Public Input No. 3416-NFPA 70-2017 [Definition: Automatic.]

Automatic.

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

Availability.

The percentage of time that a system is available to perform its function(s)

Statement of Problem and Substantiation for Public Input

The availability of a power system is its essential characteristic. Everything we do in the power industry is focused on making sure that power is available because of the linkage between public safety and safe and available electrical power.. This definition, coupled with the tern "reliable" should track explicitly in the NEC and should raise awareness that reliability calculations are as essential as short circuit and load flow calculations. We see an expansion of this concept in Annex F.

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Public Input No. 3427-NFPA 70-2017 [Definition: Receptacle Outlet.]

Receptacle Outlet.

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

Reliability.

Reliability. The probability that a system or component will operate properly for a specified period of time under design operating conditions without failure.

Informational Note: Additional information is available in IEEE 3006.5 Recommended Practice for the Use of Probability Methods for Conducting a Reliability Analysis of Industrial and Commercial Power Systems

Statement of Problem and Substantiation for Public Input

We need to recognize that the greater public hazard lies in the absence of electrical rather than fire hazard. In other words, forced outages occur with far greater frequency than fires and needs engineering solutions that the inspection community needs to tool up for. This proposed definition pairs with the proposed definition of "Availability".

Electrical safety has a strong correlation with power system reliability -- for electricians as well as occupants. Reliability is the probability that a product or service will operate properly for a specified period of time under design operating conditions without failure. Reliability is time dependent. The longer the time, the lower the reliability, regardless of what the system design is. The higher quality of the system design, the higher the probability of successful operation for a longer period of time.

By comparison, a related term is Availability. Availability is the long-term average fraction of time that a repairable component or system is in service and satisfactorily performing its intended function. For example, if the electricity is off for one hour in a year, but the rest of the year the electricity is on, the availability of electrical power for that year is 8759 hours divided by 8760 hours, which is 0.999886.

As the mother standard for nearly all electrical power standards in the world these distinctions need to track in the vocabulary of our industry - specifically in Article 100 -- because this is the go-to place for electrical terminology in global electrical standards. The word "reliability" appears 10 times in the 2017 NEC

The reliability of a power system is its essential characteristic. Everything we do in the power industry is focused on making sure that power is present and safe. This definition, coupled with the tern "available" should track explicitly in the NEC and should raise awareness that reliability calculations are as essential as short circuit and load flow calculations.

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

110.1 Scope.

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

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

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

Statement of Problem and Substantiation for Public Input

The stronger the linkage between the NFPA and IEEE on electrical power technology the better. This document is one of several that replaces content in ANSI/IEEE 241 Recommended Practice for Electric Power Systems in Commercial Buildings -- the so-called "Gray Book"; and the ANSI/IEEE 141 Recommended Practice for Power Distribution for Industrial Plants -- the so-called "Red Book"; both of which are now being sunsetted and superseded by 3007.3.

IEEE 3000 Standards Collection™ is the trademarked name of the family of industrial and commercial power systems standards formerly known as IEEE Color Books. The IEEE 3000 Standards Collection overall includes the same content as the Color Books that have been referenced into previous editions of the NEC but is now organized into approximately 70 IEEE "dot" standards that cover specific technical topics.

This method of development, of capturing and quickly conveying leading practice from transactions among academic experts and practitioners into our industry, supports the NFPA International mission of eliminating death, injury, property and economic loss due to fire, electrical and related hazards. Details about this document is available at the link below:

https://standards.ieee.org/findstds/standard/3007.3-2012.html

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Public Input No. 3433-NFPA 70-2017 [Section No. 110.10]

110.10 Circuit Impedance, Short-Circuit Current Ratings, Reliability and Other Characteristics.

The overcurrent protective devices, the total impedance, the equipment short-circuit current ratings, and other characteristics of the circuit to be protected shall be selected and coordinated to permit the circuit protective devices used to clear a fault to do so without extensive damage to the electrical equipment of the circuit. This fault shall be assumed to be either between two or more of the circuit conductors or between any circuit conductor and the equipment grounding conductor(s) permitted in 250.118. Listed equipment applied in accordance with their listing shall be considered to meet the requirements of this section.

Informational Note: System reliability is an essential characteristic of a power system. System grounding through an impedance that is now permitted in Section 250.36 will yield an early warning signal that a power delivery component is about to fail and thereby reduce the frequency of use of the second source. The impedance grounded system will, in most cases, permit the system to deliver power until a scheduled outage thereby reducing risk to occupants. Impedance grounded systems also reduce incident energy exposure by dramatically by diverting fault current through a resistor. With incident energy reduced, maintenance may be undertaken more safely reducing the risk of more forced outages.

Statement of Problem and Substantiation for Public Input

This proposal is another in a series to raise the visibility of system reliability as an essential characteristic and to convey information about how short circuit, incident energy, system grounding methods and reliability are all related.

I proposed this change during the 2017 revision cycle, which was rejected with a recommendation to propose it again for placement in Article 250 during the 2020 revision cycle. That has been done but I am placing it on the CMP-1 agenda again to support the other proposals intended to raise the level of discussion about strengthening the NEC's statements about power system reliability,

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Public Input No. 3436-NFPA 70-2017 [New Section after 110.22(B)]

TITLE OF NEW CONTENT

For more information, see IEEE 3003.2 Recommended Practice for Equipment Grounding and Bonding in Industrial and Commercial Power Systems

Statement of Problem and Substantiation for Public Input

Series circuit breaker ratings have subtleties that should be informed by faster-moving engineering considerations available in the new IEEE 3000 series of recommended practices. This document is one of several that replaces content in IEEE 142 -- the so-called “Green Book” -- which has been sunsetted and superseded by 3003.2.

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Details about this document is available at the link below:

https://standards.ieee.org/findstds/standard/3003.2-2014.html

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Public Input No. 3442-NFPA 70-2017 [Section No. 110.26(D)]

(D) Illumination.

Illumination shall be provided for all working spaces about service equipment, switchboards, switchgear, panelboards, or motor control centers installed indoors. Control by automatic means only shall not be permitted. Additional lighting outlets shall not be required where the work space is illuminated by an adjacent light source or as permitted by 210.70(A)(1), Exception No. 1, for switched receptacles.

<u>(E) Emergency Illumination.</u>

<u>An emergency lighting system shall automatically illuminate the areas around electrical service equipment greater than 200 amperes for a duration of not less than 90 minutes.</u>

Statement of Problem and Substantiation for Public Input

To provide INGRESS AND egress illumination in the event of a power failure -- especially when the power failure is the result of an accident at the service. Previous responses to this proposal refer to building codes and NFPA 101. Sections 1008 (Means of Egress Illumination) and Setion 1009 (Accessible Means of Egress) of the ICC's International Building Code do not contemplate the condition in which a power failure caused the outage to begin with and that there would be no illumination for worker rescue. NFPA 101 refers to the IBC which effectively creates a do-nothing loop which should be remedied in an NEC section that sets general rules for electrical safety..

