding new HVAC equipment. This is not justified based on analysis of 8,529 individually sub-metered end-uses in existing dwellings reported by Lawrence Berkeley National Lab (LBNL). Most new HVAC equipment added to dwellings contributes much less than 100% of its nameplate rating to dwelling maximum demand. In contrast, other loads are currently allowed to be added using 220.83 at 40%, but their contributions are substantially underestimated (for example, EVSE, water heaters and clothes dryers). LBNL also reported analysis of metering data from 9,093 existing Vermont dwellings that installed cold climate heat pumps. They observed only a 5% demand factor across this population of dwellings, with new heat pumps rated at an average of 3.6 kW, increasing whole dwelling maximum demand by only 0.2 kW.

Consistent with these findings, 220.83 is revised as follows:

• Differential treatment when adding new HVAC is eliminated, condensing 220.83(A) and 220.83(B) into a single section 220.83, with a single Table 220.83 for load percentages.

• General lights and general receptacles loads are reduced from 3 to 2 va/ft2, consistent with other revisions (see 220.41).

• Treatment of existing loads remains the same (first 8 kVA at 100%, remainder at 40%).

• All new loads being added to existing dwellings is treated at a more conservative 50% demand factor, which is consistent with median values observed in sub-metering data for water heating, clothes dryers and a variety of HVAC loads.

• Two notable exceptions are treated with higher demand factors of 80%—EVSE and Central Electric Resistance Space Heating—because sub-metering showed they were large loads with the highest demand factors.

Public Input No. 873-NFPA 70-2023 [Section No. 220.83(A)]

(A) Where Additional Air-Conditioning Equipment or Electric Space-Heating Equipment Is Not to Be Installed.

The percentages listed in Table 220.83(A) shall be used for existing and additional new loads.

Table 220.83(A) Without Additional Air-Conditioning or Electric Space-Heating Equipment

Load (kVA)	Percent of Load
First 8 kVA of load at	100
Remainder of load at	40

Load calculations shall include the following:

(1) General lighting and general-use receptacles at 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 as determined by 220.42

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)

(3) The nameplate rating of the following:

a. All appliances that are fastened in place, permanently connected, or located to be on a specific circuit

b. Ranges, wall-mounted ovens, counter-mounted cooking units

c. Clothes dryers that are not connected to the laundry branch circuit specified in item (2)

d. Water heaters

Statement of Problem and Substantiation for Public Input

220.83 (A) is used to determine if the existing service or feeder has sufficient capacity to serve additional loads. There is no allowance required to be accounted for if there is air conditioning or electric space heating already installed. The section only references "where additional AC or electric space heating is to be installed". So if we were not going to add additional heat or AC to existing heat or AC, we don't count the existing units into the calculation? Table 220.83(A) (using 220.83 (A) 1-3) do not include VA requirements for existing heat or AC. That seems incorrect and an insufficient existing load calculation to me.

Submitter Information Verification

Submitter Full Name: Chad Privratsky
Organization: IBEW 280
Street Address:
City:
State:
Zip:
Submittal Date: Mon May 22 19:09:03 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The Public Input is incomplete, as it does not indicate what changes should be made to the text. Refer to the Regulations Governing the Development of NFPA Standards, clause 4.3.4.1(c). If the submitter’s intent is to request an interpretation, the appropriate process is to request a Formal Interpretation in accordance with the Regulations Governing the Development of NFPA Standards, Section 6.2.

Public Input No. 4491-NFPA 70-2023 [Section No. 220.83(B)]

(B) Where Additional Air-Conditioning Equipment or Electric Space-Heating Equipment Is to Be Installed.

The percentages listed in Table 220.83(B) shall be used for existing and additional new loads. The larger connected load of air conditioning or space heating, but not both, shall be used.

Table 220.83(B) With Additional Air-Conditioning or Electric Space-Heating Equipment

Load	Percent of Load
Air-conditioning equipment	100
Central electric space heating	100
Less than four separately controlled space-heating units	100
First 8 kVA of all other loads	100
Remainder of all other loads	40

Other loads shall include the following:

(1) General lighting and general-use receptacles at 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 as determined by 220.42

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)

(3) The nameplate rating of the following:

(4) All appliances that are fastened in place, permanently connected, or located to be on a specific circuit

(5) Ranges, wall-mounted ovens, counter-mounted cooking units

(6) Clothes dryers that are not connected to the laundry branch circuit specified in item (2)

(7) Water heaters

(8) Maximum load of an Energy Management System controlling any number of noncoincident loads

Statement of Problem and Substantiation for Public Input

All load calc methods should specify allowance for loads controlled by an Energy Management System

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4488-NFPA 70-2023 [Section No. 220.83(A)]	repeating comment for with and without air conditioning on an existing dwelling unit

Submitter Information Verification

Submitter Full Name: kyle breuning
Organization: Lunar Energy
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 16:28:28 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8184-NFPA 70-2024

Statement: Section 220.70 was relocated to Article 220 Part I to reinforce that a Power Control System can be used for load calculations throughout Article 220. The new 220.7 restructures the requirements into 5 sub-sections for clarity.

Energy Management System (EMS) was renamed to Power Control System (PCS) to differentiate an EMS with overload control from an EMS without overload control. 220.7(A) refers to Part II of Article 750, which is the subject of a

PI for CMP 13 to identify requirements for EMS with overload control functionality. Should CMP 13 not create part II, this action will need to be revisited.

A requirement was added that the setpoint shall be determined by “Qualified Personnel”.

Public Input No. 851-NFPA 70-2023 [Section No. 220.83(B)]

(B) Where Additional Air-Conditioning Equipment or Electric Space-Heating Equipment Is to Be Installed.

The percentages listed in Table 220.83(B) shall be used for existing and additional new loads. The larger connected load of air conditioning or space heating, but not both, shall be used.

Table 220.83(B) With Additional Air-Conditioning or Electric Space-Heating Equipment

Load	Percent of Load
Air-conditioning equipment	100
Central electric space heating	100
Less than four separately controlled space-heating units	100
First 8 kVA of all other loads	100
Remainder of all other loads	40

Other loads shall include the following:

(1) General lighting and general-use receptacles at 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 as determined by 220.~~42~~ 41

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)

(3) The nameplate rating of the following:

(4) All appliances that are fastened in place, permanently connected, or located to be on a specific circuit

(5) Ranges, wall-mounted ovens, counter-mounted cooking units

(6) Clothes dryers that are not connected to the laundry branch circuit specified in item (2)

(7) Water heaters

Statement of Problem and Substantiation for Public Input

220.83(B) deals with existing dwelling units where additional air-conditioning equipment or electric space-heating equipment will be installed. 220.83(B)(1) deals with load calculations and references the 3 VA (watts) per square foot for a general lighting load. For this 3 VA (watts) per square foot, this section references 220.42. A closer look at 220.42 finds that this section deals with “Lighting Loads for Non-Dwelling Units” with no reference to the 3 VA (watts) per square foot for a dwelling anywhere in the section. During the 2023 NEC revision cycle, I believe CMP-2 was attempting to point the User of the Code to 220.41 (Dwelling Units, Minimum Unit Load) rather than 220.42. Section 220.41 is where the User of the Code would find the 3 VA (watts) per square foot for dwelling units. Section 220.41 was new for the 2023 NEC where it was moved from 220.14(J).

Submitter Information Verification

Submitter Full Name: L. Keith Lofland
Organization: (Retired)
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 18 00:23:37 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8188-NFPA 70-2024

Statement: 220.83 differentiates when adding or not adding new HVAC equipment. This is not justified based on analysis of 8,529 individually sub-metered end-uses in existing dwellings reported by Lawrence Berkeley National Lab (LBNL). Most new HVAC equipment added to dwellings contributes much less than 100% of its nameplate rating to dwelling maximum demand. In contrast, other loads are currently allowed to be added using 220.83 at 40%, but their contributions are substantially underestimated (for example, EVSE, water heaters and clothes dryers). LBNL also reported analysis of metering data from 9,093 existing Vermont dwellings that installed cold climate heat pumps. They observed only a 5%

demand factor across this population of dwellings, with new heat pumps rated at an average of 3.6 kW, increasing whole dwelling maximum demand by only 0.2 kW.

Consistent with these findings, 220.83 is revised as follows:

• Differential treatment when adding new HVAC is eliminated, condensing 220.83(A) and 220.83(B) into a single section 220.83, with a single Table 220.83 for load percentages.

• General lights and general receptacles loads are reduced from 3 to 2 va/ft2, consistent with other revisions (see 220.41).

• Treatment of existing loads remains the same (first 8 kVA at 100%, remainder at 40%).

• All new loads being added to existing dwellings is treated at a more conservative 50% demand factor, which is consistent with median values observed in sub-metering data for water heating, clothes dryers and a variety of HVAC loads.

• Two notable exceptions are treated with higher demand factors of 80%—EVSE and Central Electric Resistance Space Heating—because sub-metering showed they were large loads with the highest demand factors.

Public Input No. 3073-NFPA 70-2023 [Section No. 220.84(A)]

(A) Feeder or Service Load.

It shall be permissible to calculate the load of a feeder or service that supplies three or more dwelling units of a multifamily dwelling in accordance with Table 220.84(B) instead of Part III of this article if all the following conditions are met:

(1) No dwelling unit is supplied by more than one feeder.

(2) Each dwelling unit is equipped with electric cooking equipment.

Exception: When the calculated load for multifamily dwellings without electric cooking in Part III of this article exceeds that calculated under Part IV for the identical load plus electric cooking (based on 8 kW per unit), the lesser of the two loads shall be permitted to be used.

(3) Each dwelling unit is equipped with either electric space heating or air conditioning, or both. Feeders and service conductors whose calculated load is determined by this optional calculation shall be permitted to have the neutral load determined by 220.61.

(4) Where two or more single-phase dwelling units are supplied by a 3-phase, 4-wire feeder or service, the total load shall be calculated on the basis of twice the maximum number dwelling units connected between any two phases.

Statement of Problem and Substantiation for Public Input

A 1-phase, 120/208V, multifamily dwelling with 30-unit dwelling units supplied from a 3-phase, 4-wire feeder or service will have their loads distributed as follows; 10 units between phases A and B, 10 units between phases B and C, and 10 units between phases A and C. In this example, we need to apply the demand factor based on twenty units, not thirty units. Adding this language will make the load calculation technically correct.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 29 10:58:55 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: The suggested language is not a condition to use Table 220.84(B). The proposal has merit but needs to be written and located appropriately.

Public Input No. 438-NFPA 70-2023 [Section No. 220.84(A)]

(A) Feeder or Service Load.

It shall be permissible to calculate the load of a feeder or service that supplies three or more dwelling units of a multifamily dwelling in accordance with Table 220.84(B) instead of Part III of this article if all the following conditions are met:

(1) No dwelling unit is supplied by more than one feeder.

(2) Each dwelling unit is equipped with electric cooking equipment.

Exception: When the calculated load for multifamily dwellings without electric cooking in Part III of this article exceeds that calculated under Part IV for the identical load plus electric cooking (based on 8 kW per unit), the lesser of the two loads shall be permitted to be used.

(3) Each dwelling unit is equipped with either electric space heating or air conditioning, or both. Feeders and service conductors whose calculated load is determined by this optional calculation shall be permitted to have the neutral load determined by 220.61.

Exception: When the calculated load for multifamily dwellings served by a centralized electric heating or air-conditioning conditioning system in Part III of this article exceeds that calculated under Part IV for a simulated, engineered in-dwelling heating or air-conditioning system, the lesser of the two loads shall be permitted to be used.

Statement of Problem and Substantiation for Public Input

For multifamily buildings, we've seen a significant increase in the use of high-efficiency centralized HVAC systems (e.g. VRF) versus conventional split-systems. In calculating dwelling services and feeders per NEC 220 for buildings with VRF systems, we interpret Part IV's Optional Calculation to be inapplicable, since the air-conditioning load is not connected to the dwelling feeder, as is the case with split-systems. Unfortunately, using calculations in Part III for dwellings with VRF systems results in a much higher load for the dwelling feeders and services compared to the loads calculated for less efficient, conventional split systems calculated in Part IV.

Proposal: Similar to the simulated load approach for electric cooking in NEC 220.84 (i.e. 8KW per unit), we propose that if a centralized HVAC system is used, "simulating" load conditions for conventional split systems using the optional calculation in Part IV be allowed to size dwelling feeders and services. Further, we recommend that the word "equipped" in 220.84(A)(3) be revised so that it's clear that Part IV is to be used only if the dwelling feeder carries the load for the air-conditioning equipment.

Submitter Information Verification

Submitter Full Name: Ross Bush

Organization: Jordan Skala Engineers

Street Address:

City:

State:

Zip:

Submittal Date: Wed Mar 08 11:16:33 EST 2023

Committee: NEC-P02

Committee Statement

Resolution: Adding an exception for these types of loads, similar to what is done in 220.84(A)(2) Exception, has merit. However, the proposed text relies on the phrase "simulated, engineered in-dwelling heating or air-conditioning system", which is not defined or explained elsewhere in the Code. Additional clarity is needed regarding this part of the proposed text before this exception could be added.

Public Input No. 3242-NFPA 70-2023 [Section No. 220.84(C)]

(C) Calculated Loads.

The calculated load to which the demand factors of Table 220.84(B) apply shall include the following:

(1) General lighting and general-use receptacles at either:

(2) 33 volt-amperes/m ^{2} or 3 volt-amperes/ft ^{2}

~~for general lighting and general-use receptacles~~

(1)

(2) 33 volt-amperes/m ^{2} or 3 volt-amperes/ft ^{2} minus the percent of high-efficacy light sources multiplied by 0.165 volt-amperes/m ^{2} or 0.015 volt-amperes/ft ^{2} based on a lighting audit performed in the dwelling unit or on a proposed lighting design.

(3) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)

(4) The nameplate rating of the following:

(5) All appliances that are fastened in place, permanently connected, or located to be on a specific circuit

(6) Ranges, wall-mounted ovens, counter-mounted cooking units

(7) Clothes dryers that are not connected to the laundry branch circuit specified in item (2)

(8) Water heaters

(9) The nameplate ampere or kVA rating of all permanently connected motors not included in item (3)

(10) The larger of the air-conditioning load or the fixed electric space-heating load

Statement of Problem and Substantiation for Public Input

The current minimum load for general lights and receptacles can substantially over-estimate the unit load when high-efficacy light sources (e.g., LED, CFL) are used throughout the dwelling unit. In new dwelling units, building code requirements for high-efficacy lighting are ubiquitous in the US, leading to reduced lighting loads. In addition, recent rulemaking by the US Department of Energy (DOE) also impacts the lighting density in both new and existing US dwellings. Beginning July 2023, the sale of any general service lamp (GSL) that does not meet a minimum efficacy standard of 45 lumens per watt is prohibited in the US (10 CFR 430.32(dd)). This rulemaking will drastically reduce the ongoing lighting density in new and existing US dwellings. This new federal regulation paired with the results presented below from occupied US dwellings provides a strong case for allowing a reduction in the general receptacles and lighting assumption for both new and existing dwelling service and feeder load calculations.

A currently unpublished report from LBNL funded by the US DOE reports on sub-metering in 896 occupied US dwellings. In this report, median general lights and receptacles power density was 2.3 watts/ft2, though a substantial minority of existing dwellings exceeded the threshold. The same report also analyzes lighting audit data from 2,053 existing dwellings from the NEEA RBSA (2016) field study in Pacific Northwest dwellings. Overall, the median installed lighting energy density was 1.03 watts per ft2. The lighting density was strongly dependent on the fraction of high-efficacy light sources. The median fraction of efficient lighting in the NEEA RBSA data was 53% of the installed bulbs. We found that for each percent of light sources that were high efficacy, the installed lighting density was reduced by 0.0158 watts/ft2. Based on this observed relationship, we propose adding an optional method to reduce the general lights and general receptacle loads by 0.015 watts/ft2 times the percentage of high-efficacy fixtures observed in an audit or in a proposed lighting design. Based on this approach, a dwelling with 100% efficient lighting sources would have a general lights and general receptacles load of 1.5 watts/ft2 (3-100*0.015). A dwelling with 50% efficient light sources would have 2.25 watts/ft2 (3-50*0.015). And a dwelling with 0% efficient light sources would maintain the 3 watts/ft2 value.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3028-NFPA 70-2023 [Section No. 220.83]	Contains same proposal for lighting density reductions
Public Input No. 3319-NFPA 70-2023 [Section No. 220.83]	Contains same proposal for lighting density reductions
Public Input No. 3236-NFPA 70-2023 [Section No. 220.41]	Contains same proposal for lighting density reductions
Public Input No. 3239-NFPA 70-2023 [Section No. 220.82(B)]	Contains same proposal for lighting density reductions
Public Input No. 3028-NFPA 70-2023 [Section No. 220.83]	
Public Input No. 3236-NFPA 70-2023 [Section No. 220.41]	
Public Input No. 3239-NFPA 70-2023 [Section No. 220.82(B)]	
Public Input No. 3319-NFPA 70-2023 [Section No. 220.83]	

Submitter Information Verification

Submitter Full Name: Brennan Less
Organization: LBNL
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 30 16:57:06 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8092-NFPA 70-2024

Statement: The minimum load for general lights and receptacles over-estimates the load when high-efficacy light sources (e.g., LED, CFL) are used. In new dwelling units, building code requirements for high-efficacy lighting are ubiquitous in the US. In addition, recent rulemaking by the US Department of Energy (DOE) prohibits the sale of any general service lamp (GSL) that does not meet a minimum efficacy standard of 45 lumens per watt (10 CFR 430.32(dd)). This rulemaking effectively prohibits the sale of all incandescent and halogen GSL in the US.

Lawrence Berkely National Lab (LBNL) has recently reported on sub-metering in 896 occupied US dwellings showing median general lights and receptacle density of 2.3 watts/ft2, including dwellings with a variety of lighting types. Similarly, LBNL reported on lighting audit data from 2,053 existing dwellings in the Pacific Northwest. The installed lighting density was strongly dependent on the fraction of LED/CFL light sources, with an observed reduction in lighting density of 0.015 va/ft2 for each percent of LED or CFL light sources in the dwelling. 100% CFL or LED lighting reduced lighting density by 1.5 va/ft2.

The new value of 2 va/ft2 assumes approx. 80% LED or CFL lighting in the dwelling (3 va/ft2 – 0.80*0.012). Note -— The 0.015 va/ft2 from LBNL is reduced in this calculation to 0.012 va/ft2 using an 80% power factor (this is consistent with treatment of lighting loads in Table 220.42(A)).

Public Input No. 4498-NFPA 70-2023 [Section No. 220.84(C)]

(C) Calculated Loads.

The calculated load to which the demand factors of Table 220.84(B) apply shall include the following:

(1) 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 for general lighting and general-use receptacles

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2)

(3) The nameplate rating of the following:

- (4) <u>All appliances that are fastened in place, permanently connected, or located to be on a specific circuit</u>
- (5) <u>Ranges, wall-mounted ovens, counter-mounted cooking units</u>
- (6) <u>Clothes dryers that are not connected to the laundry branch circuit specified in item (2)</u>
- (7) <u>Water heaters</u>

(8) The nameplate ampere or kVA rating of all permanently connected motors not included in item (3)

(9) The larger of the air-conditioning load or the fixed electric space-heating load

(10) <u>Maximum load of an Energy Management System controlling any number of noncoincident loads</u>

Statement of Problem and Substantiation for Public Input

Whether commercial building, single family dwelling, or multi family dwellings, load calcs should have specific allowances for Energy Management Systems where the EMS is controlling only some of the loads at the site (and not controlling the entire dwelling).

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4235-NFPA 70-2023 [Section No. 220.60]	All occupancy type buildings and load calc methods should have allowances for an Energy Management System

Submitter Information Verification

Submitter Full Name: kyle breuning
Organization: Lunar Energy
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 16:35:04 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8184-NFPA 70-2024

Statement: Section 220.70 was relocated to Article 220 Part I to reinforce that a Power Control System can be used for load calculations throughout Article 220. The new 220.7 restructures the requirements into 5 sub-sections for clarity.

Energy Management System (EMS) was renamed to Power Control System (PCS) to differentiate an EMS with overload control from an EMS without overload control. 220.7(A) refers to Part II of Article 750, which is the subject of a PI for CMP 13 to identify requirements for EMS with overload control functionality. Should CMP 13 not create part II, this action will need to be revisited.

A requirement was added that the setpoint shall be determined by “Qualified Personnel”.

Public Input No. 1234-NFPA 70-2023 [Section No. 220.87]

220.87 Determining Existing Loads.

The calculation of a feeder or service load for existing installations shall be permitted to use actual maximum demand

~~to determine the existing load under~~
subject to compliance with all of the

~~following conditions: The maximum demand data is available for a 1-year period. Exception: If the maximum demand data for a 1-year period is not available, the calculated load shall be permitted to be based on the maximum demand (conditions described in 220.87(A), 220.87(B) and 220.87(C).~~

~~*Exception: This method shall not be permitted if the feeder or service has an interconnected electric power production source connected on the load side of the measurement point unless all interconnected electric power production sources are disconnected from the system for the duration of the data collection period.*~~

~~(A) **Maximum Demand Data Source** . The maximum demand data shall be the highest average kilowatts reached and maintained for a 15-minute interval . Maximum demand data shall be permitted to be obtained by either of the following:~~

~~(1) The maximum demand data is available for a 1-year period, minimum.~~

~~(2) The maximum demand is continuously recorded over a minimum 30-day period using a recording ammeter or power meter connected to the highest loaded phase of the feeder or service, based on the initial loading at the start of the recording. The recording shall reflect the maximum demand of the feeder or service by being taken when the building or space is occupied and shall include by measurement or calculation the larger of the heating or cooling equipment load, and other loads that might be periodic in nature due to seasonal or similar conditions.~~

~~This exception shall not be permitted if the feeder or service has a renewable energy system (i.e., solar photovoltaic or wind electric) or employs any form of peak load shaving.The maximum demand at 125 percent~~

~~(B) The maximum demand multiplied by 125 percent plus the new load does not exceed the ampacity of the feeder or rating of the service.~~

~~(C) The feeder has overcurrent protection in accordance with 240.4 , and the service has overload protection in accordance with 230.90 .~~

Statement of Problem and Substantiation for Public Input

1. The last sentence of the exception creates an exception to an exception. This proposed change resolves that issue.

2. As currently written, the last sentence of the exception only applies to the exception while the connection of a renewable energy system could very well affect the 1-year maximum demand data, depending on where the renewable energy system is connected relative to the data collection point.

3. All interconnected electric power production sources, not just renewable energy systems or peak load shaving methods as stated in the last sentence of the exception, can affect the data. Whether or not the interconnected power production sources affect the data is contingent upon the location of the measurement relative to the location of the interconnected electric power production sources. Data collection obtained at a point which is located on the load side of the interconnected power production source connections will accurately reflect the demand load - it is only when the interconnected power production source connections are on the load side of the measurement point that the data is invalidated.

Submitter Information Verification

Submitter Full Name: Jason Rohe
Organization: Schnackel Engineers
Street Address:
City:
State:
Zip:

Submittal Date: Thu Jun 29 10:38:59 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8188-NFPA 70-2024

Statement: 220.83 differentiates when adding or not adding new HVAC equipment. This is not justified based on analysis of 8,529 individually sub-metered end-uses in existing dwellings reported by Lawrence Berkeley National Lab (LBNL). Most new HVAC equipment added to dwellings contributes much less than 100% of its nameplate rating to dwelling maximum demand. In contrast, other loads are currently allowed to be added using 220.83 at 40%, but their contributions are substantially underestimated (for example, EVSE, water heaters and clothes dryers). LBNL also reported analysis of metering data from 9,093 existing Vermont dwellings that installed cold climate heat pumps. They observed only a 5% demand factor across this population of dwellings, with new heat pumps rated at an average of 3.6 kW, increasing whole dwelling maximum demand by only 0.2 kW.

Consistent with these findings, 220.83 is revised as follows:

• Differential treatment when adding new HVAC is eliminated, condensing 220.83(A) and 220.83(B) into a single section 220.83, with a single Table 220.83 for load percentages.

• General lights and general receptacles loads are reduced from 3 to 2 va/ft2, consistent with other revisions (see 220.41).

• Treatment of existing loads remains the same (first 8 kVA at 100%, remainder at 40%).

• All new loads being added to existing dwellings is treated at a more conservative 50% demand factor, which is consistent with median values observed in sub-metering data for water heating, clothes dryers and a variety of HVAC loads.

• Two notable exceptions are treated with higher demand factors of 80%—EVSE and Central Electric Resistance Space Heating—because sub-metering showed they were large loads with the highest demand factors.

Public Input No. 1990-NFPA 70-2023 [Section No. 220.87]

220.87 Determining Existing Loads.

The calculation of a feeder or service load for existing installations shall be permitted to use actual maximum demand to determine the existing load under all of the following conditions:

(1) The maximum demand data is available for a 1-year period.

Exception: If the maximum demand data for a 1-year period is not available, the calculated load shall be permitted to be based on the maximum demand (the highest average kilowatts / kilovolt amperes / amperes reached and maintained for a 15-minute interval) continuously recorded over a minimum 30-day period using a recording ammeter or power meter connected to the highest loaded phase of the feeder or service, based on the initial loading at the start of the recording. The recording shall reflect the maximum demand of the feeder or service by being taken when the building or space is occupied and shall include by measurement or calculation the larger of the heating or cooling equipment load, and other loads that might be periodic in nature due to seasonal or similar conditions. This exception shall not be permitted if the feeder or service has a renewable energy system (i.e., solar photovoltaic or wind electric) or employs any form of peak load shaving.

(2) The maximum demand at 125 percent plus the new load does not exceed the ampacity of the feeder or rating of the service.

(3) The feeder has overcurrent protection in accordance with 240.4, and the service has overload protection in accordance with 230.90.

Statement of Problem and Substantiation for Public Input

The intent of determining the existing load is for sizing a "feeder" or "service load". If the case is a 'feeder", you needs the "amperes" (wire size and OCPD). The "kilowatts" measurement by itself will not give you the "amperes" needed. If the case is "service load", then kilowatts, kilovolt amperes and amps may apply (transformer / generator / UPS). The exception indicates using a "recording ammeter" which is the most common instrument used for the measurement. However, most recording ammeters do not measure "kilowatts". Power meters typically will measure kilowatts, kilovolt amperes and amperes.

Submitter Information Verification

Submitter Full Name: Robert McLeod

Organization: Bechtel

Street Address:

City:

State:

Zip:

Submittal Date: Thu Aug 10 09:02:34 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: Dwelling units are measured in kilowatt-hours.

Public Input No. 2855-NFPA 70-2023 [Section No. 220.87]

220.87 Determining Existing Loads.

The calculation of a feeder or service load for existing installations shall be permitted to use actual maximum demand to determine the existing load under all of the following conditions:

(1) The maximum demand data is available for a 1-year period.

Exception: If the maximum demand data for a 1-year period is not available, the calculated load shall be permitted to be based on the maximum demand (the highest average kilowatts reached and maintained for a 15-minute interval) continuously recorded over a minimum 30-day period using a recording ammeter or power meter connected to the highest loaded phase of the feeder or service, based on the initial loading at the start of the recording. The recording shall reflect the maximum demand of the feeder or service by being taken when the building or space is occupied and shall include by measurement or calculation the larger of the heating or cooling equipment load, and other loads that might be periodic in nature due to seasonal or similar conditions. This exception shall not be permitted if the feeder or service ~~has a renewable energy system (i.e., solar photovoltaic or wind electric) or employs any form of peak load shaving~~ is supplied by more than one power source unless the contribution of all sources are included in the maximum load demand data .

(2) The maximum demand at 125 percent plus the new load does not exceed the ampacity of the feeder or rating of the service.

(3) The feeder has overcurrent protection in accordance with 240.4, and the service has overload protection in accordance with 230.90.

Statement of Problem and Substantiation for Public Input

The presence of a renewable energy system or the use of energy management should not eliminate the ability to utilize this exception provided the entire load on the feeder or service conductors is included in the measurements. Though the existing language may presume load demand data would come from a single utility meter, there are many other energy metering options available today to collect highly accurate load data. Since this section applies to feeders, it is likely that metering devices other than utility service meters would be used. All sources of supply are capable of being measured through the use of such meters. Provided all load can be accounted for in the measured data, regardless of what source supplied the load, this exception should be available without penalty to an owner who has a renewable energy system.

Submitter Information Verification

Submitter Full Name:	Larry Sherwood
Organization:	Sustainable Energy Action Comm
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Fri Aug 25 15:22:14 EDT 2023
Committee:	NEC-P02

Committee Statement

Resolution: The proposed text is too broad and could encompass multiple power sources, aside from solar and wind.

Public Input No. 3303-NFPA 70-2023 [Section No. 220.87]

220.87 Determining Existing Loads for Other Than Dwelling Units .

The calculation of a feeder or service load for existing installations other than dwelling units shall be permitted to use actual maximum demand to determine the existing load under all of the following conditions~~:~~ . For existing dwelling unit loads using metered data see 220.83(B).

(1) The maximum demand data is available for a 1-year period.

Exception: If the maximum demand data for a 1-year period is not available, the calculated load shall be permitted to be based on the maximum demand (the highest average kilowatts reached and maintained for a 15-minute interval) continuously recorded over a minimum 30-day period using a recording ammeter or power meter connected to the highest loaded phase of the feeder or service, based on the initial loading at the start of the recording. The recording shall reflect the maximum demand of the feeder or service by being taken when the building or space is occupied and shall include by measurement or calculation the larger of the heating or cooling equipment load, and other loads that might be periodic in nature due to seasonal or similar conditions. This exception shall not be permitted if the feeder or service has a renewable energy system (i.e., solar photovoltaic or wind electric) or employs any form of peak load shaving.

(2) The maximum demand at 125 percent plus the new load does not exceed the ampacity of the feeder or rating of the service.

(3) The feeder has overcurrent protection in accordance with 240.4, and the service has overload protection in accordance with 230.90.

Statement of Problem and Substantiation for Public Input

This proposed change is paired with our Public Input No. 3028-NFPA 70-2023 (Section No. 220.83). The proposed language clarifies that load calculations using existing dwelling metering data are to be made using 220.83(B) and that 220.87 is for other than dwelling units.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3028-NFPA 70-2023 [Section No. 220.83]	
Public Input No. 3028-NFPA 70-2023 [Section No. 220.83]	

Submitter Information Verification

Submitter Full Name: Brennan Less
Organization: LBNL
Street Address:
City:
State:
Zip:

Submittal Date: Thu Aug 31 17:08:29 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: There is no justification for limiting the rule to “other than dwelling units”.

Public Input No. 3320-NFPA 70-2023 [Section No. 220.87]

220.87 ~~Determining Existing Loads.~~

~~The calculation of a feeder or service load for existing installations~~

Load Based on Metered Data.

This section shall be permitted to

~~use~~

be used to determine if the existing service or feeder is of sufficient capacity to serve additional loads using actual maximum demand to determine the existing load under all of the

~~following conditions:~~

conditions in either 220.87(A) or 220.87(B).

(A) Other than existing dwelling units

(1) The maximum demand data is available for a 1-year period.