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Public Input No. 4325-NFPA 70-2017 [Section No. 110.27(A)]

(A) Live Parts Guarded Against Accidental Contact.

Except as elsewhere required or permitted by this *Code,* live parts of electrical equipment operating at 50 to 1000 volts, nominal shall be guarded against accidental contact by approved enclosures or by any of the following means:

(1) By location in a room, vault, cage or similar enclosure that is accessible only to qualified persons.

(2) By permanent, substantial partitions or screens arranged on all sides and above so that only qualified persons have access to the space within reach of the live parts. Any openings in such partitions or screens shall be sized and located so that persons are not likely to come into accidental contact with the live parts or to bring conducting objects into contact with them.

(3) By location on a balcony, gallery, or platform elevated and arranged so as to exclude unqualified persons.

(4) By elevation above the floor or other working surface as follows:

(5) A minimum of 2.5 m (8 ft) for 50 volts to 300 volts between ungrounded conductors

(6) A minimum of 2.6 m (8 ft 6 in.) for 301 volts to 600 volts between ungrounded conductors

(7) A minimum of 2.62 m (8 ft 7 in.) for 601 volts to 1000 volts between ungrounded conductors

Statement of Problem and Substantiation for Public Input

Exterior switchgear with exposed live parts should be guarded above live parts to prevent access by persons, animals, drones or other objects that enter the space from above.

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Public Input No. 4327-NFPA 70-2017 [Section No. 110.33(A)(2)]

(2) Guarding.

Where bare energized parts at any voltage or insulated energized parts above 1000 volts, nominal, are located adjacent to such entrance, they shall be suitably guarded to prevent access by persons, animals, drones or other objects that enter the space from above . .

Statement of Problem and Substantiation for Public Input

This makes a more specific statement about making sure that exterior switchgear with exposed live parts should be guarded ABOVE above live parts to prevent access by persons, animals, drones or other objects that enter the space from above. Many utilities construct screens above their transformers and related switchgear to prevent rodents from causing flash-overs. Owing to the increasing use of drones we should be more specific about restricting vertical access for safety and security reasons.

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Public Input No. 3250-NFPA 70-2017 [Section No. 210.19(A) [Excluding any Sub-Sections]]

Informational Note No. 1: See 310.15 for ampacity ratings of conductors.

Informational Note No. 2: See Part II of Article 430 for minimum rating of motor branch-circuit conductors.

Informational Note No. 3: See 310.15(A)(3) for temperature limitation of conductors.

Informational Note No. 4: 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 Informational Note No. 2 of 215.2(A)(1)for voltage drop on feeder conductors.

<u>Informational Note 5: For information regarding circuit breakers, see IEEE 3004.5 IEEE Recommended Practice for the Application of Low-Voltage Circuit Breakers in Industrial and Commercial Power Systems</u>

Statement of Problem and Substantiation for Public Input

The stronger the linkage between the NFPA and IEEE on electrical power technology the better. This document replaces ANSI/IEEE 142 -- the so-called “Red Book”, which is now being sunsetted and superseded by 3004.5.

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This method of development, of capturing and quickly conveying leading practice from transactions among academic experts and practitioners into our industry, supports the NFPA International mission of eliminating death, injury, property and economic loss due to fire, electrical and related hazards. My own experience with other international electrical standard developers suggests that closer coupling of the fire and electrical safety community in the US would be welcomed.

Details about this document is available at the link below:

https://standards.ieee.org/findstds/standard/3004.5-2014.html

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Public Input No. 1076-NFPA 70-2017 [New Section after 220.1]

220.2 Definitions

Demonstrated Load. Historical demand watt information recorded over at least a 24-month period for the same type of facility as the one in question, equated to watts/square foot (watts/square meter)

Additional Proposed Changes

File Name	Description	Approved
CSA-Groups-CEC-Section-8-Circuit-loading-and-demand-factors.pdf		

Statement of Problem and Substantiation for Public Input

This is a correlating and necessary definition to accompany a proposal for demonstrated load in a new proposal in Section 220.86.

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Public Input No. 3214-NFPA 70-2017 [Section No. 220.1]

220.1 Scope.

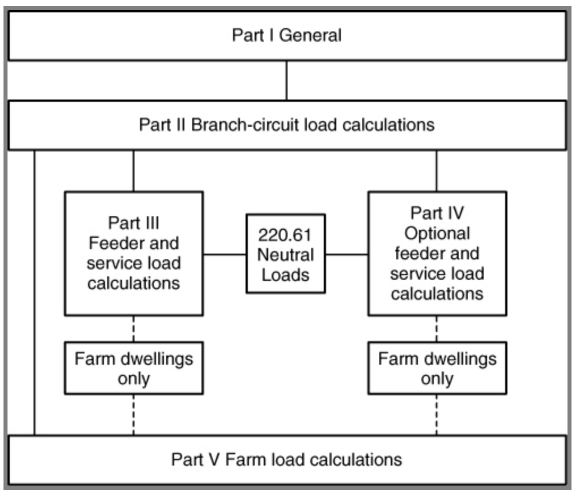
This article provides requirements for calculating branch-circuit, feeder, and service loads. Part I provides general requirements for calculation methods. Part II provides calculation methods for branch-circuit loads. Parts III and IV provide calculation methods for feeder and service loads. Part V provides calculation methods for farm loads.

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

Informational Note No. 2: See Figure 220.1 for information on the organization of Article 220.

Informational Note 3: For information regarding electrical power system design, see 3001.5 IEEE Recommended Practice for the Application of Power Distribution Apparatus in Industrial and Commercial Power Systems

Figure 220.1 Branch-Circuit, Feeder, and Service Load Calculation Methods.



Statement of Problem and Substantiation for Public Input

The stronger the linkage between the NFPA and IEEE on electrical power technology the better.. Consideration for this proposal to be placed elsewhere in the NEC would also be welcomed.

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Public Input No. 1075-NFPA 70-2017 [New Section after 220.86]

220.86+ Demonstrated Load

For loads other than those calculated in accordance with Table 220.86, feeder and service load calculations shall be permitted to be based upon demonstrated loads provided that such calculations are performed by a qualified person as determined by the regulatory authority having jurisdiction.

Additional Proposed Changes

File Name	Description	Approved
CSA-Groups-CEC-Section-8-Circuit-loading-and-demand-factors.pdf	Canadian Electrical Code allowance for "Demonstrated Load" concepts to be applied to service and feeder capacity calcuations	

Statement of Problem and Substantiation for Public Input

This proposal places before the committee, and related Task Groups, an example of how our colleagues in Canada have approached a resolution to the problem of oversized building power chains in educational facilities. Note that the "demonstrated load" concept is introduced as a definition at the beginning of this article.