Exception: If the maximum demand data for a 1-year period is not available, the calculated load shall be permitted to be based on the maximum demand (the highest average kilowatts reached and maintained for a 15-minute interval) continuously recorded over a minimum 30-day period using a recording ammeter or power meter connected to the highest loaded phase of the feeder or service, based on the initial loading at the start of the recording. The recording shall reflect the maximum demand of the feeder or service by being taken when the building or space is occupied and shall include by measurement or calculation the larger of the heating or cooling equipment load, and other loads that might be periodic in nature due to seasonal or similar conditions. This exception shall not be permitted if the feeder or service has a renewable energy system (i.e., solar photovoltaic or wind electric) or employs any form of peak load shaving.

(2) The maximum demand at 125 percent plus the new load does not exceed the ampacity of the feeder or rating of the service.

(3) The feeder has overcurrent protection in accordance with 240.4, and the service has overload protection in accordance with 230.90.

(B) Existing dwelling units

(1) T he existing load on the feeder or service shall be the maximum metered kVA under the following conditions.

(2) Metered data shall be collected when the dwelling unit is occupied.

(3) Metered data shall be collected using a recording ammeter, power meter or electric utility consumption meter.

(4) Metered data shall be averaged over consecutive, non-rolling 15 minute or 60 minute time intervals. The existing load using 15 minute time averaged metered data shall be the maximum kVA recorded for any 15 minute time interval. The existing load using 60 minute time averaged metered data shall be the maximum kVA recorded for any 60 minute time interval adjusted by one of the following:

(5) For maximum average kVA less than or equal to 7.5, the adjusted existing load shall be 2.2 kVA + maximum average kVA x 1.4.

(6) For maximum average kVA greater than 7.5, the adjusted existing load shall be 5.2 kVA + maximum average kVA.

(7) Metered data shall be for a minimum period of either one year or 30 days. If the 30 day minimum period is used, all of the following shall apply:

(8) The recording shall include by measurement or calculation the larger of the heating or cooling equipment load and other loads that might be periodic in nature due to seasonal or similar conditions.

(9) M etered data for a feeder or service with one or more electric power production sources operating in parallel with a primary source from an electric utility shall represent the total demand of connected loads using either of the following:

(10) At each time interval, the metered data shall be the imported power from the electric utility plus the output(s) of all other electric power production sources.

(11) A t each time interval, the metered data shall be the imported power from the electric utility plus the nameplate rated output(s) of all other electric power production sources. See 690.8 for Solar Photovoltaic (PV) Systems and 706.30 for Energy Storage Systems.

(12) A feeder or service that employs peak load reduction shall be permitted to use 220.87(B) if the peak load reduction is managed by an Energy Management System in accordance with 750.30.

(13) The existing load from 220.87(B)(1) at 125 percent plus the change in load calculated using 220.87(B)(2)(1-3) does not exceed the ampacity of the feeder or rating of the service. Accounting for existing loads being replaced or removed in 220.87(B)(2)(2-3) shall be permitted. The larger connected load of any new air-conditioning or space heating equipment, but not both, shall be used.

(14) Sum the nameplate rating(s) of any new load(s) being installed.

(15) S um the nameplate rating(s) of any existing load(s) being replaced or removed.

(16) C alculate the change in load as the new load(s) being installed minus the existing load(s) being replaced or removed. If the existing load from 220.87(B)(1) at 125 percent is less than 8 kVA, the change in load shall be

treated at 100 percent until 8 kVA is reached. All remaining change in load shall be treated using the percentages listed for new loads in Table 220.83.

(17) The feeder has overcurrent protection in accordance with 240.4, and the service has overload protection in accordance with 230.90.

Additional Proposed Changes

File Name	Description	Approved
nfpa_v2_220.87_strikethrough_copy_final.docx	Redline strikethrough copy of proposed changes to 220.87.	
nfpa_v2_220.87_clean_copy_final.docx	Clean copy of proposed changes to 220.87.	

Statement of Problem and Substantiation for Public Input

Millions of existing US dwelling units are going to undergo the electrification of fuel-fired end-uses in the coming decades. The use of load management tools, electric vehicle charging, renewable energy systems and energy storage systems are also increasing. The National Electric Code must provide an existing dwelling unit load calculation that is clear, flexible, accurate and able to be consistently and safely applied at-scale by stakeholders including governments, utilities, contractors and property owners. Our proposed revisions to 220.87 (and related changes in 220.83) target either improving the accuracy of load calculations for existing dwellings, or ensuring that calculation procedures and assumptions are clear and able to be consistently and safely applied.

Based on feedback from industry and practitioners, section 220.87 reads unclearly, which results in inconsistent interpretation of the requirements and assumptions of this compliance path. Clarity is lacking around the following items: (a) appropriate time-step for data, (b) type of electrical data (demand vs. consumption metering), (c) and accounting for new loads. For example, an exception in this code section clearly allows the use of 15-minute average consumption data in determining the existing load when less than 1-year of data is available, but it does not specify what the default time-step of the data is outside of that exception (i.e., 15-minutes, hourly, daily?). The lack of clarity leads to confusion and inconsistent application and interpretation. Similarly, any new loads added via 220.87 do not clearly have a demand factor assumption applied, which again leads to inconsistent interpretation. Does this lack of a specification mean that a 100% assumption applies? Or that one can use demand factors from elsewhere in section 220? These elements need to be clarified in a way that applies distinctly to existing dwellings, and not to all building typologies. We propose leaving the current language of 220.87 alone, but restricting its application to other than dwelling units, while providing clarity and specific procedures for existing dwelling unit loads.

Our proposed changes are based on industry feedback and detailed analysis of data sourced from thousands of occupied US dwellings. We have demonstrated adequate performance of the proposed existing dwelling electrical load calculations at a >95% design level, based on nearly 18,000 individual branch circuits and end-use loads. The results of these analyses will be published in an upcoming US DOE report authored by LBNL. A hard copy summarizing the results has been mailed to NFPA for use with this submittal. A summary of proposed changes and key supporting analysis results include:

We propose the same demand factors be used for new loads being added to existing dwelling units (see proposed Table 220.83 in PI # 3319), whether the calculation is based on nameplate ratings (220.83) or on metered data (220.87(B)). This approach ensures consistent treatment of new loads being added through either compliance path. It also aligns with the reality of how dwelling maximum demand changes when new loads are added. To demonstrate, we performed example load calculations based on metering data (proposed in Section 220.87(B)) for each of the 8,529 sub-metered circuits and the 9,093 Vermont dwellings noted above. The proposed calculation procedure using 50% demand factor to account for new loads was effective in 99% of sub-metered circuits and in 96% of Vermont dwellings that added cold climate heat pumps.

We propose clear specification of the methods for gathering and analyzing dwelling metering data for deriving a load calculation, including requirements addressing data time intervals, metering duration, metering type, etc. These proposed changes address the lack of clarity noted by industry professionals above. Most importantly, the proposed method targets 15-minute maximum demand data, but it allows the use of 60-minute data, if it is adjusted according to proposed values. In 11,940 existing US dwellings, we adjusted 60-minute maximum demand according to the proposed values and found that actual 15-minute maximum demand exceeded the prediction in only 1% of dwellings. This allowance for 60-minute data is particularly important, because it allows the nation's smart meter infrastructure to be used to generate automatic existing load calculations for dwellings. Without our proposed adjustment, use of 60-minute data will under-predict actual demand in many dwellings.

Finally, we propose compliance paths for existing dwellings to use metering data if they have less than one year of data and use multiple power production sources (e.g, PV, ESS) or peak load reduction strategies. Rather than excluding these dwellings from using metering data, additional requirements are specified that ensure accurate load calculations.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3319-NFPA 70-2023 [Section No. 220.83]	Related changes addressing existing dwelling units, including shared Table 220.83.
Public Input No. 3319-NFPA 70-2023 [Section No. 220.83]	

Submitter Information Verification

Submitter Full Name: Brennan Less
Organization: LBNL
Street Address:

City:
State:
Zip:
Submittal Date: Thu Aug 31 19:33:10 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: CMP-2 has concerns regarding the existing loads and how to address those in the calculations, as well as the timeframe for measuring the load information. The proposed text might be difficult to enforce without additional data. In addition, it might have unintended consequences on other articles, such as sizing generators.

220.87 ~~**Determining Existing Loads**~~**Load Based on Metered Data**. ~~The calculation of a feeder or service load for existing installations shall be permitted to use~~This section shall be permitted to be used to determine if the existing service or feeder is of sufficient capacity to serve additional loads using actual maximum demand to determine the existing load under all of the ~~following~~ conditions in either 220.87(A) or 220.87(B).~~:~~

(A) **Other than existing dwelling units**.

(1) The maximum demand data is available for a 1-year period.

Exception: If the maximum demand data for a 1-year period is not available, the calculated load shall be permitted to be based on the maximum demand (the highest average kilowatts reached and maintained for a 15-minute interval) continuously recorded over a minimum 30-day period using a recording ammeter or power meter connected to the highest loaded phase of the feeder or service, based on the initial loading at the start of the recording. The recording shall reflect the maximum demand of the feeder or service by being taken when the building or space is occupied and shall include by measurement or calculation the larger of the heating or cooling equipment load, and other loads that might be periodic in nature due to seasonal or similar conditions. This exception shall not be permitted if the feeder or service has a renewable energy system (i.e., solar photovoltaic or wind electric) or employs any form of peak load shaving.

(2) The maximum demand at 125 percent plus the new load does not exceed the ampacity of the feeder or rating of the service.

(3) The feeder has overcurrent protection in accordance with 240.4, and the service has overload protection in accordance with 230.90.

(B) **Existing dwelling units**.

(1) The existing load on the feeder or service shall be the maximum metered kVA under the following conditions.
  - (a) Metered data shall be collected when the dwelling unit is occupied.
  - (b) Metered data shall be collected using a recording ammeter, power meter or electric utility consumption meter.
  - (c) Metered data shall be averaged over consecutive, non-rolling 15 minute or 60 minute time intervals. The existing load using 15 minute time averaged metered data shall be the maximum kVA recorded for any 15 minute time interval. The existing load using 60 minute time averaged metered data shall be the maximum kVA recorded for any 60 minute time interval adjusted by one of the following:
    - (i) For maximum average kVA less than or equal to 7.5, the adjusted existing load shall be 2.2 kVA + maximum average kVA x 1.4.
    - (ii) For maximum average kVA greater than 7.5, the adjusted existing load shall be 5.2 kVA + maximum average kVA.
  - (d) Metered data shall be for a minimum period of either one year or 30 days. If the 30 day minimum period is used, all of the following shall apply:

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(i) The recording shall include by measurement or calculation the larger of the heating or cooling equipment load and other loads that might be periodic in nature due to seasonal or similar conditions.

(ii) Metered data for a feeder or service with one or more electric power production sources operating in parallel with a primary source from an electric utility shall represent the total demand of connected loads using either of the following:

1) At each time interval, the metered data shall be the imported power from the electric utility plus the output(s) of all other electric power production sources.

2) At each time interval, the metered data shall be the imported power from the electric utility plus the nameplate rated output(s) of all other electric power production sources. See 690.8 for Solar Photovoltaic (PV) Systems and 706.30 for Energy Storage Systems.

(iii) A feeder or service that employs peak load reduction shall be permitted to use 220.87(B) if the peak load reduction is managed by an Energy Management System in accordance with 750.30.

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(2) The existing load from 220.87(B)(1) at 125 percent plus the change in load calculated using 220.87(B)(2)(a-c) does not exceed the ampacity of the feeder or rating of the service. Accounting for existing loads being replaced or removed in 220.87(B)(2)(b-c) shall be permitted. The larger connected load of any new air-conditioning or space heating equipment, but not both, shall be used.

(a) Sum the nameplate rating(s) of any new load(s) being installed.

(b) Sum the nameplate rating(s) of any existing load(s) being replaced or removed.

(c) Calculate the change in load as the new load(s) being installed minus the existing load(s) being replaced or removed. If the existing load from 220.87(B)(1) at 125 percent is less than 8 kVA, the change in load shall be treated at 100 percent until 8 kVA is reached. All remaining change in load shall be treated using the percentages listed for new loads in Table 220.83.

(3) The feeder has overcurrent protection in accordance with 240.4, and the service has overload protection in accordance with 230.90.

220.87 Load Based on Metered Data. This section shall be permitted to be used to determine if the existing service or feeder is of sufficient capacity to serve additional loads using actual maximum demand to determine the existing load under all of the conditions in either 220.87(A) or 220.87(B).

(A) **Other than existing dwelling units**.

(1) The maximum demand data is available for a 1-year period.

Exception: If the maximum demand data for a 1-year period is not available, the calculated load shall be permitted to be based on the maximum demand (the highest average kilowatts reached and maintained for a 15-minute interval) continuously recorded over a minimum 30-day period using a recording ammeter or power meter connected to the highest loaded phase of the feeder or service, based on the initial loading at the start of the recording. The recording shall reflect the maximum demand of the feeder or service by being taken when the building or space is occupied and shall include by measurement or calculation the larger of the heating or cooling equipment load, and other loads that might be periodic in nature due to seasonal or similar conditions. This exception shall not be permitted if the feeder or service has a renewable energy system (i.e., solar photovoltaic or wind electric) or employs any form of peak load shaving.

(2) The maximum demand at 125 percent plus the new load does not exceed the ampacity of the feeder or rating of the service.

(3) The feeder has overcurrent protection in accordance with 240.4, and the service has overload protection in accordance with 230.90.

(B) **Existing dwelling units**.

(1) The existing load on the feeder or service shall be the maximum metered kVA under the following conditions.
  (a) Metered data shall be collected when the dwelling unit is occupied.
  (b) Metered data shall be collected using a recording ammeter, power meter or electric utility consumption meter.
  (c) Metered data shall be averaged over consecutive, non-rolling 15 minute or 60 minute time intervals. The existing load using 15 minute time averaged metered data shall be the maximum kVA recorded for any 15 minute time interval. The existing load using 60 minute time averaged metered data shall be the maximum kVA recorded for any 60 minute time interval adjusted by one of the following:
    (i) For maximum average kVA less than or equal to 7.5, the adjusted existing load shall be 2.2 kVA + maximum average kVA x 1.4.
    (ii) For maximum average kVA greater than 7.5, the adjusted existing load shall be 5.2 kVA + maximum average kVA.
  (d) Metered data shall be for a minimum period of either one year or 30 days. If the 30 day minimum period is used, all of the following shall apply:
    (i) The recording shall include by measurement or calculation the larger of the heating or cooling equipment load and other loads that might be periodic in nature due to seasonal or similar conditions.

(ii) Metered data for a feeder or service with one or more electric power production sources operating in parallel with a primary source from an electric utility shall represent the total demand of connected loads using either of the following:

1) At each time interval, the metered data shall be the imported power from the electric utility plus the output(s) of all other electric power production sources.
2) At each time interval, the metered data shall be the imported power from the electric utility plus the nameplate rated output(s) of all other electric power production sources. See 690.8 for Solar Photovoltaic (PV) Systems and 706.30 for Energy Storage Systems.

(iii) A feeder or service that employs peak load reduction shall be permitted to use 220.87(B) if the peak load reduction is managed by an Energy Management System in accordance with 750.30.

(2) The existing load from 220.87(B)(1) at 125 percent plus the change in load calculated using 220.87(B)(2)(a-c) does not exceed the ampacity of the feeder or rating of the service. Accounting for existing loads being replaced or removed in 220.87(B)(2)(b-c) shall be permitted. The larger connected load of any new air-conditioning or space heating equipment, but not both, shall be used.

(a) Sum the nameplate rating(s) of any new load(s) being installed.
(b) Sum the nameplate rating(s) of any existing load(s) being replaced or removed.
(c) Calculate the change in load as the new load(s) being installed minus the existing load(s) being replaced or removed. If the existing load from 220.87(B)(1) at 125 percent is less than 8 kVA, the change in load shall be treated at 100 percent until 8 kVA is reached. All remaining change in load shall be treated using the percentages listed for new loads in Table 220.83.

(3) The feeder has overcurrent protection in accordance with 240.4, and the service has overload protection in accordance with 230.90.