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Public Input No. 3667-NFPA 70-2017 [Section No. 220.86]

220.~~86~~ ~~Schools.~~ 86 Educational Occupanies

The calculation of a feeder or service load for ~~schools~~ educational occupancies 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~~ Educational Occupancies

Connected Load		Demand Factor (Percent)
First 33 VA/m^2	(3 VA/ft^2) at	100
Plus,		
Over 33 through 220 VA/m^2	(3 through 20 VA/ft^2) at	75
Plus,		
Remainder over 220 VA/m^2	(20 VA/ft^2) at	25

Statement of Problem and Substantiation for Public Input

The Committee resolved a similar proposal last cycle with the claim that this section permits use of Table 220.86 for schools up to the 12th grade. This proposal is intended to clarify that a section developed for "schools" may not be appropriate for colleges and universities with significantly different use patterns and should be harmonized with the dominant building code in the US.

K-12 schools have a higher occupancy rate (and a higher power density requirement) 9 months of the year than colleges and universities which operate year-round but with a much lower power density across a broad span of occupancy classes. Anecdotal evidence suggests that college and university square footage, on average, is 80 percent unoccupied because much less of the square footage is devoted to instruction.

Admittedly, another section could be written for Group B educational buildings which would involve commercial design practice (and perhaps a campus-style complex of buildings) but for the moment, this title change will improve useability of the 2020 NEC for the education facilities industry..

For the convenience of the committee without easy access to the IBC: All Group E occupancies have three features in common:

- they are limited to the education, supervision or personal care of persons at an educational level no greater than 12th grade
- the occupants are only in the facility for a limited time each day
- there are at least six persons being educated, supervised, or cared for at the same time.

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Public Input No. 3674-NFPA 70-2017 [Section No. 220.86]

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 (Percent)
First 33 VA/m^2 Plus,	(~~3 VA~~ 2 VA /ft^2) at	100
Over 33 through 220 VA/m^2 Plus,	(~~3 through 20 VA~~ 2 through 15 VA /ft^2) at	75
Remainder over 220 VA/m^2	(~~20 VA~~ 15 VA /ft^2) at	25

Additional Proposed Changes

File Name	Description	Approved
NFPA_FPRF_REPORT-Branch-Circuit-Loading-Phase1-FINAL.pdf	Evaluation of Electrical Feeder and Branch Circuit Loading: Phase I Final Report by Tammy Gammon, Ph,D, P.E.	
NFPA_FPRF_REPORT-Branch-Circuit-Loading-Phase1-FINAL.pdf		

Statement of Problem and Substantiation for Public Input

The loading data gathered by the original University of Michigan workgroup that informed the exception in Table 220.12 in the 2014 NEC revealed that school power system capacity is being significantly overdesigned at least by 25-33%. This outcome catalyzed more investigation into the appropriate design guidelines for branch circuits and feeders.

A milestone in that advocacy priority resulted in a Fire Protection Research Foundation project that is linked on this landing page for Standards Michigan advocacy priorities, created to establish platform for more investigation into this concept and others during the 2020 NEC revision cycle:

http://standardsmichigan.com/nfpa-2020-concepts/

We hope that the results of this study -- also attached herewith -- enlightens the discussion of the technical committee.   Safety and economic benefits accrue for most occupancy classes governed by the NEC.

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Public Input No. 3445-NFPA 70-2017 [New Section after 220.103]

VI. Optional Calculation Methods for HVAC Equipment

220.104 Electric Chillers. Where reduced loads results from chiller units operating on duty-cycle, or intermittently, or from all chillers not operating at the same time, feeder demand may be calculated from historical maximum demand watt information recorded over at least a 24-month period for the same occupancy class identified in the energy code enforced by the Authority Having Jurisdiction

Additional Proposed Changes

File Name	Description	Approved
CSA-Groups-CEC-Section-8-Circuit-loading-and-demand-factors.1498472174465.pdf	Canadian Electrical Code Section 8 Circuit loading and demand factors	

Statement of Problem and Substantiation for Public Input

It is noteworthy that the occupancy classes that dominate the subject of electric load calculations of Chapter 2 are residential in nature. Not all, but most. Even Annex D, which contains 13 calculation examples, is pre-occupied with load calculations that apply to residential facility classes.

But a large part of the building industry that uses the NEC is obviously non-residential and needs guidance on what electrical designers need to do when mechanical engineers submit a load list that involves one or more electric chiller units supplied from the same service equipment. Without this, 100% demand diversity adds significant capacity that, in most installations, will never be used, will increase waste heat losses and increase flash hazard.

The attachment shows how the technical committees of the Canadian Electrical Code have attempted to resolve this problem. I have made a modification to the CEC approach; recognizing that ASHRAE energy standards prevail in most US jurisdictions.

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Public Input No. 3784-NFPA 70-2017 [Section No. 230.1]

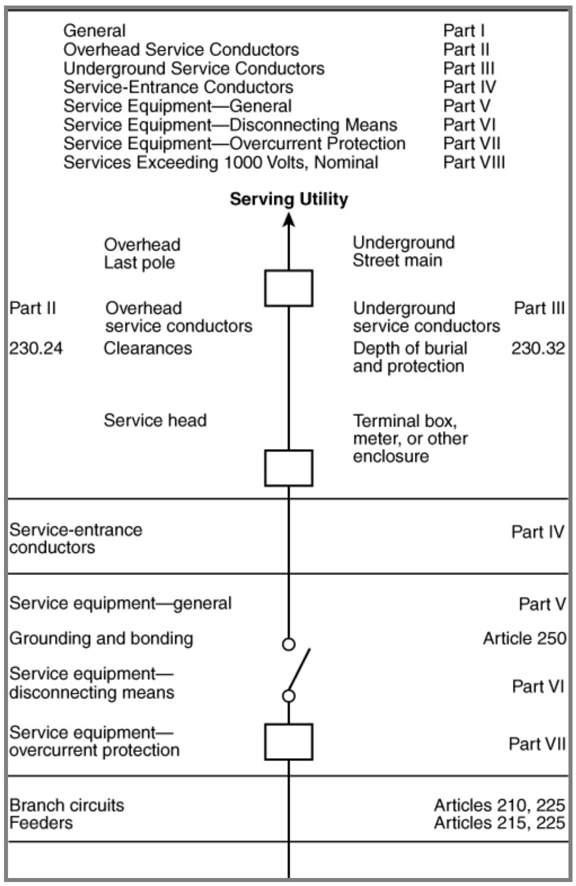
230.1 Scope.

This article covers service conductors and equipment for control and protection of services and their installation requirements.

Informational Note 1 : See Figure 230.1.

Informational Note 2: For information regarding power distribution apparatus, see 3001.5, IEEE Recommended Practice for the Application of Power Distribution Apparatus in Industrial and Commercial Power Systems

Figure 230.1 Services.



Statement of Problem and Substantiation for Public Input

The stronger the linkage between the NFPA and IEEE on electrical power technology the better. This document is one of several that replaces content in ANSI/IEEE 241 Recommended Practice for Electric Power Systems in Commercial Buildings -- the so-called “Gray Book”; and the ANSI/IEEE 141 Recommended Practice for Power Distribution for Industrial Plants -- the so-called “Red Book”; both of which are now being sunsetted and superseded by 3007.3. Another, related title is now under development -- IEEE 3001.2 Recommended Practice for Evaluating the Electrical Service Requirements of Industrial and Commercial Power Systems -- that will also be applicable to the content of Article 230.

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Public Input No. 3217-NFPA 70-2017 [Section No. 230.70 [Excluding any Sub-Sections]]

Means shall be provided to disconnect all conductors in a building or other structure from the service-entrance conductors.

Informational Note: For information regarding metering, see IEEE 3001.8 Recommended Practice for the Instrumentation and Metering of Industrial and Commercial Power Systems

Statement of Problem and Substantiation for Public Input

The stronger the linkage between the NFPA and IEEE on electrical power technology the better.

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Details about this document is available at the link below:

http://ieeexplore.ieee.org/document/6493364/

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Public Input No. 4269-NFPA 70-2017 [New Section after 230.200]

230.201 Service or Feeder Load

As an alternative to the feeder and service load calculations required by Parts III and IV of Article 220, alternative service load calculations that are based upon historical demand information shall be permitted to be performed by a registered professional engineer or an individual under their supervision.

Additional Proposed Changes

File Name	Description	Approved
NFPA_FPRF_REPORT-Branch-Circuit-Loading-Phase1-FINAL.pdf	NFPA_FPRF_REPORT-Branch-Circuit-Loading-Phase1-FINAL	

Statement of Problem and Substantiation for Public Input

This is a continuation of a series of proposals presented to several committees over the past several revision cycles intended to close the gap between design capacity and observed demand in a significant majority of buildings in educational campuses. Educational campuses, especially the large research university campuses, have a broad range of building types and are essentially "cities within cities" and the perfect study unit for cities of the future.

Since the last revision of the NEC, the University of Michigan catalyzed the funding and completion of an NFPA Fire Protection Research Foundation project to investigate the widely observed oversizing of electrical services for a broad class of occupancy types. Much of the work was coordinated the IEEE Education & Healthcare Facilities Committee, several universities and the Michigan affiliate of an education industry trade association. Phase I of the project is attached herewith and a dedicated landing page related to this and other proposals has been set up:

http://standardsmichigan.com/nfpa-2020-concepts/

We would like to see open-ended engineering methods permitted to "right-size" medium voltage services. This language permits a reconciliation of the competing objectives of fire safety, flash hazard reduction, material and energy conservation and anticipates the outcome of a Phase II research project..

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Public Input No. 4267-NFPA 70-2017 [Section No. 230.200]

230.200 General.

Service conductors and equipment used on circuits exceeding 1000 volts, nominal, shall comply with all the applicable provisions of the preceding sections of this article and with the following sections that supplement or modify the preceding sections. In no case shall the provisions of Part VIII apply to equipment on the supply side of the service point.

Informational Note: For clearances of conductors of over 1000 volts, nominal, see ANSI/IEEE C2-~~2012~~ 2017 , *National Electrical Safety Code*.

Statement of Problem and Substantiation for Public Input

The latest revision of the NESC is dated 2017. For more information:

http://www.techstreet.com/ieee/standards/ieee-c2-2017?product_id=1914980#jumps

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Public Input No. 3215-NFPA 70-2017 [Section No. 250.1]

250.1 Scope.

This article covers general requirements for grounding and bonding of electrical installations, and the specific requirements in (1) through (6).

(1) Systems, circuits, and equipment required, permitted, or not permitted to be grounded

(2) Circuit conductor to be grounded on grounded systems

(3) Location of grounding connections

(4) Types and sizes of grounding and bonding conductors and electrodes

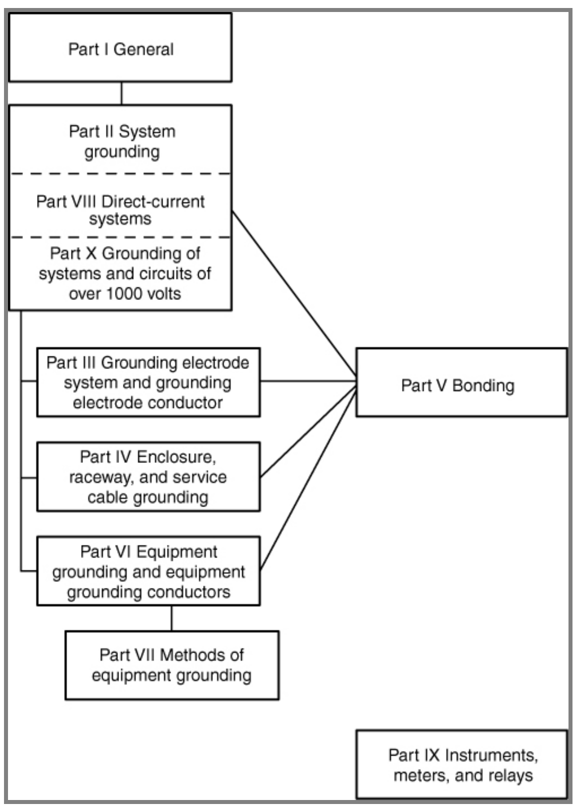
(5) Methods of grounding and bonding

(6) Conditions under which guards, isolation, or insulation may be substituted for grounding

Informational Note: See Figure 250.1 for information on the organization of Article 250 covering grounding and bonding requirements.

<u>Informational Note 2: For information regarding grounding and bonding see IEEE 3003.2 Recommended Practice for Equipment Grounding and Bonding in Industrial and Commercial Power Systems</u>

Figure 250.1 Grounding and Bonding.



Statement of Problem and Substantiation for Public Input

The stronger the linkage between the NFPA and IEEE on electrical power technology the better. This reference simply replaces the Green Book (ANSI/IEEE 142) which appeared as a Fine Print Note in other parts of this article in previous revisions of the NEC .

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Public Input No. 3430-NFPA 70-2017 [Section No. 250.36 [Excluding any Sub-Sections]]

High-impedance grounded neutral systems in which a grounding impedance, usually a resistor, limits the ground-fault current to a low value shall be permitted for 3-phase ac systems of 480 volts to 1000 volts if all the following conditions are met:

(1) The conditions of maintenance and supervision ensure that only qualified persons service the installation.

(2) Ground detectors are installed on the system.

(3) Line-to-neutral loads are not served.

High-impedance grounded neutral systems shall comply with the provisions of 250.36(A) through (G).