Public Input No. 349-NFPA 70-2023 [Section No. 220.87]

220.87 Determining Existing Loads.

The calculation of a feeder or service load for existing installations shall be permitted to use actual maximum demand to determine the existing load under all of the following conditions:

(1) The maximum demand data ~~is~~ (the highest average kilowatts reached and maintained for a 15-minute interval) is available for a 1-year period.

Exception: If the maximum demand data for a 1-year period is not available, the calculated load shall be permitted to be based on the maximum demand ~~(the highest average kilowatts reached and maintained for a 15-minute interval) continuously~~ recorded over a minimum 30-day period using a recording ammeter or power meter connected to the highest loaded phase of the feeder or service, based on the initial loading at the start of the recording. The recording shall reflect the maximum demand of the feeder or service by being taken when the building or space is occupied and shall include by measurement or calculation the larger of the heating or cooling equipment load, and other loads that might be periodic in nature due to seasonal or similar conditions. This exception shall not be permitted if the feeder or service has a renewable energy system (i.e., solar photovoltaic or wind electric) or employs any form of peak load shaving.

(2) The maximum demand at 125 percent plus the new load does not exceed the ampacity of the feeder or rating of the service.

(3) The feeder has overcurrent protection in accordance with 240.4, and the service has overload protection in accordance with 230.90.

Statement of Problem and Substantiation for Public Input

At present, 220.87(1) provides no definition of "maximum demand data" or specification of the time interval for averaging. On the assumption that 220.87(1) is intended to use the same definition and 15 minute averaging interval as the exception, that language belongs in 220.87(1), not the exception. The word "continuously" is then removed to avoid any implication that a different averaging interval is required in the exception.

Submitter Information Verification

Submitter Full Name: Wayne Whitney
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Sat Feb 18 14:40:13 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: The relocation of the text from the exception to the main requirement is a significant change, as compared to the provision for using the 15-minute interval in the exception, and the full effect of the change is unclear.

Public Input No. 590-NFPA 70-2023 [Section No. 220.87]

220.87 Determining Existing Loads.

The calculation of a feeder or service load for existing installations shall be permitted to use actual maximum demand to determine the existing load under all of the following conditions:

(1) The maximum demand data is available for a 1-year period.

Exception: If the maximum demand data for a 1-year period is not available, the calculated load shall be permitted to be based on the maximum demand (the highest average kilowatts reached and maintained for a 15-minute interval) continuously recorded over a minimum 30-day period using a recording ammeter or power meter connected to the highest loaded phase of the feeder or service, based on the initial loading at the start of the recording. The recording shall reflect the maximum demand of the feeder or service by being taken when the building or space is occupied and shall include by measurement or calculation the larger of the heating or cooling equipment load, and other loads that might be periodic in nature due to seasonal or similar conditions. This exception shall not be permitted if the feeder or service has a renewable energy system (i.e., solar photovoltaic or wind electric) or employs any form of peak load shaving.

(2) The maximum demand at 125 percent plus the new <u>continuous and noncontinuous</u> load does not exceed the ampacity of the feeder or rating of the service.

(3) The feeder has overcurrent protection in accordance with 240.4, and the service has overload protection in accordance with 230.90.

Statement of Problem and Substantiation for Public Input

There is confusion as to whether or not the load calculation should utilize continuous loads at 100% or 125% when determining if the service is adequate. Since the service cables are 100% rated, the "new load" should be sum of the continuous and noncontinuous loads.

Submitter Information Verification

Submitter Full Name: Eric Putnam
Organization:
Street Address:
City:
State:
Zip:
Submittal Date: Tue Apr 11 18:28:47 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: Requirements for “Continuous and Non-Continuous Loads” were located in Article 220 in the 1996 and earlier editions of the NEC. For 1999, these requirements were relocated to Articles 210 and 215, as these requirements are associated with the sizing of the conductor and overcurrent device and not the computation of the load. While some requirements in 220 may indicate a multiplier of 125%, it is not the intent to apply the 125% multiplier based on the load being considered “continuous”.

Public Input No. 4031-NFPA 70-2023 [Definition:]

Add row to table under Article 210:

"Ul 60335-2-40 Household and Similar Electrical Appliances, Part 2: Particular Requirements for Electrical Heat Pumps, Air Conditioners and Dehumidifers"

Table A.1(a) Product Safety Standards for Conductors and Equipment That Have an Associated Listing Requirement

Article	Standard Number	Standard Title
110	UL 10C	Positive Pressure Fire Tests of Door Assemblies
-		
	UL 305	Panic Hardware
-		
	UL 486D	Sealed Wire Connector Systems
-		
	UL 2043	Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
-		
	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
210	UL 498	Attachment Plugs and Receptacles
-		
	UL 935	Fluorescent-Lamp Ballasts
-		
	UL 943	Ground Fault Circuit Interrupters
-		
	UL 1029	High-Intensity-Discharge Lamp Ballast
-		
	UL 1699	Arc-Fault Circuit-Interrupters
-		
	UL 1699A	Outlet Branch Circuit AFCIs
225	UL 6	Electrical Rigid Metal Conduit — Steel
-		
	UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel
-		
	UL 360	Liquid-Tight Flexible Metal Conduit
-		
	UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
-		
	UL 1242	Electrical Intermediate Metal Conduit — Steel
-		
	UL 1660	Liquid-Tight Flexible Nonmetallic Conduit
-		
	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
230	UL 6	Electrical Rigid Metal Conduit — Steel
-		
	UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel
-		

UL 67	Panelboards

-

UL 98	Enclosed and Dead-Front Switches

-

UL 218	Fire Pump Controllers

-

UL 231	Power Outlets

-

UL 347	Medium-Voltage AC Contactors, Controllers, and Control Centers

-

UL 360	Liquid-Tight Flexible Metal Conduit

-

UL 414	Meter Sockets

-

UL 486A-486B	Wire Connectors

-

UL 486C	Splicing Wire Connectors

-

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

-

UL 508	Industrial Control Equipment

-

UL 508A	Industrial Control Panels

-

UL 514B	Conduit, Tubing and Cable Fittings

-

UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

-

UL 845	Motor Control Centers

-

UL 857	Busways

-

UL 869A	Reference Standard for Service Equipment

-

UL 891	Switchboards

- - - -

UL 977	Fused Power-Circuit Devices

-

UL 1008	Transfer Switch Equipment

-

UL 1008A	Transfer Switch Equipment, Over 1000 Volts

-

UL 1008M	Meter-Mounted Transfer Switches

-

UL 1008S	Solid-State Transfer Switches

-

UL 1053	Ground-Fault Sensing and Relaying Equipment

-

UL 1062	Unit Substations

-

UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

-

UL 1242	Electrical Intermediate Metal Conduit — Steel

-

UL 1429	Pullout Switches

-

UL 1449	Surge Protective Devices

-

UL 1558	Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear

-

UL 1660	Liquid-Tight Flexible Nonmetallic Conduit

-

UL 1740	Robots and Robotic Equipment

-

UL 1953	Power Distribution Blocks

-

UL 2011	Machinery

-

UL 2200	Stationary Engine Generator Assemblies

-

UL 2416	Audio/Video, Information and Communication Technology Equipment Cabinet, Enclosure and Rack Systems

-

UL 2446	Unitary Boiler Room Systems

-

UL 2565	Industrial Metalworking and Woodworking Machine Tools

-

UL 2735	Electric Utility Meters

-

UL 2745	Meter Socket Adapters for Communications Equipment

-

UL 2876	Remote Racking Devices for Switchgear and Controlgear

-

	UL 4248-1	Fuseholders — Part 1: General Requirements
-		
	UL 60947-1	Low-Voltage Switchgear and Controlgear — Part 1: General Rules
-		
	UL 61800-5-1	Adjustable Speed Electrical Power Drive Systems — Part 5-1: Safety Requirements — Electrical, Thermal and Energy
240	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 2: 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 Non-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 248-15	Low-Voltage Fuses — Part 15: Class T Fuses
-		
	UL 248-17	Low-Voltage Fuses — Part 17: Class CF Fuses
-		
	UL 248-18	Low-Voltage Fuses — Part 18: Class CD Fuses
-		
	UL 489	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
-		
	UL 489I	Solid State Molded-Case Circuit Breakers
-		
	UL 943	Ground-Fault Circuit-Interrupters
-		
	UL 1053	Ground-Fault Sensing and Relaying Equipment

-

	UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

-

	UL 4248-1	Fuseholders — Part 1: General Requirements
242	UL 1449	Surge Protective Devices
250	UL 1	Flexible Metal Conduit

-

UL 4	Armored Cable

-

UL 5	Surface Metal Raceways and Fittings

-

UL 6	Electrical Rigid Metal Conduit — Steel

-

UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

-

UL 360	Liquid-Tight Flexible Metal Conduit

-

UL 467	Grounding and Bonding Equipment

-

UL 486A-486B	Wire Connectors

-

UL 486C	Splicing Wire Connectors

-

UL 486D	Sealed Wire Connector Systems

-

UL 498	Attachment Plugs and Receptacles

-

UL 504	Mineral-Insulated, Metal-Sheathed Cable

-

UL 514A	Metallic Outlet Boxes

-

UL 514B	Conduit, Tubing, and Cable Fittings

-

UL 797	Electrical Metallic Tubing — Steel

-

UL 797A	Electrical Metallic Tubing — Aluminum

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UL 1242	Electrical Intermediate Metal Conduit — Steel

-

UL 1569	Metal-Clad Cables

-

	UL 1652	Flexible Metallic Tubing
300	UL 4	Armored Cable
-		
	UL 44	Thermoset-Insulated Wires and Cables
-		
	UL 83	Thermoplastic-Insulated Wires and Cables
-		
	UL 83A	Fluoropolymer Insulated Wire
-		
	UL 263	Fire Tests of Building Construction and Materials
-		
	UL 504	Mineral-Insulated, Metal-Sheathed Cable
-		
	UL 746C	Polymeric Materials — Use in Electrical Equipment Evaluations
-		
	UL 1569	Metal-Clad Cable
-		
	UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
-		
	UL 2239	Hardware for Support of Conduit, Tubing and Cable
-		
	UL 2556	Wire and Cable Test Methods
-		
	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
310	UL 44	Thermoset-Insulated Wires and Cables
-		
	UL 83	Thermoplastic-Insulated Wires and Cables
-		
	UL 83A	Fluoropolymer Insulated Wire
-		
	UL 224	Extruded Insulating Tubing
-		
	UL 1063	Machine-Tool Wires and Cables
-		
	UL 1441	Coated Electrical Sleeving
315	ANSI C119.4	Electric Connectors — Connectors for Use between Aluminum-to-Aluminum and Aluminum-to-Copper Conductors Designed for Normal Operation at or Below 93ºC and Copper-to-Copper Conductors Designed for Normal Operation at or Below 100ºC
-		
	IEEE 48	IEEE Standard for Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV
-		

IEEE 386	IEEE Standard for Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV

-

IEEE 404	IEEE Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2.5 kV to 500 kV

-

UL 4	Armored Cable

-

UL 504	Mineral-Insulated, Metal-Sheathed Cable

-

UL 1072	Medium Voltage Power Cables

-

	UL 1569	Metal-Clad Cable
312	UL 50	Enclosures for Electrical Equipment

-

UL 50E	Enclosures for Electrical Equipment, Environmental Considerations

-

UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

-

UL 916	Energy Management Equipment

-

UL 2808	Energy Monitoring Equipment

-

	UL 61010-1 and UL 61010-2-030	Electrical Equipment for Measurement, Control, and Laboratory Use — Part 2-030: Particular Requirements for Testing and Measuring Circuits
314	UL 50	Enclosures for Electrical Equipment

-

UL 50E	Enclosures for Electrical Equipment, Environmental Considerations

-

UL 486D	Sealed Wire Connector Systems

-

UL 498	Attachment Plugs and Receptacles

-

UL 498B	Receptacles with Integral Switching Means

-

UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

-

UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

-

UL 514A	Metallic Outlet Boxes

-

UL 514B	Conduit, Tubing, and Cable Fittings

-

	UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
-		
	UL 514D	Cover Plates for Flush-Mounted Wiring Devices
-		
	UL 1953	Power Distribution Blocks
320	UL 4	Armored Cable
-		
	UL 44	Thermoset-Insulated Wires and Cables
-		
	UL 83	Thermoplastic-Insulated Wires and Cables
-		
	UL 83A	Fluoropolymer Insulated Wire
-		
	UL 514B	Conduit, Tubing, and Cable Fittings
-		
	UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
-		
	UL 1063	Machine-Tool Wires and Cables
-		
	UL 1565	Positioning Devices
-		
	UL 2239	Hardware for the Support of Conduit, Tubing, and Cable
- - -		
322	UL 486A-486B	Wire Connectors
-		
	UL 498	Attachment Plugs and Receptacles
-		
	UL 514A	Metallic Outlet Boxes
- - -		
324	UL 486A-486B	Wire Connectors
-		
	UL 498	Attachment Plugs and Receptacles
330	UL 44	Thermoset-Insulated Wires and Cables
-		
	UL 66	Fixture Wire
-		
	UL 83	Thermoplastic-Insulated Wires and Cables
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UL 508	Industrial Control Equipment

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UL 60335-2-89	Household and Similar Electrical Appliances — Safety — Part 2-89: Particular Requirements for Commercial Refrigerating Appliances with an Incorporated or Remote Refrigerant Unit or Compressor

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500	FM 121303	Guide for Use of Detectors for Flammable Gases

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UL 698A	Industrial Control Panels Relating to Hazardous (Classified) Locations

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UL 783	Electric Flashlights and Lanterns for Use in Hazardous (Classified) Locations

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UL 823	Electric Heaters For Use in Hazardous (Classified) Locations

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UL 844	Electric Heaters For Use in Hazardous (Classified) Locations

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UL 1203	Explosionproof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations

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UL 1389	Plant Oil Extraction Equipment for Installation and Use in Ordinary (Unclassified) Locations and Hazardous (Classified) Locations

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UL 1836	Electric Motors and Generators for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2 and Zone 22 Hazardous (Classified) Locations

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UL 60079-30-1	Explosive Atmospheres — Electrical Resistance Trace Heating — General and Testing Requirements

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UL 60079-33	Explosive Atmospheres — Part 33: Equipment Protection by Special Protection “s”

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UL 122001	General Requirements for Electrical Ignition Systems for Internal Combustion Engines in Class I, Division 2 or Zone 2, Hazardous (Classified) Locations

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UL 122701	Requirements for Process Sealing Between Electrical Systems and Potentially Flammable or Combustible Process Fluids

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NFPA 496	Standard for Purged and Pressurized Enclosures for Electrical Equipment

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UL 783	Electric Flashlights and Lanterns for Use in Hazardous (Classified) Locations

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UL 1072	Medium-Voltage Power Cables

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UL 823	Standard for Electric Heaters For Use in Hazardous (Classified) Locations

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UL 844	Luminaires for Use in Hazardous (Classified) Locations

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UL 1309A	Cable for Mobile Installations

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UL 80079-36	Explosive Atmospheres — Part 36: Non-Electrical Equipment for Explosive Atmospheres — Basic Method and Requirements

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UL 80079-37	Explosive Atmospheres — Part 37: Non-Electrical Equipment for Explosive Atmospheres — Non Electrical Type of Protection Constructional Safety "c", Control of Ignition Source "b", Liquid Immersion "k"

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UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

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UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

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UL 498F	Plugs, Socket-Outlets and Couplers with Arcuate (Locking Type) Contacts

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UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

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UL 1022	Line Isolation Monitors

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520	UL 62	Flexible Cords and Cables
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530	UL 62	Flexible Cords and Cables
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UL 1573	Stage and Studio Luminaires and Connector Strips

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UL 1680	Stage and Lighting Cables

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UL 1691	Single Pole Locking-Type Separable Connectors

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UL 1836	Electric Motors and Generators for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2 and Zone 22 Hazardous (Classified) Locations

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UL 5C	Surface Raceways and Fittings for Use with Data, Signal, and Control Circuits

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UL 20	General Use Snap Switches

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UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

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UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

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UL 498F	Plugs, Socket-Outlets and Couplers with Arcuate (Locking Type) Contacts

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UL 514A	Metallic Outlet Boxes

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UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

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547	UL 50	Enclosures for Electrical Equipment, Non-Environmental Considerations

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UL 50E	Enclosures for Electrical Equipment, Environmental Considerations

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UL 62	Flexible Cords and Cables

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UL 514A	Metallic Outlet Boxes

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UL 514B	Conduit, Tubing, and Cable Fittings

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UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

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UL 1598	Luminaires

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UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

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UL 307A	Liquid Fuel-Burning Heating Appliances for Manufactured Homes and Recreational Vehicles

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UL 307B	Gas-Burning Heating Appliances for Manufactured Homes and Recreational Vehicles

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UL 360	Liquid-Tight Flexible Metal Conduit

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UL 467	Grounding and Bonding Equipment

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UL 498	Attachment Plugs and Receptacles

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UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

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UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

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UL 498F	Plugs, Socket-Outlets and Couplers with Arcuate (Locking Type) Contacts

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UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

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UL 817	Cord Sets and Power-Supply Cords

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UL 1242	Electrical Intermediate Metal Conduit — Steel

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UL 1462	Mobile Home Pipe Heating Cable

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UL 1598	Luminaires

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UL 1660	Liquid-Tight Flexible Nonmetallic Conduit

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UL 2108	Low-Voltage Lighting Systems

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	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
551	UL 6	Electrical Rigid Metal Conduit — Steel

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UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

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UL 62	Flexible Cords and Cables

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UL 231	Power Outlets

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UL 234	Low Voltage Lighting Fixtures for use in Recreational Vehicles

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UL 360	Liquid-Tight Flexible Metal Conduit

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UL 467	Grounding and Bonding Equipment

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UL 486C	Splicing Wire Connectors

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UL 498	Attachment Plugs and Receptacles

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UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

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UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

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UL 498F	Plugs, Socket-Outlets and Couplers with Arcuate (Locking Type) Contacts

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UL 514A	Metallic Outlet Boxes

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UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

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UL 514D	Cover Plates for Flush-Mounted Wiring Devices

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UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

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UL 817	Cord Sets and Power-Supply Cords

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UL 943	Ground-Fault Circuit-Interrupters

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UL 1004-4	Electric Generators

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UL 1008	Transfer Switch Equipment

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UL 1008M	Transfer Switch Equipment, Meter Mounted

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UL 1008S	Solid-State Transfer Switches

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UL 1242	Electrical Intermediate Metal Conduit — Steel

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UL 1449	Surge Protective Devices

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UL 1598	Luminaires

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UL 1660	Liquid-Tight Flexible Nonmetallic Conduit

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UL 2200	Stationary Engine Generator Assemblies

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UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

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UL 60730-1	Automatic Electrical Controls; Part 1: General Requirements

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	UL 60730-2-9	Automatic Electrical Controls; Part 2: Particular Requirements for Temperature Sensing Controls
552	SAE J1128-2015	Low Voltage Primary Cable, for Types GXL, HDT, and SXL

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SAE J1127-2015	Low Voltage Battery Cable, for Types SGT and SGR

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UL 6	Electrical Rigid Metal Conduit — Steel

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UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

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UL 50	Enclosures for Electrical Equipment, Non-Environmental Considerations

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UL 50E	Enclosures for Electrical Equipment, Environmental Considerations

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UL 62	Flexible Cords and Cables

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UL 67	Panelboards

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UL 231	Power Outlets

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UL 234	Low Voltage Lighting Fixtures for Use in Recreational Vehicles

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UL 360	Liquid-Tight Flexible Metal Conduit

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UL 430	Waste Disposers

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UL 467	Grounding and Bonding Equipment

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UL 514A	Metallic Outlet Boxes

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UL 514B	Conduit, Tubing, and Cable Fittings

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UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

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UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

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UL 817	Cord Sets and Power-Supply Cords

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UL 916	Energy Management Equipment

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UL 943	Ground-Fault Circuit-Interrupters

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UL 1004-4	Electric Generators

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UL 1242	Electrical Intermediate Metal Conduit — Steel

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UL 1563	Electric Spas, Equipment Assemblies, and Associated Equipment

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UL 1598	Luminaires

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UL 1660	Liquid-Tight Flexible Nonmetallic Conduit

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UL 2108	Low Voltage Lighting Systems

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UL 2200	Stationary Engine Generator Assemblies

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	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
555	UL 6	Electrical Rigid Metal Conduit — Steel

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UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

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	UL 231	Power Outlets
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	UL 486D	Sealed Wire Connector Systems
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	UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
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	UL 676	Underwater Luminaires and Submersible Junction Boxes
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	UL 943	Ground-Fault Circuit-Interrupters
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	UL 1053	Ground-Fault Sensing and Relaying Equipment
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	UL 1650	Portable Power Cable
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	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
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	UL 514B	Conduit, Tubing, and Cable Fittings
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	UL 588	Seasonal and Holiday Decorative Products
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	UL 817	Cord Sets
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	UL 943	Ground-Fault Circuit-Interrupters
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	UL 1088	Temporary Lighting Strings
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600	UL 1	Flexible Metal Conduit
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	UL 5	Surface Metal Raceways and Fittings
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	UL 50	Enclosures for Electrical Equipment, Non-Environmental Considerations

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UL 98B	Enclosed and Dead-Front Switches for Use in Photovoltaic Systems

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UL 248-19	Low-Voltage Fuses — Part 19: Photovoltaic Fuses

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UL 360	Liquid-Tight Flexible Metal Conduit

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UL 489B	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures For Use With Photovoltaic (PV) Systems

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UL 508I	Disconnect Switches Intended for Use in Photovoltaic Systems

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UL 814	Gas-Tube-Sign Cable

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UL 879	Electric Sign Components

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UL 879A	LED Sign and Sign Retrofit Kits

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UL 879B	Polymeric Enclosure Systems for the Splice Between Neon Tubing Electrode Leads and GTO Cable, and the GTO Cable Leading to the Splice

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UL 943	Ground-Fault Circuit-Interrupters

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UL 1310	Class 2 Power Units

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UL 1660	Liquid-Tight Flexible Nonmetallic Conduit

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UL 1699B	Photovoltaic (PV) DC Arc-Fault Circuit Protection

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Ul 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

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UL 2161	Neon Transformers and Power Supplies

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UL 2703	Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels

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UL 3001	Distributed Energy Generation and Storage Systems

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UL 3003	Distributed Generation Cables

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UL 3703	Solar Trackers

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UL 4703	Photovoltaic Wire

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UL 6703	Connectors for Use in Photovoltaic Systems

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UL 7103	Investigation for Building-Integrated Photovoltaic Roof Coverings

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UL 8703	Concentrator Photovoltaic Modules and Assemblies

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UL 9703	Distributed Generation Wiring Harnesses

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UL 61730-1	Photovoltaic (PV) Module Safety Qualification — Part 1: Requirements For Construction

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UL 61730-2	Photovoltaic (PV) Module Safety Qualification — Part 2: Requirements For Testing

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UL 62109	Power Converters for Use in Photovoltaic Power Systems — Part 1: General Requirements

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UL 62368-1 Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
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UL 4	Armored Cable

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UL 5	Surface Metal Raceways and Fittings

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UL 5A	Nonmetallic Surface Raceways and Fittings

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UL 5B	Strut-Type Channel Raceways and Fittings

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UL 5C	Surface Raceways and Fittings for Use with Data, Signal, and Control Circuits

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UL 62	Flexible Cords and Cables

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UL 183	Manufactured Wiring Systems

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UL 209	Cellular Metal Floor Raceways and Fittings

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UL 360	Liquid-Tight Flexible Metal Conduit

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UL 797	Electrical Metallic Tubing — Steel

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	UL 797A	Electrical Metallic Tubing — Aluminum and Stainless Steel
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	UL 857	Busways
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	UL 2024	Cable Routing Assemblies and Communications Raceways
605	UL 962	Household and Commercial Furnishings
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	UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers
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	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
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620	UL 62	Flexible Cords and Cables
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	UL 83	Thermoplastic-Insulated Wires and Cables
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	UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
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	UL 508	Industrial Control Equipment
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	UL 508A	Industrial Control Panels
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	UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures
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	UL 1310	Class 2 Power Units
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	UL 1449	Surge Protective Devices
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	UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables
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	UL 2556	Wire and Cable Test Methods
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	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
625	UL 62	Flexible Cords And Cables
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	UL 1650	Portable Power Cable
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	UL 2202	Electric Vehicle (EV) Charging System Equipment
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	UL 2231-1	Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits — Part 1: General Requirements
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	UL 2231-2	Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits — Part 2: Particular Requirements for Protection Devices for Use in Charging Systems
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	UL 2251	Plugs, Receptacles and Couplers for Electrical Vehicles
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	UL 2580	Batteries for Use in Electric Vehicles
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	UL 2594	Electric Vehicle Supply Equipment
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	UL 9741	Electric Vehicle Power Export Equipment (EVPE)
626	UL 62	Flexible Cords and Cables
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	UL 231	Power Outlets
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	UL 498	Attachment Plugs and Receptacles
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	UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts
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	UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection
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	UL 498F	Plugs, Socket-Outlets and Couplers with Arcuate (Locking Type) Contacts
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	UL 817	Cord Sets and Power-Supply Cords
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	UL 1651	Optical Fiber Cable
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	UL 1686	Pin and Sleeve Configurations
630	UL 551	Transformer-Type Arc-Welding Machines
640	UL 13	Power Limited Circuit Cables

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UL 62	Flexible Cords and Cables

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UL 813	Commercial Audio Equipment

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UL 1310	Class 2 Power Units

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UL 1419	Professional Video and Audio Equipment

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UL 1492	Audio-Video Products and Accessories

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UL 1711	Amplifiers for Fire Protective Signaling Systems

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UL 2269	Optical Fiber/Communications/Signaling/Coaxial Cable Outlet Boxes

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UL 6500	Audio/Video and Musical Instrument Apparatus for Household, Commercial, and Similar General Use

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UL 60065	Audio, Video and Similar Electronic Apparatus — Safety Requirements

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UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements

645 UL 38 Manual Signaling Boxes for Fire Alarm Systems

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UL 268	Smoke Detectors for Fire Alarm Systems

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UL 444	Communications Cables

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UL 464	Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories

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UL 497B	Protectors for Data Communications and Fire Alarm Circuits

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UL 833	Control Units and Accessories for Fire Alarm Systems

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UL 864	Control Units and Accessories for Fire Alarm Systems

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UL 1424	Cables for Power-Limited Fire-Alarm Circuits

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UL 1425	Cables for Non-Power-Limited Fire-Alarm Circuits

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UL 1449	Surge Protective Devices

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UL 1480	Speakers for Fire Alarm and Signaling Systems, Including Accessories

UL 1638	Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories
UL 1651	Optical Fiber Cable
UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables
UL 1690	Data-Processing Cable
UL 1778	Uninterruptible Power Systems
UL 2024	Cable Routing Assemblies and Communications Raceways
UL 60950-1	Information Technology Equipment Safety — Part 1: General Requirements
UL 60950-21	Information Technology Equipment Safety — Part 21: Remote Power Feeding
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UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements

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UL 10C	Positive Pressure Fire Tests of Door Assemblies
UL 62	Flexible Cords and Cables
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UL 98	Enclosed and Dead-Front Switches
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UL 347	Medium-Voltage AC Contactors, Controllers, and Control Centers
UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 508	Industrial Control Equipment
UL 508A	Industrial Control Panels
UL 845	Motor Control Centers

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UL 869A	Reference Standard for Service Equipment

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UL 891	Switchboards

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UL 924	Emergency Lighting and Power Equipment

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UL 977	Fused Power-Circuit Devices

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UL 1008	Transfer Switch Equipment

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UL 1008A	Transfer Switch Equipment, Over 1000 Volts

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UL 1008M	Meter-Mounted Transfer Switches

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UL 1008S	Solid-State Transfer Switches

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UL 1062	Unit Substations

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UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

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UL 1429	Pullout Switches

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UL 1449	Surge Protective Devices

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UL 1655	Community-Antenna Television Cables

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UL 1989	Standby Batteries

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UL 2755	Modular Data Centers

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	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
647	UL 1598	Luminaires
650	UL 1310	Class 2 Power Units

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UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords

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	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
670	ANSI/CSA-C22.2 No. 19085-1	Woodworking machines — Safety — Part 1: Common requirements

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UL 508	Industrial Control Equipment

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UL 61800-5-1	Adjustable Speed Electrical Power Drive Systems — Part 5-1: Safety Requirements — Electrical, Thermal and Energy

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675	UL 493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables

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	UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
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UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

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UL 20	General Use Snap-Switches

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UL 62	Flexible Cords and Cables

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UL 360	Liquid-Tight Flexible Metal Conduit

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UL 379	Power Units for Fountain, Swimming Pool, and Spa Luminaires

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UL 467	Grounding and Bonding Equipment

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UL 486D	Sealed Wire Connector Systems

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UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

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UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

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UL 676	Underwater Luminaires and Submersible Junction Boxes

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UL 676A	Potting Compounds for Swimming Pool, Fountain, and Spa Equipment

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UL 943	Ground-Fault Circuit-Interrupters

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UL 943C	Special Purpose Ground-Fault Circuit-Interrupters

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UL 1004-10	Pool Pump Motors

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UL 1081	Swimming Pool Pumps, Filters, and Chlorinators

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UL 1241	Junction Boxes for Swimming Pool Luminaires

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UL 1242	Electrical Intermediate Metal Conduit — Steel

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UL 1261	Electric Water Heaters for Pools and Tubs

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UL 1563	Electric Spas, Equipment Assemblies, and Associated Equipment

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UL 1569	Metal-Clad Cables

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UL 1660	Liquid-Tight Flexible Nonmetallic Conduit

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UL 1795	Hydromassage Bathtubs

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UL 2420	Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

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UL 2452	Electric Swimming Pool and Spa Cover Operators

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UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

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UL 2515A	Supplemental Requirements for Extra Heavy Wall Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

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UL 2995	Lifts for Swimming Pools and Spas

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	UL 60335-2-1000	Household and Similar Electrical Appliances: Particular Requirements for Electrically Powered Pool Lifts
682	UL 486D	Sealed Wire Connector Systems

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UL 1650	Portable Power Cable

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	UL 1838	Low Voltage Landscape Lighting Systems
690	UL 98B	Enclosed and Dead-Front Switches for Use in Photovoltaic Systems

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UL 248-19	Low-Voltage Fuses — Part 19: Photovoltaic Fuses

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UL 467	Grounding and Bonding Equipment

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UL 489B	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures For Use With Photovoltaic (PV) Systems

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UL 508I	Disconnect Switches Intended for Use in Photovoltaic Systems

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UL 1569	Metal-Clad Cables

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UL 1699B	Photovoltaic (PV) DC Arc-Fault Circuit Protection

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UL 1703	Flat-Plate Photovoltaic Modules and Panels

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UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources

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UL 2703	Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels

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UL 3001	Distributed Energy Generation and Storage Systems

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UL 3003	Distributed Generation Cables

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UL 3005	Distributed Energy Resource Management Systems

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UL 3703	Solar Trackers

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UL 3730	Photovoltaic Junction Boxes

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UL 3741	Photovoltaic Hazard Control

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UL 4703	Photovoltaic Wire

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UL 6703	Connectors for Use in Photovoltaic Systems

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UL 7103	Investigation for Building-Integrated Photovoltaic Roof Coverings

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UL 8703	Concentrator Photovoltaic Modules and Assemblies

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UL 8801	Photovoltaic Luminaire Systems

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UL 9703	Distributed Generation Wiring Harnesses