Informational Note 1 System grounding through an impedance that is now permitted in Section 250.36 will yield an early warning signal that a power delivery component is about to fail and thereby reduce the frequency of use of the second source. The impedance grounded system will, in most cases, permit the system to deliver power until a scheduled outage thereby reducing risk to occupants. Impedance grounded systems also reduce incident energy exposure by dramatically by diverting fault current through a resistor. With incident energy reduced, maintenance may be undertaken more safely reducing the risk of more forced outages. System reliability is an essential characteristic of a power system.

Informational Note 2: For more information, see IEEE 3003.2 Recommended Practice for Equipment Grounding and Bonding in Industrial and Commercial Power Systems

Statement of Problem and Substantiation for Public Input

This proposal is another in a series to raise the visibility of system reliability as an essential characteristic and to convey information about how short circuit, incident energy, system grounding methods and reliability are all related. This proposal responds to the recommendation made by CMP-1 during the 2017 revision cycle.

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Public Input No. 3252-NFPA 70-2017 [Section No. 368.240]

368.240 Wiring 1000 Volts or Less, Nominal.

Secondary control devices and wiring that are provided as part of the metal-enclosed bus run shall be insulated by fire-retardant barriers from all primary circuit elements with the exception of short lengths of wire, such as at instrument transformer terminals.

Informational Note: For information regarding instrument transformers, see IEEE 3004.1 Recommended Practice for the Application of Instrument Transformers in Industrial and Commercial Power Systems

Statement of Problem and Substantiation for Public Input

The stronger the linkage between the NFPA and IEEE on electrical power technology the better. This document is one of several that replaces content in IEEE 142 -- the so-called "Red Book", which is now being sunsetted and superseded by 3004.1.

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This method of development, of capturing and quickly conveying leading practice from transactions among academic experts and practitioners into our industry, supports the NFPA International mission of eliminating death, injury, property and economic loss due to fire, electrical and related hazards. My own experience with other international electrical standard developers suggests that closer coupling of the fire and electrical safety community in the US would be welcomed.

Details about this document is available at the link below:

https://standards.ieee.org/findstds/standard/3004.1-2013.html

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Public Input No. 3219-NFPA 70-2017 [Section No. 430.26]

430.26 Feeder Demand Factor.

Where reduced heating of the conductors results from motors operating on duty-cycle, intermittently, or from all motors not operating at one time, the authority having jurisdiction may grant permission for feeder conductors to have an ampacity less than specified in 430.24, provided the conductors have sufficient ampacity for the maximum load determined in accordance with the sizes and number of motors supplied and the character of their loads and duties.

Informational Note: Demand factors determined in the design of new facilities can often be validated against actual historical experience from similar installations. ~~Refer to ANSI/IEEE Std. 141,~~ ~~*IEEE Recommended Practice for Electric Power Distribution for Industrial Plants,*~~ ~~and ANSI/IEEE Std. 241,~~ ~~*Recommended Practice for Electric Power Systems in Commercial Buildings,*~~ ~~for information on the calculation of loads and demand factor.~~ For more information, see IEEE 3004.8 Recommended Practice for Motor Protection in Industrial and Commercial Power Systems

Statement of Problem and Substantiation for Public Input

The stronger the linkage between the NFPA and IEEE on electrical power technology the better. This document replaces the previous reference to IEEE 142, which is now sunsetted and superceded by 3004.8.

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Details about this document is available at the link below:

https://standards.ieee.org/findstds/standard/3004.8-2016.html

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Public Input No. 3251-NFPA 70-2017 [Section No. 490.1]

490.1 Scope.

This article covers the general requirements for equipment operating at more than 1000 volts, nominal.

Informational Note No. 1: See *NFPA 70E*-2015, *Standard for Electrical Safety in the Workplace*, for electrical safety requirements for employee workplaces.

Informational Note No. 2: For further information on hazard signs and labels, see ANSI Z535.4-2011, *Product Signs and Safety Labels*.

Informational Note 3: For information regarding power distribution apparatus, see 3001.5, IEEE Recommended Practice for the Application of Power Distribution Apparatus in Industrial and Commercial Power Systems

Statement of Problem and Substantiation for Public Input

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Details about this document is available at the link below:

https://standards.ieee.org/findstds/standard/3001.5-2013.html

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Public Input No. 4334-NFPA 70-2017 [Section No. 517.2]

517.2 Definitions.

Alternate Power Source.

One or more generator sets, or battery systems where permitted, intended to provide power during the interruption of the normal electrical service; or the public utility electrical service intended to provide power during interruption of service normally provided by the generating facilities on the premises. [**99:** 3.3.4]

Ambulatory Health Care Occupancy.

An occupancy used to provide services or treatment simultaneously to four or more patients that provides, on an outpatient basis, one or more of the following:

(1) Treatment for patients that renders the patients incapable of taking action for self-preservation under emergency conditions without assistance of others.

(2) Anesthesia that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others.

(3) Emergency or urgent care for patients who, due to the nature of their injury or illness, are incapable of taking action for self-preservation under emergency conditions without the assistance of others. [***101:*** 3.3.188.1]

Anesthetizing Location.

Any area of a facility that has been designated to be used for the administration of any flammable or nonflammable inhalation anesthetic agent in the course of examination or treatment, including the use of such agents for relative analgesia.

Battery-Powered Lighting Units.

Individual unit equipment for backup illumination consisting of the following:

(1) Rechargeable battery

(2) Battery-charging means

(3) Provisions for one or more lamps mounted on the equipment, or with terminals for remote lamps, or both

(4) Relaying device arranged to energize the lamps automatically upon failure of the supply to the unit equipment

Critical Branch.

A system of feeders and branch circuits supplying power for task illumination, fixed equipment, select receptacles, and select power circuits serving areas and functions related to patient care that are automatically connected to alternate power sources by one or more transfer switches during interruption of normal power source. [**99:** 3.3.27]

Demonstrated Load.

Historical maximum demand watt information recorded over at least a 24-month period for the same type of facility as the one in question, equated in watts per square foot (watts per meter)

Electrical Life-Support Equipment.

Electrically powered equipment whose continuous operation is necessary to maintain a patient’s life. [**99:** 3.3.39]

Equipment Branch.

A system of feeders and branch circuits arranged for delayed, automatic, or manual connection to the alternate power source and that serves primarily 3-phase power equipment. [**99:** 3.3.43].

Essential Electrical System.

A system comprised of alternate sources of power and all connected distribution systems and ancillary equipment, designed to ensure continuity of electrical power to designated areas and functions of a health care facility during disruption of normal power sources, and also to minimize disruption within the internal wiring system. [**99:** 3.3.45]

Exposed Conductive Surfaces.

Those surfaces that are capable of carrying electric current and that are unprotected, uninsulated, unenclosed, or unguarded, permitting personal contact. [**99:** 3.3.47]

> Informational Note: Paint, anodizing, and similar coatings are not considered suitable insulation, unless they are listed for such use.

Fault Hazard Current.

See *Hazard Current* .

Flammable Anesthetics.

Gases or vapors, such as fluroxene, cyclopropane, divinyl ether, ethyl chloride, ethyl ether, and ethylene, which may form flammable or explosive mixtures with air, oxygen, or reducing gases such as nitrous oxide.

Flammable Anesthetizing Location.

Any area of the facility that has been designated to be used for the administration of any flammable inhalation anesthetic agents in the normal course of examination or treatment.

Governing Body.

The person or persons who have the overall legal responsibility for the operation of a health care facility. [**99:** 3.3.62]

Hazard Current.

For a given set of connections in an isolated power system, the total current that would flow through a low impedance if it were connected between either isolated conductor and ground.

Fault Hazard Current.

The hazard current of a given isolated system with all devices connected except the line isolation monitor.

Monitor Hazard Current.

The hazard current of the line isolation monitor alone.

Total Hazard Current.

The hazard current of a given isolated system with all devices, including the line isolation monitor, connected.

Health Care Facilities.

Buildings, portions of buildings, or mobile enclosures in which human medical, dental, psychiatric, nursing, obstetrical, or surgical care are provided. [**99:** 3.3.67]

> Informational Note: Examples of health care facilities include, but are not limited to, hospitals, nursing homes, limited care facilities, clinics, medical and dental offices, and ambulatory care centers, whether permanent or movable.

Hospital.

A building or portion thereof used on a 24-hour basis for the medical, psychiatric, obstetrical, or surgical care of four or more inpatients. [***101:*** 3.3.142]

Isolated Power System.

A system comprising an isolating transformer or its equivalent, a line isolation monitor, and its ungrounded circuit conductors. [**99:** 3.3.83]

Isolation Transformer.

A transformer of the multiple-winding type, with the primary and secondary windings physically separated, that inductively couples its ungrounded secondary winding(s) to the grounded feeder system that energizes its primary winding(s). [**99:** 3.3.84]

Invasive Procedure.

Any procedure that penetrates the protective surfaces of a patient's body (i.e., skin, mucous membrane, cornea) and that is performed with an aseptic field (procedural site). Not included in this category are placement of peripheral intravenous needles or catheters used to administer fluids and/or medications, gastrointestinal endoscopies (i.e., sigmoidoscopies), insertion of urethral catheters, and other similar procedures. [**99:** 3.3.81]

Life Safety Branch.

A system of feeders and branch circuits supplying power for lighting, receptacles, and equipment essential for life safety that is automatically connected to alternate power sources by one or more transfer switches during interruption of the normal power source. [**99:** 3.3.87]

Limited Care Facility.

A building or portion thereof used on a 24-hour basis for the housing of four or more persons who are incapable of self-preservation because of age; physical limitation due to accident or illness; or limitations such as mental retardation/developmental disability, mental illness, or chemical dependency.

Line Isolation Monitor.

A test instrument designed to continually check the balanced and unbalanced impedance from each line of an isolated circuit to ground and equipped with a built-in test circuit to exercise the alarm without adding to the leakage current hazard. [**99:** 3.3.89]

Medical Office (Dental Office).

A building or part thereof in which the following occur: (1) examinations and minor treatments or procedures are performed under the continuous supervision of a medical or dental professional; (2) only sedation or local anesthesia is involved and treatment or procedures do not render the patient incapable of self-preservation under emergency conditions; and (3) overnight stays for patients or 24-hour operation are not provided. [**99:** 3.3.98]

Monitor Hazard Current.

See *Hazard Current* .

Nurses' Stations.

Areas intended to provide a center of nursing activity for a group of nurses serving bed patients, where the patient calls are received, nurses are dispatched, nurses' notes written, inpatient charts prepared, and medications prepared for distribution to patients. Where such activities are carried on in more than one location within a nursing unit, all such separate areas are considered a part of the nurses' station.

Nursing Home.

A building or portion of a building used on a 24-hour basis for the housing and nursing care of four or more persons who, because of mental or physical incapacity, might be unable to provide for their own needs and safety without the assistance of another person. [***101:*** 3.3.142.2]

Patient Bed Location.

The location of a patient sleeping bed, or the bed or procedure table of a critical care space. [**99:** 3.3.125]

Patient Care Space.

Any space of a health care facility wherein patients are intended to be examined or treated. [**99:** 3.3.127]

Informational Note No. 1: The governing body of the facility designates patient care space in accordance with the type of patient care anticipated. [**99:** 1.3.4.1]

Informational Note No. 2: Business offices, corridors, lounges, day rooms, dining rooms, or similar areas typically are not classified as patient care spaces. [**99:** A.3.3.127]

Basic Care (Category 3) Space.

Space in which failure of equipment or a system is not likely to cause injury to the patients, staff, or visitors but can cause patient discomfort. [**99:** 3.3.127.3]

Informational Note: [Category 3] spaces, formerly known as basic care rooms [(spaces)], are typically where basic medical or dental care, treatment, or examinations are performed. Examples include, but are not limited to, examination or treatment rooms in clinics, medical and dental offices, nursing homes, and limited care facilities. [**99:** A.3.3.127.3]

General Care (Category 2) Space.

Space in which failure of equipment or a system is likely to cause minor injury to patients, staff, or visitors. [**99:** 3.3.127.2]

Informational Note: [Category 2] spaces were formerly known as general care rooms [(spaces)]. Examples include, but are not limited to, inpatient bedrooms, dialysis rooms, in vitro fertilization rooms, procedural rooms, and similar rooms. [**99:** A.3.3.127.2]

Critical Care (Category 1) Space.

Space in which failure of equipment or a system is likely to cause major injury or death of patients, staff, or visitors. [**99:** 3.3.127.1]

Informational Note: [Category 1] spaces, formerly known as critical care rooms [(spaces)], are typically where patients are intended to be subjected to invasive procedures and connected to line-operated, patient care–related appliances. Examples include, but are not limited to, special care patient rooms used for critical care, intensive care, and special care treatment rooms such as angiography laboratories, cardiac catheterization laboratories, delivery rooms, operating rooms, post-anesthesia care units, trauma rooms, and other similar rooms. [**99:** A.3.3.127.1]

Support (Category 4) Space.

Space in which failure of equipment or a system is not likely to have a physical impact on patient care. [**99:** 3.3.127.4]

Informational Note: [Category 4] spaces were formerly known as support rooms [(spaces)]. Examples of support spaces include, but are not limited to, anesthesia work rooms, sterile supply, laboratories, morgues, waiting rooms, utility rooms, and lounges. [**99:** A.3.3.127.4]

Patient Care Vicinity.