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UL 61730-1	Photovoltaic (PV) Module Safety Qualification — Part 1: Requirements for Construction

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UL 61730-2	Photovoltaic (PV) Module Safety Qualification — Part 2: Requirements for Testing

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UL 62109-1	Power Converters for Use in Photovoltaic Power Systems — Part 1: General Requirements

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UL 62275	Cable Management Systems — Cable Ties for Electrical Installation

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UL 2262A	Borohydride Fuel Cartridges with Integral Fuel Processing for Use with Portable Fuel Cell Power Systems or Similar Equipment

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UL 2265	Fuel Cell Power Units and Fuel Storage Containers for Portable Devices

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UL 2265A	Hand-held or Hand-Transportable Fuel Cell Power Units with Disposable Methanol Fuel Cartridges for use in Original Equipment Manufacturer's Information Technology Equipment

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UL 2265C	Hand-Held or Hand-Transportable Alkaline (Direct Borohydride) Fuel Cell Power Units and Borohydride Fuel Cartridges For Use With Consumer Electronics or Information Technology Equipment

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UL 2266	Electromagnetic Compatibility, Electrical Safety, and Physical Protection of Stationary and Portable Fuel Cell Power Systems for Use with Commercial Network Telecommunications Equipment

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UL 2267	Fuel Cell Power Systems for Installation in Industrial Electric Trucks

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694	UL 467	Grounding and Bonding Equipment

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UL 489C	Molded-Case Circuit Breakers and Molded-Case Switches for Use with Wind Turbines

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UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

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UL 2227	Flexible Motor Supply Cable and Wind Turbine Tray Cable

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UL 2736	Single Pole Separable Interconnecting Cable Connectors for Use with Wind Turbine Generating Systems

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UL 4143	Wind Turbine Generator — Life Time Extension (LTE)

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UL 6141	Wind Turbines Permitting Entry of Personnel

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UL 6142	Wind Turbine Generating Systems — Small

695	UL 6	Electrical Rigid Metal Conduit — Steel

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UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

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UL 218	Fire Pump Controllers

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UL 448	Centrifugal Stationary Pumps for Fire-Protection Service

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UL 448B Residential Fire Pumps Intended for One- and Two-Family Dwellings and Manufactured Homes

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UL 448C Stationary, Rotary-Type, Positive-Displacement Pumps for Fire Protection Service

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UL 651 Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

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UL 1004-5 Fire Pump Motors

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UL 1242 Electrical Intermediate Metal Conduit — Steel

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UL 1569 Metal-Clad Cables

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UL 1724 Fire Tests for Electrical Circuit Protective Systems

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UL 2196 Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables

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UL 2515 Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

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700	UL 924	Emergency Lighting and Power Equipment

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UL 1008 Transfer Switch Equipment

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UL 1008A Transfer Switch Equipment, Over 1000 Volts

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UL 1449 Surge Protective Devices

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UL 1724 Fire Tests for Electrical Circuit Protective Systems

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UL 2196 Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables

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	UL 2200	Stationary Engine Generator Assemblies
701	UL 924	Emergency Lighting and Power Equipment

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UL 1008 Transfer Switch Equipment

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	UL 1008A	Transfer Switch Equipment, Over 1000 Volts
702	UL 98	Enclosed and Dead-Front Switches

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UL 1008 Transfer Switch Equipment

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	UL 1008A	Transfer Switch Equipment, Over 1000 Volts

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	UL 1008S	Solid-State Transfer Switches
705	UL 62	Flexible Cords and Cables

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UL 98	Enclosed and Dead-Front Switches

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UL 486D	Sealed Wire Connector Systems

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UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

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UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

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UL 1429	Pullout Switches

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UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

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UL 2200	Stationary Engine Generator Assemblies

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UL 3003	Distributed Generation Cables

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UL 6141	Wind Turbines Permitting Entry of Personnel

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UL 9540	Energy Storage Systems and Equipment

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UL 248-3	Low-Voltage Fuses — Part 3: Class CA and CB Fuses

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UL 248-4	Low-Voltage Fuses — Part 4: Class CC Fuses

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UL 248-5	Low-Voltage Fuses — Part 5: Class G Fuses

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UL 248-6	Low-Voltage Fuses — Part 6: Class H Non-Renewable Fuses

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	UL 248-8	Low-Voltage Fuses — Part 8: Class J Fuses
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	UL 489H	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures, for Use with Direct Current (DC) Microgrids
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	UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures
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	UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources
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	UL 9540	Energy Storage Systems and Equipment
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	UL 83	Thermoplastic-Insulated Wires and Cables
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	UL 360	Liquid-Tight Flexible Metal Conduit
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	UL 493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables
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	UL 497A	Secondary Protectors for Communications Circuits
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	UL 1008	Transfer Switch Equipment
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	UL 1008A	Transfer Switch Equipment, Over 1000 Volts
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	UL 1008M	Meter-Mounted Transfer Switches

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	UL 1008S	Solid-State Transfer Switches

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	UL 1569	Metal-Clad Cables

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	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables
710	UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

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UL 2200	Stationary Engine Generator Assemblies

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UL 8801	Photovoltaic Luminaire Systems

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UL 9540	Energy Storage Systems and Equipment

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UL 62109-1	Power Converters for use in Photovoltaic Power Systems — Part 1: General Requirements

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UL 62109-2	Power Converters for Use in Photovoltaic Power Systems — Part 2: Particular Requirements for Inverters

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722	UL 13	Standard for Power-Limited Circuit Cables

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UL 444	Standard for Safety for Communications Cables

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UL 1424	Cables for Power-Limited Fire-Alarm Circuits

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UL 1651	Optical Fiber Cable

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UL 1666	Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts

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UL 1685	Standard for Safety for Vertical-Tray Fire-Propagation and Smoke- Release Test for Electrical and Optical-Fiber Cables

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UL 1724	Fire Tests for Electrical Circuit Protective Systems

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UL 2024	Standard for Safety for Communications Cables

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UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables

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	UL 2556	Standard for Wire and Cable Test Methods
725	UL 1310	Class 2 Power Units
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	UL 5C	Surface Raceways and Fittings for Use with Data, Signal, and Control Circuits
	UL 209	Cellular Metal Floor Raceways and Fittings
	UL 467	Grounding and Bonding Equipment
	UL 514A	Metallic Outlet Boxes
	UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

	UL 568	Nonmetallic Cable Tray Systems
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	UL 884	Underfloor Raceways and Fittings
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	UL 1724	Fire Tests for Electrical Circuit Protective Systems
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	UL 2024	Cable Routing Assemblies and Communications Raceways
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	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables
760	UL 268	Smoke Detectors for Fire Alarm Signaling Systems
-		
	UL 268A	Smoke Detectors for Duct Application
-		
	UL 486C	Splicing Wire Connectors
-		
	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
-		
	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 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables
-		
	UL 60730-2-14	Automatic Electrical Controls; Part 2: Particular Requirements for Electric Actuators
770	UL 467	Grounding and Bonding Equipment
-		
	UL 568	Nonmetallic Cable Tray Systems
-		
	UL 1651	Optical Fiber Cable
-		
	UL 2024	Optical Fiber and Communication Cable Raceway
-		
	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables
-		

	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
800	UL 444	Communications Cables
-		
	UL 467	Grounding and Bonding Equipment
-		
	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 497E	Protectors for Antenna Lead-In Conductors
-		
	UL 523	Telephone Service Drop Wire
-		
	UL 568	Nonmetallic Cable Tray Systems
-		
	UL 723	Test for Surface Burning Characteristics of Building Materials
-		
	UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
-		
	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 1863	Communication Circuit Accessories
-		
	UL 2024	Cable Routing Assemblies and Communications Raceways
-		
	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
805	UL 444	Communications Cables
-		
	UL 497	Protectors for Paired-Conductor Communications Circuits
-		
	UL 497A	Secondary Protectors for Communications Circuits
-		
	UL 497C	Protectors for Coaxial Communications Circuits
-		
	UL 497E	Protectors for Antenna Lead-In Conductors

-

	UL 523	Telephone Service Drop Wire

-

	UL 719	Nonmetallic-Sheathed Cables

-

	UL 1310	Class 2 Power Units

-

	UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords

-

	UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

-

	UL 1863	Communication Circuit Accessories

-

	UL 2043	Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces

-

	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation

-

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
810	UL 150	Antenna Rotators

-

	UL 452	Antenna-Discharge Units

-

	UL 467	Grounding and Bonding Equipment

-

	UL 497E	Protectors for Antenna Lead-In Conductors
820	UL 444	Communications Cables

-

	UL 497E	Protectors for Antenna Lead-In Conductors

-

	UL 1655	Community-Antenna Television Cables
830	UL 444	Communications Cables

-

	UL 497A	Secondary Protectors for Communications Circuits

-

	UL 497C	Protectors for Coaxial Communications Circuits

-

	UL 497E	Protectors for Antenna Lead-In Conductors

-

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
840	UL 444	Communications Cables

-

UL 467	Grounding and Bonding Equipment

-

UL 498A	Current Taps and Adapters

-

UL 1310	Class 2 Power Units

-

UL 1651	Optical Fiber Cable

-

UL 1863	Communication Circuit Accessories

-

UL 2024	Cable Routing Assemblies and Communications Raceways

-

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
Tables 11(A) and 11(B)	UL 1310	Class 2 Power Units
	UL 1434	Thermistor-Type Devices
	UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers
	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
Tables 12(A) and 12(B)	UL 1310	Class 2 Power Units
	UL 1434	Thermistor-Type Devices
	UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers
	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements

Table A.1(b) Product Safety Standards for Conductors and Equipment That Do Not Have an Associated Listing Requirement

Article	**Standard Number**	**Standard Title**
110	UL 969	Marking and Labeling Systems

-

	UL 9691	Recommended Practice for Nameplates for Use in Electrical Installations
300	UL 635	Insulating Bushings
314	UL 514C	Conduit, Tubing, and Cable Fittings

-

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
320	UL 514A	Metallic Outlet Boxes

-

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
322	UL 5	Surface Metal Raceways and Fittings

-

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
324	UL 5	Surface Metal Raceways and Fittings

-

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
330	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
332	UL 1565	Positioning Devices

-

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
334	UL 6	Electrical Rigid Metal Conduit — Steel

-

UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

-

UL 514B	Conduit, Tubing, and Cable Fittings

-

UL 651	Schedule 40 and 80 Rigid PVC Conduit

-

UL 797	Electrical Metallic Tubing — Steel

-

UL 797A	Electrical Metallic Tubing — Aluminum and Stainless Steel

-

UL 1242	Electrical Intermediate Metal Conduit — Steel

-

UL 1565	Positioning Devices

-

UL 2239	Hardware for the Support of Conduit, Tubing and Cable

-

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.
335	UL 2250	Instrumentation Tray Cable
337	UL 1565	Positioning Devices

-

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
340	UL 493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables
342	UL 635	Insulating Bushings

-

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
344	UL 635	Insulating Bushings

-

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
348	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
350	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
352	UL 635	Insulating Bushings

-

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
353	UL 635	Insulating Bushings
355	UL 635	Insulating Bushings

-

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
356	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
358	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
362	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
368	UL 857	Busways
392	UL 568	Nonmetallic Cable Tray Systems
400	UL 62	Flexible Cords and Cables

-

UL 498	Attachment Plugs and Receptacles

-

UL 498B	Receptacles with Integral Switching Means

-

UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

-

UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

-

UL 514B	Conduit, Tubing, and Cable Fittings

-

UL 817	Cord Sets and Power-Supply Cords

-

UL 1650	Portable Power Cable

-

	UL 1680	Stage and Lighting Cables
402	UL 66	Fixture Wire
408	UL 50	Enclosures for Electrical Equipment, Non-Environmental Considerations

-

	UL 50E	Enclosures for Electrical Equipment, Environmental Considerations
424	UL 834	Heating, Water Supply, and Power Boilers — Electric

-

UL 1693	Electric Radiant Heating Panels and Heating Panel Sets

-

UL 1995	Heating and Cooling Equipment

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UL 1996	Electric Duct Heaters

-

UL 60335-1	Safety of Household and Similar Electrical Appliances, Part 1: General Requirements

-

	UL 60335-2-40	Household and Similar Electrical Appliances, Part 2–40
425	UL 834	Heating, Water Supply, and Power Boilers — Electric
426	UL 1588	Roof and Gutter De-Icing Cable Units
427	UL 515	Electrical Resistance Trace Heating for Commercial Applications

-

UL 1462	Mobile Home Pipe Heating Cable

-

	UL 2049	Residential Pipe Heating Cable
430	UL 248-13	Low Voltage Fuses — Part 13: Semiconductor Fuses
445	UL 3001	Distributed Energy Generation and Storage Systems

-

	UL 3010	Single Site Energy Systems
450	UL 50	Enclosures for Electrical Equipment, Non-Environmental Considerations

-

UL 50E	Enclosures for Electrical Equipment, Environmental Considerations

-

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 248-8	Low-Voltage Fuses — Part 8: Class J Fuses

-

UL 248-9	Low-Voltage Fuses — Part 9: Class K Fuses

-

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

-

UL 1561	Dry-Type General Purpose and Power Transformers

-

	UL 5085-2	Low Voltage Transformers — Part 2: General Purpose Transformers
460	UL 810	Capacitors

-

UL 1283	Electromagnetic Interference Filters

-

	UL 60384-14	Fixed Capacitors for Use in Electronic Equipment — Part 14: Sectional Specification: Fixed Capacitors for Electromagnetic Interference Suppression and Connection to the Supply Mains
470	UL 508	Industrial Control Equipment

-

	UL 1283	Electromagnetic Interference Filters
500	ANSI/IEEE C2	National Electrical Safety Code, Section 127A, Coal Handling Areas

-

API RP 14F	Recommended Practice for Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Division 1 and Division 2 Locations

-

API RP 500	Recommended Practice for Classification of Locations of Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2

-

API RP 2003	Protection Against Ignitions Arising Out of Static Lightning and Stray Currents.

-

ASHRAE 15	Safety Standard for Refrigeration Systems.

-

ASME B1.20.1	Pipe Threads, General Purpose (Inch)

-

IEEE 844.2	Standard for Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures — Application Guide for Design, Installation, Testing, Commissioning, and Maintenance

-

IEEE 60079-30-2	IEEE/IEC International Standard for Explosive atmospheres — Part 30-2: Electrical resistance trace heating — Application guide for design, installation, and maintenance

-

IIAR 2	Standard for Safe Design of Closed-Circuit Ammonia Refrigeration Systems

-

ISA-12.10	Area Classification in Hazardous (Classified) Dust Locations

-

ISO 965-1	ISO general purpose metric screw threads — Tolerances — Part 1: Principles and basic data

-

ISO 965-3	ISO general purpose metric screw threads — Tolerances — Part 3: Deviations for constructional screw threads

-

NFPA 30	Flammable and Combustible Liquids Code

-

NFPA 32	Standard for Drycleaning Facilities

-

NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

-

NFPA 34	Standard for Dipping, Coating and Printing Processes Using Flammable or Combustible Liquids

-

NFPA 35	Standard for the Manufacture of Organic Coatings

-

NFPA 36	Standard for Solvent Extraction Plants

-

NFPA 45	Standard on Fire Protection for Laboratories Using Chemicals

-

NFPA 55	Compressed Gases and Cryogenic Fluids Code

-

NFPA 58	Liquefied Petroleum Gas Code

-

NFPA 59	Utility LP-Gas Plant Code

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NFPA 77	Recommended Practice on Static Electricity

-

NFPA 497	Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas

-

NFPA 499	Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installation in Chemical Process Areas

-

NFPA 780	Standard for the Installation of Lightning Protection Systems

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NFPA 820	Standard for Fire Protection in Wastewater Treatment and Collection Facilities

-

UL 60079-29-2	Explosive Atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen

-

UL 120002	Certificate Standard for AEx Equipment for Hazardous (Classified) Locations

-

UL 120101	Definitions and Information Pertaining to Electrical Equipment in Hazardous (Classified) Locations

-

UL 121303	Guide for Combustible Gas Detection as a Method of Protection

-

	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and 22 Hazardous (Classified) Locations
501	UL 62	Flexible Cord and Cable

-

	UL 504	Mineral-Insulated, Metal-Sheathed Cable
502	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and Zone 22 Hazardous (Classified) Locations
503	NFPA 505	Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations

-

	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and Zone 22 Hazardous (Classified) Locations
504	ISA-RP 12.06.01	Recommended Practice for Wiring Methods for Hazardous (Classified) Locations Instrumentation — Part 1: Intrinsic Safety
505	ANSI/API RP 14FZ	Recommended Practice for Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Zone 0, Zone 1, and Zone 2 Locations

-

API RP 505	Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, and Zone 2

-

API RP 2003	Protection Against Ignitions Arising Out of Static Lightning and Stray Currents.