A space, within a location intended for the examination and treatment of patients, extending 1.8 m (6 ft) beyond the normal location of the patient bed, chair, table, treadmill, or other device that supports the patient during examination and treatment and extending vertically to 2.3 m (7 ft 6 in.) above the floor. [**99:** 3.3.128]

Patient Equipment Grounding Point.

A jack or terminal that serves as the collection point for redundant grounding of electrical appliances serving a patient care vicinity or for grounding other items in order to eliminate electromagnetic interference problems. [**99:** 3.3.129]

Psychiatric Hospital.

A building used exclusively for the psychiatric care, on a 24-hour basis, of four or more inpatients.

Reference Grounding Point.

The ground bus of the panelboard or isolated power system panel supplying the patient care room. [**99:** 3.3.143]

Relative Analgesia.

A state of sedation and partial block of pain perception produced in a patient by the inhalation of concentrations of nitrous oxide insufficient to produce loss of consciousness (conscious sedation).

Selected Receptacles.

A minimum number of receptacles selected by the governing body of a facility as necessary to provide essential patient care and facility services during loss of normal power. [**99:** 3.3.148]

Task Illumination.

Provisions for the minimum lighting required to carry out necessary tasks in the described areas, including safe access to supplies and equipment and access to exits. [**99:** 63.3.161]

Total Hazard Current.

The hazard current of a given isolated system with all devices, including the line isolation monitor, connected. [**99:** 3.3.66.3]

Wet Procedure Location.

The area in a patient care space where a procedure is performed that is normally subject to wet conditions while patients are present, including standing fluids on the floor or drenching of the work area, either of which condition is intimate to the patient or staff. [**99:** 3.3.171]

> Informational Note: Routine housekeeping procedures and incidental spillage of liquids do not define a wet procedure location. [**99:** A.3.3.171]

X-Ray Installations, Long-Time Rating.

A rating based on an operating interval of 5 minutes or longer.

X-Ray Installations, Mobile.

X-ray equipment mounted on a permanent base with wheels, casters, or a combination of both to facilitate moving the equipment while completely assembled.

X-Ray Installations, Momentary Rating.

A rating based on an operating interval that does not exceed 5 seconds.

X-Ray Installations, Portable.

X-ray equipment designed to be hand carried.

X-Ray Installations, Transportable.

X-ray equipment to be conveyed by a vehicle or that is readily disassembled for transport by a vehicle.

Additional Proposed Changes

File Name	Description	Approved
CSA-Groups-CEC-Section-8-Circuit-loading-and-demand-factors_2_.pdf	CSA Group CEC Section 8 Circuit loading and demand factors.	

Statement of Problem and Substantiation for Public Input

This proposed definition pairs with a design concept proposed later in this Article -- Section 517,11. It has been taken from the CSA Group (Canadian Electrical Code) and is attached herewith.

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Public Input No. 4331-NFPA 70-2017 [Section No. 517.11]

517.11 General Installation — Construction Criteria.

The purpose of this article is to specify the installation criteria and wiring methods that minimize electrical hazards by the maintenance of adequately low potential differences only between exposed conductive surfaces that are likely to become energized and could be contacted by a patient.

> Informational Note 1 : In a health care facility, it is difficult to prevent the occurrence of a conductive or capacitive path from the patient's body to some grounded object, because that path may be established accidentally or through instrumentation directly connected to the patient. Other electrically conductive surfaces that may make an additional contact with the patient, or instruments that may be connected to the patient, then become possible sources of electric currents that can traverse the patient's body. The hazard is increased as more apparatus is associated with the patient, and, therefore, more intensive precautions are needed. Control of electric shock hazard requires the limitation of electric current that might flow in an electrical circuit involving the patient's body by raising the resistance of the conductive circuit that includes the patient, or by insulating exposed surfaces that might become energized, in addition to reducing the potential difference that can appear between exposed conductive surfaces in the patient care vicinity, or by combinations of these methods. A special problem is presented by the patient with an externalized direct conductive path to the heart muscle. The patient may be electrocuted at current levels so low that additional protection in the design of appliances, insulation of the catheter, and control of medical practice is required.

> Informational Note 2: Service, feeder and branch circuit load calculations for health care facilities shall be permitted to be based upon demonstrated loads, provided that such calculations are performed by a qualified person, as determined by the Authority Having Jurisdiction.

Additional Proposed Changes

File Name	Description	Approved
CSA-Groups-CEC-Section-8-Circuit-loading-and-demand-factors_2_.pdf	CSA Group Section 8 Circuit loading and demand factors (Canadian Electrical Code)	

Statement of Problem and Substantiation for Public Input

This proposal pairs with the proposal for a new term -- "Demonstrated Load" -- which takes its inspiration from the Canadian Electrical Code. The intent is to "rightsize" the health care facilities power chain by giving design experts more freedom than presently allowed i Chapter 2. A cut from the Canadian Electrical Code is attached herewith.

Please note that a web page has been set up to make it easier for technical committee members to access a recent NFPA Fire Protection Research Foundation project crafted to scope a data gathering effort that would help the health care facilities industry in the US and abroad rightsize the power chain.

http://standardsmichigan.com/nfpa-2020-concepts/

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Public Input No. 3181-NFPA 70-2017 [Section No. 700.1]

700.1 Scope.

This article applies to the electrical safety of the installation, operation, and maintenance of emergency systems consisting of circuits and equipment intended to supply, distribute, and control electricity for illumination, power, or both, to required facilities when the normal electrical supply or system is interrupted.

Informational Note No. 1: For further information regarding wiring and installation of emergency systems in health care facilities, see Article 517.

Informational Note No. 2: For further information regarding performance and maintenance of emergency systems in health care facilities, see NFPA 99-2015, *Health Care Facilities Code*.

Informational Note No. 3: For specification of locations where emergency lighting is considered essential to life safety, see NFPA *101*-2015, *Life Safety Code*.

Informational Note No. 4: For further information regarding performance of emergency and standby power systems, see NFPA 110-2013, *Standard for Emergency and Standby Power Systems*.

Informational Note No. 5: For further information regarding the reliability of emergency and standby power systems, see IEEE 3006.7, Recommended Practice for Determining the Reliability of 7x24 Continuous Power Systems in Industrial and Commercial Facilities

Statement of Problem and Substantiation for Public Input

.This is the authoritative document for all of the systems covered in Articles 700 through 708 and should be the foundation for designing, constructing, inspecting and maintaining these power systems.

IEEE 3000 Standards Collection™ is the trademarked name of the family of industrial and commercial power systems standards formerly known as IEEE Color Books. The IEEE 3000 Standards Collection overall includes the same content as the Color Books that have been referenced into previous editions of the NEC but is now organized into approximately 70 IEEE “dot” standards that cover specific technical topics. This method of development, of capturing leading practice from transactions among academic and practitioners supports the NFPA International mission of eliminating death, injury, property and economic loss due to fire, electrical and related hazards.