-

ASME B1.20.1	Pipe Threads, General Purpose (Inch)

-

EI 15	Model Code of Safe Practice, Part 15: Area Classification Code for Installations Handling Flammable Fluids

-

IEEE 844.2	Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures — Application Guide for Design, Installation, Testing, Commissioning, and Maintenance

-

IEEE 60079-30-2	Explosive Atmospheres — Part 30-2: Electrical resistance trace heating — Application guide for design, installation and maintenance

-

IIAR 2	Standard for Safe Design of Closed-Circuit Ammonia Refrigeration Systems

-

ISA-60079-10-1 (12.24.01)	Explosive Atmospheres — Part 10-1: Classification of Areas — Explosive gas atmospheres

-

ISA-60079-29-2	Explosive Atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen

-

ISO 965-1	ISO general purpose metric screw threads — Tolerances — Part 1: Principles and basic data

-

ISO 965-3	ISO general purpose metric screw threads — Tolerances — Part 3: Deviations for constructional screw threads

-

NFPA 30	Flammable and Combustible Liquids Code

-

NFPA 77	Recommended Practice on Static Electricity

-

NFPA 497	Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas

-

NFPA 780	Standard for the Installation of Lightning Protection Systems

-

UL 80079-20-1	Explosive Atmospheres — Part 20-1: Material Characteristics for Gas and Vapour Classification — Test Methods and Data

-

UL 120101	Definitions and Information Pertaining to Electrical Equipment in Hazardous (Classified) Locations

-

UL 121303	Guide for Use of Detectors for Flammable Gases

-

	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and Zone 22 Hazardous (Classified) Locations
506	ASME B1.20.1	Pipe Threads, General Purpose (Inch)

-

IEEE 844.2	Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures — Application Guide for Design, Installation, Testing, Commissioning, and Maintenance

-

IEEE 60079-30-2	Explosive Atmospheres — Part 30-2: Electrical resistance trace heating — Application guide for design, installation and maintenance

-

ISA-60079-10-2 (12.10.05)	Explosive Atmospheres — Part 10-2: Classification of Areas — Combustible Dust Atmospheres	

-

NFPA 499	Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installation in Chemical Process Areas

-

	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and Zone 22 Hazardous (Classified) Locations
511	NFPA 30A	Code for Motor Fuel Dispensing Facilities and Repair Garages

-

	NFPA 88A	Standard for Parking Structures
512	ICC IFC	International Fire Code

-

NFPA 1	Fire Code

-

NFPA 30	Flammable and Combustible Liquids Code

-

NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

-

NFPA 36	Standard for Solvent Extraction Plants

-

NFPA 58	Liquefied Petroleum Gas Code

-

NFPA 70B	Recommended Practice for Electrical Equipment Maintenance

-

	NFPA 497	Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas
513	NFPA 30	Flammable and Combustible Liquids Code

-

NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

-

	NFPA 409	Standard on Aircraft Hangars
514	NFPA 2	Hydrogen Technologies Code

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NFPA 30A	Code for Motor Fuel Dispensing Facilities and Repair Garages

-

NFPA 52	Vehicular Natural Gas Fuel Systems Code

-

NFPA 58	Liquefied Petroleum Gas Code

-

NFPA 59	Utility LP-Gas Plant Code

-

	NFPA 303	Fire Protection Standard for Marinas and Boatyards
515	NFPA 30	Flammable and Combustible Liquids Code
516	NFPA 13	Standard for the Installation of Sprinkler Systems

-

NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

-

NFPA 34	Standard for Dipping, Coating and Printing Processes Using Flammable or Combustible Liquids

-

NFPA 77	Recommended Practice on Static Electricity

-

NFPA 91	Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids

-

	NFPA 701	Standard Methods of Fire Tests for Flame Propagation of Textiles and Films
620	UL 4	Armored Cable

-

UL 44	Thermoset-Insulated Wires and Cables

-

UL 66	Fixture Wire

-

UL 504	Mineral Insulated Wire

-

UL 1063	Machine-Tool Wires and Cables

-

	UL 1569	Metal Clad Cable
625	UL 3001	Distributed Energy Generation and Storage Systems

-

	UL 3010	Single Site Energy Systems
630	UL 1276	Welding Cable
650	UL 1651	Optical Fiber Cable
660	UL 62	Flexible Cords and Cables

-

	UL 817	Cord Sets and Power Supply Cords
668	UL 4	Armored Cable

-

	UL 62	Flexible Cords and Cables
670	UL 2011	Machinery
675	UL 44	Thermoset-Insulated Wires and Cables

-

UL 83	Thermoplastic-Insulated Wires and Cables

-

UL 83A	Fluoropolymer Insulated Wire

-

UL 1063	Machine-Tool Wires and Cables

-

	UL 1263	Irrigation Cable
690	UL 3001	Distributed Energy Generation and Storage Systems

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	UL 3010	Single Site Energy Systems
691	UL 3001	Distributed Energy Generation and Storage Systems

-

	UL 3010	Single Site Energy Systems
692	UL 44	Thermoset-Insulated Wires and Cables

-

UL 83	Thermoplastic-Insulated Wires and Cables

-

UL 83A	Fluoropolymer Insulated Wire

-

UL 1063	Machine-Tool Wires and Cables

-

UL 3001	Distributed Energy Generation and Storage Systems

-

	UL 3010	Single Site Energy Systems
694	UL 44	Thermoset-Insulated Wires and Cables

-

UL 62	Flexible Cords and Cables

-

UL 83	Thermoplastic-Insulated Wires and Cables

-

UL 83A	Fluoropolymer Insulated Wire

-

UL 1063	Machine-Tool Wires and Cables

-

UL 3001	Distributed Energy Generation and Storage Systems

-

	UL 3010	Single Site Energy Systems
700	UL 3001	Distributed Energy Generation and Storage Systems
701	UL 3001	Distributed Energy Generation and Storage Systems
702	UL 3001	Distributed Energy Generation and Storage Systems
705	UL 3001	Distributed Energy Generation and Storage Systems

-

	UL 3010	Single Site Energy Systems
710	UL 3001	Distributed Energy Generation and Storage Systems

-

UL 3010	Single Site Energy Systems

Statement of Problem and Substantiation for Public Input

Adding UL 60335-2-40 as a referenced standard to Article 210 in Informative Annex A Product Safety Standards because Section 210.8(F) references “listed HVAC equipment,” and this is the applicable reference for listed HVAC equipment.

Note: This public input is related to AHRI's 4 other public inputs in Article 100 (Public Input 3901), Section 210.8 (Public Input 4026), Section 440.4 (Public Input 4029), Section 440.9 (Public Input 4030), which provide important context. The public input in Section 210.8(F) provides exceptions where GFCI protection is not required. The public input in Section 440.4 provides marking requirements for listed HVAC equipment when the listed alternate protective grounding options are utilized by an HVAC manufacturer on equipment. The public input in Section 440.9 adds listed alternate protective grounding options that can be utilized by an HVAC manufacturer on equipment in lieu of adding GFCI protection in the field. The public input in Article 100 adds definitions for "touch current" and "protective grounding current" that provide important context to the reader.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3901-NFPA 70-2023 [New Article after 100]	
Public Input No. 4026-NFPA 70-2023 [Section No. 210.8(F)]	
Public Input No. 4029-NFPA 70-2023 [Section No. 440.4(C)]	
Public Input No. 4030-NFPA 70-2023 [Section No. 440.9]	
Public Input No. 3901-NFPA 70-2023 [New Article after 100]	
Public Input No. 4026-NFPA 70-2023 [Section No. 210.8(F)]	
Public Input No. 4029-NFPA 70-2023 [Section No. 440.4(C)]	
Public Input No. 4030-NFPA 70-2023 [Section No. 440.9]	

Submitter Information Verification

Submitter Full Name: Thomas Deary
Organization: AHRI
Street Address:
City:
State:
Zip:

Submittal Date: Wed Sep 06 14:34:19 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The standard is already appropriately identified in Article 440 for HVAC equipment. Adding it as a reference for Article 210 is unnecessary.

Public Input No. 3074-NFPA 70-2023 [Definition: Example D1(b) One-Family Dwelling]

Example D1(b) One-Family Dwelling

Assume same conditions as Example No. D1(a), plus addition of one 6-A, ~~230~~ 240 -V, room air-conditioning unit and one 12-A, ~~115~~ 120 -V, room air-conditioning unit,* one 8-A, ~~115~~ 120 -V, rated waste disposer, and one 10-A, 120-V, rated dishwasher. See Article 430 for general motors and Article 440, Part VII, for air-conditioning equipment. ~~Motors have nameplate ratings of 115 V and 230 V for use on 120-V and 240-V nominal voltage systems.~~

*(For feeder neutral, use larger of the two appliances for unbalance.)

From Example D1(a), feeder current is 78 A (3-wire, 240 V).

	-	Line A	Neutral	Line B
Amperes from Example D1(a)	78	61	78	
One ~~230~~ 240 -V air conditioner	6	—	6	
One ~~115~~ 120 -V air conditioner and 120-V dishwasher	12	12	10	
One ~~115~~ 120 -V disposer	—	8	8	
25% of air-conditioner *(see 440.33)*	3	3	2	
Total amperes per conductor	99	84	104	

Therefore, the service would be rated 110 A.

Statement of Problem and Substantiation for Public Input

Changing 115V to 120V and 230V to 240V in the calculation example to make it easier for Code users. These revisions will simplify how to calculate the loads by using the nominal system voltage instead of the utilization equipment voltage.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 11:00:47 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The ratings of the equipment are correct as currently written, and it is noted that the equipment is allowed to operate on the 120-V and 240-V nominal voltage systems. While the submitter is correct that air-conditioners are covered in Article 440.33, the example includes motor-operated appliances as well, which are covered in 430.24. Referring to 430.24 or 440.33 yield the same results and neither is more accurate than the other.

Public Input No. 3075-NFPA 70-2023 [Definition: Example D2(a) Optional Calculation for One-Fami...]

Example D2(a) Optional Calculation for One-Family Dwelling, Heating Larger Than Air Conditioning

(see 220.82)

The dwelling has a floor area of 1500 ft^2, exclusive of an unfinished cellar not adaptable for future use, unfinished attic, and open porches. It has a 12-kW range, a 2.5-kW water heater, a 1.2-kW dishwasher, 9 kW of electric space heating installed in five rooms, a 5-kW clothes dryer, and a 6-A, ~~230~~ 240 -V, room air-conditioning unit. Assume range, water heater, dishwasher, space heating, and clothes dryer kW ratings equivalent to kVA.

Air Conditioner kVA Calculation

6 A × ~~230 V~~ 240 V ÷ 1000 = 1.~~38 kVA~~ 44 kVA

This 1.~~38 kVA~~ 44 kVA [item 1 from 220.82(C)] is less than 40% of 9 kVA of separately controlled electric heat [item 6 from 220.82(C)], so the 1.~~38 kVA~~ 44 kVA need not be included in the service calculation.

General Load

1500 ft^2 at 3 VA		4,500 VA
Two 20-A appliance outlet circuits at 1500 VA each		3,000 VA
Laundry circuit		1,500 VA
Range (at nameplate rating)		12,000 VA
Water heater		2,500 VA
Dishwasher		1,200 VA
Clothes dryer		5,000 VA
	Total	29,700 VA

Application of Demand Factor

[see 220.82(B)]

First 10 kVA of general load at 100%		10,000 VA
Remainder of general load at 40% (19.7 kVA × 0.4)		7,880 VA
	Total of general load	17,880 VA
9 kVA of heat at 40% (9000 VA × 0.4) =		3,600 VA
	Total	21,480 VA

Calculated Load for Service Size

21.48 kVA = 21,480 VA

21,480 VA ÷ 240 V = 90 A

Therefore, the minimum service rating would be 100 A in accordance with 230.42 and 230.79.

Feeder Neutral Load in Accordance with 220.61

1500 ft^2 at 3 VA		4,500 VA
Three 20-A circuits at 1500 VA		4,500 VA
	Total	9,000 VA
3000 VA at 100%		3,000 VA
9000 VA - 3000 VA = 6000 VA at 35%		2,100 VA
	Subtotal	5,100 VA
Range: 8 kVA at 70%		5,600 VA
Clothes dryer: 5 kVA at 70%		3,500 VA
Dishwasher		1,200 VA
	Total	15,400 VA

Calculated Load for Neutral

15,400 VA ÷ 240 V= 64 A

Statement of Problem and Substantiation for Public Input

Changing 230V to 240V in the calculation example to make it easier for Code users. These revisions will simplify how to calculate the loads by using the nominal system voltage instead of the utilization equipment voltage.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 29 11:03:21 EDT 2023

Committee: NEC-P02

Committee Statement

Resolution: The ratings of the equipment are correct as currently written, and it is noted that the equipment is allowed to operate on the 120-V and 240-V nominal voltage systems.

Public Input No. 3077-NFPA 70-2023 [Definition: Example D2(b) Optional Calculation for One-Fami...]

Example D2(b) Optional Calculation for One-Family Dwelling, Air Conditioning Larger Than Heating

[see 220.82(A) and 220.82(C)]

The dwelling has a floor area of 1500 ft^2, exclusive of an unfinished cellar not adaptable for future use, unfinished attic, and open porches. It has two 20-A small appliance circuits, one 20-A laundry circuit, two 4-kW wall-mounted ovens, one 5.1-kW counter-mounted cooking unit, a 4.5-kW water heater, a 1.2-kW dishwasher, a 5-kW combination clothes washer and dryer, six 7-A, ~~230~~ 240 -V room air-conditioning units, and a 1.5-kW permanently installed bathroom space heater. Assume wall-mounted ovens, counter-mounted cooking unit, water heater, dishwasher, and combination clothes washer and dryer kW ratings equivalent to kVA.

Air Conditioning kVA Calculation

Total amperes = 6 units × 7 A = 42 A

42 A × 240 V ÷ 1000 = 10.08 kVA (assume PF = 1.0)

Load Included at 100%

Air Conditioning: Included below *[see item 1 in 220.82(C)]*

Space Heater:

Omit *[see item 5 in 220.82(C)]*

General Load

1500 ft^2 at 3 VA		4,500 VA
Two 20-A small-appliance		-
circuits at 1500 VA each		3,000 VA
Laundry circuit		1,500 VA
Two ovens		8,000 VA
One cooking unit		5,100 VA
Water heater		4,500 VA
Dishwasher		1,200 VA
Washer/dryer		5,000 VA
	Total general load	32,800 VA
First 10 kVA at 100%		10,000 VA
Remainder at 40%		-
(22.8 kVA × 0.4 × 1000)		9,120 VA
	Subtotal general load	19,120 VA
Air conditioning		10,080 VA
	Total	29,200 VA

Calculated Load for Service

29,200 VA ÷ 240 V = 122 A (service rating)

Feeder Neutral Load, in accordance with 220.61

Assume that the two 4-kVA wall-mounted ovens are supplied by one branch circuit, the 5.1-kVA counter-mounted cooking unit by a separate circuit.

1500 ft^2 at 3 VA		4,500 VA
Three 20-A circuits at 1500 VA		4,500 VA
	Subtotal	9,000 VA
3000 VA at 100%		3,000 VA
9000 VA - 3000 VA = 6000 VA at 35%		2,100 VA
	Subtotal	5,100 VA

Two 4-kVA ovens plus one 5.1-kVA cooking unit = 13.1 kVA. Table 220.55 permits 55% demand factor or 13.1 kVA × 0.55 = 7.2 kVA feeder capacity.

	Subtotal from above	5,100 VA
Ovens and cooking unit: 7200 VA × 70% for neutral load		5,040 VA
Clothes washer/dryer: 5 kVA × 70% for neutral load		3,500 VA
Dishwasher		1,200 VA
	Total	14,840 VA

Calculated Load for Neutral

14,840 VA ÷ 240 V = 62

Statement of Problem and Substantiation for Public Input

Changing 230V to 240V in the calculation example to make it easier for Code users. These revisions will simplify how to calculate the loads by using the nominal system voltage instead of the utilization equipment voltage.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 11:05:23 EDT 2023
Committee: NEC-P02

Committee Statement

Resolution: The ratings of the equipment are correct as currently written, and it is noted that the equipment is allowed to operate on the 120-V and 240-V nominal voltage systems.

Public Input No. 65-NFPA 70-2023 [Definition: Example D2(b) Optional Calculation for One-Fami...]

Example D2(b) Optional Calculation for One-Family Dwelling, Air Conditioning Larger Than Heating

[see 220.82(A) and 220.82(C)]

The dwelling has a floor area of 1500 ft^2, exclusive of an unfinished cellar not adaptable for future use, unfinished attic, and open porches. It has two 20-A small appliance circuits, one 20-A laundry circuit, two 4-kW- ~~wall-~~ , 120/240-V wall- mounted ovens, one 5.1-kW, 120/240-V counter-mounted cooking unit, a 4.5-kW, 240-V water heater, a 1.2-kW, 120-V dishwasher, a 5-kW, 120/240-V combination clothes washer and dryer, six 7-A, 230-V room air-conditioning units, and a 1.5-kW, 240-V permanently installed bathroom space heater. Assume wall-mounted ovens, counter-mounted cooking unit, water heater, dishwasher, and combination clothes washer and dryer kW ratings equivalent to kVA.

Air Conditioning kVA Calculation

Total amperes = 6 units × 7 A = 42 A

42 A × 240 V ÷ 1000 = 10.08 kVA (assume PF = 1.0)

Load Included at 100%

Air Conditioning: Included below *[see item 1 in 220.82(C)]*

Space Heater:

Omit *[see item 5 in 220.82(C)]*

General Load

1500 ft^2 at 3 VA		4,500 VA
Two 20-A small-appliance		-
circuits at 1500 VA each		3,000 VA
Laundry circuit		1,500 VA
Two ovens		8,000 VA
One cooking unit		5,100 VA
Water heater		4,500 VA
Dishwasher		1,200 VA
Washer/dryer		5,000 VA
	Total general load	32,800 VA
First 10 kVA at 100%		10,000 VA
Remainder at 40%		-
(22.8 kVA × 0.4 × 1000)		9,120 VA
	Subtotal general load	19,120 VA
Air conditioning		10,080 VA
	Total	29,200 VA

Calculated Load for Service

29,200 VA ÷ 240 V = 122 A (service rating)

Feeder Neutral Load, in accordance with 220.61

Assume that the two 4-kVA wall-mounted ovens are supplied by one branch circuit, the 5.1-kVA counter-mounted cooking unit by a separate circuit.

1500 ft^2 at 3 VA		4,500 VA
Three 20-A circuits at 1500 VA		4,500 VA
	Subtotal	9,000 VA
3000 VA at 100%		3,000 VA
9000 VA - 3000 VA = 6000 VA at 35%		2,100 VA
	Subtotal	5,100 VA

Two 4-kVA ovens plus one 5.1-kVA cooking unit = 13.1 kVA. Table 220.55 permits 55% demand factor or 13.1 kVA × 0.55 = 7.2 kVA feeder capacity.

	Subtotal from above	5,100 VA
Ovens and cooking unit: 7200 VA × 70% for neutral load		5,040 VA
Clothes washer/dryer: 5 kVA × 70% for neutral load		3,500 VA
Dishwasher		1,200 VA
	Total	14,840 VA

Calculated Load for Neutral

14,840 VA ÷ 240 V = 62

Statement of Problem and Substantiation for Public Input

240-V ranges, cooktops, ovens, and dryers do NOT have a neutral! How can there be a neutral calculation shown in this example for appliances with no neutral? 120/240-V ranges, cooktops, ovens and dryers DO have a neutral. So which is it? 240-V or 120/240-V? The addition of "120/240-V" for these loads will make this example easier to understand. The introductory list items of Annex D Examples provides for the uniform application of nominal system voltages used in these calculations, but does not specify the voltage of the appliances. Adding these correct appliance voltages to the example is necessary since 240-V appliances do not have a neutral, but 120/240-V appliances do. And what voltage is the bathroom heater? I have installed many 120-V electric heaters. Why is there no neutral load calculation shown for the 120-V heater? That's because we need to ASSUME that voltage is 240-V. But why? Let's remove the need to make assumptions for the voltage ratings of these appliances. The correct voltages for each of these appliances needs to be specified in order to make correct calculations.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 62-NFPA 70-2023 [Definition: Example D1(a) One-Family Dwelling [Excluding an...]	neutral calculations
Public Input No. 64-NFPA 70-2023 [Definitions (D): Calculation... to Calculated ...]	neutral calculations
Public Input No. 63-NFPA 70-2023 [Definition: Example D2(a) Optional Calculation for One-Fami...]	neutral calculations
Public Input No. 66-NFPA 70-2023 [Definition: Example D4(a) Multifamily Dwelling [Excluding a...]	
Public Input No. 67-NFPA 70-2023 [Definition: Example D4(b) Optional Calculation for Multifam...]	

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:
Submittal Date: Sat Jan 07 07:12:36 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: The ratings of the equipment are correct as currently written, and it is noted that the equipment is allowed to operate on the 120-V and 240-V nominal voltage systems. 240-V appliances may or may not have a neutral conductor.

Public Input No. 64-NFPA 70-2023 [Definitions (D): Calculation... to Calculated ...]

Definitions (D): Calculation... to Calculated ...

Calculation for Neutral for Feeder and Service

Lighting and Small-Appliance Load		5,100 VA
Range: 8000 VA at 70% *(see 220.61)*		5,600 VA
~~Dryer: 5500 VA at 70% *(see 220.61)*~~		~~3,850 VA~~
	Total	~~14~~ 10 ,~~550 VA~~ 700 VA

Calculated Load for Neutral

~~14~~ 10 ,~~550 VA~~ 700 VA ÷ 240 V = ~~61 A~~ 44.58 A

Statement of Problem and Substantiation for Public Input

Removing the dryer from this neutral calculation is necessary since the voltage of the dryer in this example was stated as being 240-V. A 240-V dryer does NOT have a neutral! There should be no neutral load for an appliance without a neutral! Please see my other related PI 62. Choose either PI 62 or PI 64 since they cannot both be correct. One of them must be correct though.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 62-NFPA 70-2023 [Definition: Example D1(a) One-Family Dwelling [Excluding an...]	Neutral calculations
Public Input No. 62-NFPA 70-2023 [Definition: Example D1(a) One-Family Dwelling [Excluding an...]	
Public Input No. 65-NFPA 70-2023 [Definition: Example D2(b) Optional Calculation for One-Fami...]	
Public Input No. 66-NFPA 70-2023 [Definition: Example D4(a) Multifamily Dwelling [Excluding a...]	
Public Input No. 67-NFPA 70-2023 [Definition: Example D4(b) Optional Calculation for Multifam...]	

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:
Submittal Date: Sat Jan 07 06:53:07 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8122-NFPA 70-2024

Statement: In the example, the voltage for the range is not mentioned, but considering the calculation indicates a neutral load for the range, indicating it is rated 120/240 volts is appropriate. A similar revision is included to reflect that the dryer is rated 120/240 volts (as it also indicates a neutral load in the calculation).

Public Input No. 62-NFPA 70-2023 [Definition: Example D1(a) One-Family Dwelling [Excluding an...]

The dwelling has a floor area of 1500 ft^2, exclusive of an unfinished cellar not adaptable for future use, unfinished attic, and open porches. Appliances are a 12-kW- ~~range~~ , 120/240-V range and a 5.5-kW, 120/ 240-V dryer. Assume range and dryer kW ratings equivalent to kVA ratings in accordance with 220.54 and 220.55.

Statement of Problem and Substantiation for Public Input

240-V dryers do NOT have a neutral! How can there be a neutral calculation shown in this example for an appliance with no neutral? 120/240-V dryers DO have a neutral. The same can be said for the range except there was NO voltage specified for the range. The addition of "120/240-V" for these two loads will make this example easier to understand.
The introductory list items of Annex D Examples provides for the uniform application of nominal system voltages used in these calculations, but does not specify the voltage of the range or dryer. Adding these correct appliance voltages to the example is necessary since 240-V appliances do not have a neutral, but 120/240-V appliance do. Please see related PI 64. Choose either PI 62 or PI 64 since they cannot both be correct. One of them must be correct though.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 64-NFPA 70-2023 [Definitions (D): Calculation... to Calculated ...]	Neutral calculations
Public Input No. 64-NFPA 70-2023 [Definitions (D): Calculation... to Calculated ...]	
Public Input No. 65-NFPA 70-2023 [Definition: Example D2(b) Optional Calculation for One-Fami...]	
Public Input No. 66-NFPA 70-2023 [Definition: Example D4(a) Multifamily Dwelling [Excluding a...]	
Public Input No. 67-NFPA 70-2023 [Definition: Example D4(b) Optional Calculation for Multifam...]	

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:
Submittal Date: Sat Jan 07 06:31:23 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8122-NFPA 70-2024

Statement: In the example, the voltage for the range is not mentioned, but considering the calculation indicates a neutral load for the range, indicating it is rated 120/240 volts is appropriate. A similar revision is included to reflect that the dryer is rated 120/240 volts (as it also indicates a neutral load in the calculation).

Public Input No. 63-NFPA 70-2023 [Definition: Example D2(a) Optional Calculation for One-Fami...]

(see 220.82)

The dwelling has a floor area of 1500 ft^2, exclusive of an unfinished cellar not adaptable for future use, unfinished attic, and open porches. It has a 12-kW, 120/240-V range, a 2.5-kW water heater, a 1.2-kW dishwasher, 9 kW of electric space heating installed in five rooms, a 5-kW, 120/240-V clothes dryer, and a 6-A, 230-V, room air-conditioning unit. Assume range, water heater, dishwasher, space heating, and clothes dryer kW ratings equivalent to kVA.

Statement of Problem and Substantiation for Public Input

240-V ranges and dryers do NOT have a neutral! How can there be a neutral calculation shown in this example for appliances with no neutral? 120/240-V ranges and dryers DO have a neutral. The addition of "120/240-V" for these two loads will make this example easier to understand. The introductory list items of Annex D Examples provides for the uniform application of nominal system voltages used in these calculations, but does not specify the voltage of the range or dryer. Adding these correct appliance voltages to the example is necessary since 240-V appliances do not have a neutral, but 120/240-V appliance do.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 65-NFPA 70-2023 [Definition: Example D2(b) Optional Calculation for One-Fami...]	
Public Input No. 66-NFPA 70-2023 [Definition: Example D4(a) Multifamily Dwelling [Excluding a...]	
Public Input No. 67-NFPA 70-2023 [Definition: Example D4(b) Optional Calculation for Multifam...]	

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:

Submittal Date: Sat Jan 07 06:43:34 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: 240-V appliances may or may not have a neutral conductor.

Public Input No. 66-NFPA 70-2023 [Definition: Example D4(a) Multifamily Dwelling [Excluding a...]

A multifamily dwelling has 40 dwelling units.

Meters are in two banks of 20 each with individual feeders to each dwelling unit.

One-half of the dwelling units are equipped with 120/240-V electric ranges not exceeding 12 kW each. Assume range kW rating equivalent to kVA rating in accordance with 220.55. Other half of ranges are gas ranges.

Area of each dwelling unit is 840 ft^2.

Laundry facilities on premises are available to all tenants. Add no circuit to individual dwelling unit.

Statement of Problem and Substantiation for Public Input

Are the ranges 240-V or 120/240-V? I have installed many appliances that were 240-V with no neutral connection. Specifying the correct voltage for appliances is imperative in performing correct neutral load calculations. There should be no load calculation shown for appliances having no neutral conductor. Let's remove the need for making assumptions on what the voltage rating of these appliances could possibly be.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 62-NFPA 70-2023 [Definition: Example D1(a) One-Family Dwelling [Excluding an...]	neutral calculations
Public Input No. 63-NFPA 70-2023 [Definition: Example D2(a) Optional Calculation for One-Fami...]	neutral calculation
Public Input No. 64-NFPA 70-2023 [Definitions (D): Calculation... to Calculated ...]	neutral calculations
Public Input No. 65-NFPA 70-2023 [Definition: Example D2(b) Optional Calculation for One-Fami...]	neutral calculations
Public Input No. 67-NFPA 70-2023 [Definition: Example D4(b) Optional Calculation for Multifam...]	

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:
Submittal Date: Sat Jan 07 07:34:48 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8125-NFPA 70-2024

Statement: In the example, the voltage for the range was not mentioned, but considering the calculation indicates a neutral load for the range, it is appropriate to indicate that it is rated 120/240 volts.

Public Input No. 67-NFPA 70-2023 [Definition: Example D4(b) Optional Calculation for Multifam...]

A multifamily dwelling equipped with electric cooking and space heating or air conditioning has 40 dwelling units.

Meters are in two banks of 20 each plus house metering and individual feeders to each dwelling unit.

Each dwelling unit is equipped with an electric range of 8-kW ~~nameplate~~ , 120/240-V nameplate rating, four 1.5-kW separately controlled 240-V electric space heaters, and a 2.5-kW, 240-V electric water heater. Assume range, space heater, and water heater kW ratings equivalent to kVA. Calculate the load for the individual dwelling unit by the standard calculation (Part III of Article 220).

A common laundry facility is available to all tenants *[see 210.52(F), Exception No. 1]*.

Area of each dwelling unit is 840 ft^2.

Statement of Problem and Substantiation for Public Input

Are the ranges 240-V or 120/240-V? It matters greatly for performing neutral calculations. This voltage needs to be specified, just as the voltage for the electric space heater is specified as 240-V. I have installed 120-V heaters and I have installed 240-V heaters too. I have also installed 240-V ranges and 120/240-V ranges. There should be no neutral load calculation shown for 240-V ranges having no neutral conductor. Let's remove the need for making assumptions as to what the voltage rating of the appliances might be.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 62-NFPA 70-2023 [Definition: Example D1(a) One-Family Dwelling [Excluding an...]	Neutral calculations
Public Input No. 63-NFPA 70-2023 [Definition: Example D2(a) Optional Calculation for One-Fami...]	neutral calculations
Public Input No. 64-NFPA 70-2023 [Definitions (D): Calculation... to Calculated ...]	neutral calculations
Public Input No. 65-NFPA 70-2023 [Definition: Example D2(b) Optional Calculation for One-Fami...]	neutral calculations
Public Input No. 66-NFPA 70-2023 [Definition: Example D4(a) Multifamily Dwelling [Excluding a...]	neutral calculations

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:
Submittal Date: Sat Jan 07 07:43:05 EST 2023
Committee: NEC-P02

Committee Statement

Resolution: FR-8127-NFPA 70-2024

Statement: In the example, the voltage for the range is not mentioned, but considering the calculation indicates a neutral load for the range, it is appropriate to indicate that it is rated 120/240 volts.