More complete information is available from IEEE at the link below:

https://standards.ieee.org/findstds/standard/3006.7-2013.html

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Public Input No. 4067-NFPA 70-2017 [Section No. 700.4(A)]

(A) Capacity and Rating.

An emergency system shall have adequate capacity and rating ~~for all loads to be operated simultaneously~~ to meet the requirements of peak emergency demand . The emergency system equipment shall be suitable for the maximum available fault current at its terminals.

Statement of Problem and Substantiation for Public Input

We need to make sure we do not oversize our generators. Rarely do all loads in a building need emergency power and there is ample anecdotal evidence (from the run-time hours of de-commissioned generators and direct measurement) that emergency generators are being oversized. Replacement of word "simultaneously" will signal to designers and manufacturers that the NEC recognizes "right-sized" emergency power chains.

Energy codes and innovation are driving down the load presented by emergency lighting systems, for example. We have a great deal of actual measurements at the University of Michigan and other universities that emergency load across many facility classes is 2/3rds less than originally conceived in design.

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Public Input No. 4087-NFPA 70-2017 [Section No. 700.12 [Excluding any Sub-Sections]]

Current supply shall be such that, in the event of failure of the normal supply to, or within, the building or group of buildings concerned, emergency lighting, emergency power, or both shall be available within the time required for the application but not to exceed 10 seconds. The supply system for emergency purposes, in addition to the normal services to the building and meeting the general requirements of this section, shall be one or more of the types of systems described in 700.12(A) through (E). Unit equipment in accordance with 700.12(F) shall satisfy the applicable requirements of this article.

In selecting an emergency source of power, consideration shall be given to the occupancy and the type of service to be rendered, whether of minimum duration, as for evacuation of a theater, or longer duration, as for supplying emergency power and lighting due to an indefinite period of current failure from trouble either inside or outside the building.

Equipment shall be designed and located so as to minimize the hazards that might cause complete failure due to flooding, fires, icing, and vandalism.

Equipment for sources of power as described in 700.12(A) through (E) shall be installed either in spaces fully protected by approved automatic fire suppression systems (sprinklers, carbon dioxide systems, and so forth) or in spaces with a 1-hour fire rating where located within the following:

(1) Assembly occupancies for more than 1000 persons

(2) Buildings above 23 m (75 ft) in height with any of the following occupancy classes — assembly, educational, residential, detention and correctional, business, and mercantile

(3) Health care occupancies where persons are not capable of self-preservation

(4) Educational occupancies with more than 300 occupants

Informational Note No. 1: For the definition of *Occupancy Classification*, see Section 6.1 of NFPA *101*-2015, *Life Safety Code*.

Informational Note No. 2: For ~~further~~ information ~~, see ANSI/IEEE 493-2007,~~ regarding power system reliability see IEEE 3006.5 Recommended Practice for the ~~Design of Reliable~~ Use of Probability Methods for Conducting a Reliability Analysis of Industrial and Commercial Power Systems ~~.~~

Statement of Problem and Substantiation for Public Input

The stronger the linkage between the NFPA and IEEE on electrical power technology the better. This document is one of several that replaces content in IEEE 493 Design of Reliable Industrial and Commercial Power Systems -- the so-called "Gold Book", which is now being sunsetted and superseded by 3006.5.

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This method of development, of capturing and quickly conveying leading practice from transactions among academic experts and practitioners into our industry, supports the NFPA International mission of eliminating death, injury, property and economic loss due to fire, electrical and related hazards. My own experience with other international electrical standard developers suggests that closer coupling of the fire and electrical safety community in the US would be welcomed.

Details about this document is available at the link below:

https://standards.ieee.org/findstds/standard/3006.5-2014.html

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Public Input No. 4094-NFPA 70-2017 [Section No. 700.12 [Excluding any Sub-Sections]]

Current supply shall be such that, in the event of failure of the normal supply to, or within, the building or group of buildings concerned, emergency lighting, emergency power, or both shall be available within the time required for the application but not to exceed 10 seconds. The supply system for emergency purposes, in addition to the normal services to the building and meeting the general requirements of this section, shall be one or more of the types of systems described in 700.12(A) through (E). Unit equipment in accordance with 700.12(F) shall satisfy the applicable requirements of this article.

In selecting an emergency source of power, consideration shall be given to the occupancy and the type of service to be rendered, whether of minimum duration, as for evacuation of a theater, or longer duration, as for supplying emergency power and lighting due to an indefinite period of current failure from trouble either inside or outside the building.

Equipment shall be designed and located so as to minimize the hazards that might cause complete failure due to flooding, fires, icing, and vandalism.

Equipment for sources of power as described in 700.12(A) through (E) shall be installed either in spaces fully protected by approved automatic fire suppression systems (sprinklers, carbon dioxide systems, and so forth) or in spaces with a 1-hour fire rating where located within the following:

(1) Assembly occupancies for more than 1000 persons

(2) Buildings above 23 m (75 ft) in height with any of the following occupancy classes — assembly, educational, residential, detention and correctional, business, and mercantile

(3) Health care occupancies where persons are not capable of self-preservation

(4) Educational occupancies with more than 300 occupants

Informational Note No. 1: For the definition of *Occupancy Classification*, see Section 6.1 of NFPA *101*-2015, *Life Safety Code*.

Informational Note No. 2: For further information, see ANSI/IEEE 493-2007, *Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems*.

Informational Note No. 3: See NFPA 110 Standard for Emergency and Standby Power Systems for information about additional energy sources that may be used for emergency power.

Statement of Problem and Substantiation for Public Input

According to a long-standing provision in NFPA 110, Section 5.1 permits the use of a public utility for an emergency power system. For the convenience of the committee, reproduced below is the relevant section of NFPA 110:

...."5.1.3* A public electric utility that has a demonstrated reliability shall be permitted to be used as the EPS where the primary source is by means of on-site energy conversion."...

This possibility makes safe and economical sense for large multi-building campuses with their own district energy system that provides power reliable enough for the AHJ to identify it as the primary source. Therefore the utility on the periphery, contingent upon availability of supply circuits and local tariffs, may provide emergency power. The safety and economic advantages of this are substantial because it can reduce the number of on-site generators on the periphery of the campus with district energy power. It also reduces carbon footprint; a high priority in the education industry sustainability agenda.

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Public Input No. 3412-NFPA 70-2017 [Section No. 708.20(A)]

(A) General Requirements.

Current supply shall be such that, in the event of failure of the normal supply to the DCOA, critical operations power shall be available within the time required for the application. The supply system for critical operations power, in addition to the normal services to the building and meeting the general requirements of this section, shall be one or more of the types of systems described in 708.20(E) through (H).

Informational Note 1 : Assignment of degree of reliability of the recognized critical operations power system depends on the careful evaluation in accordance with the risk assessment.

Informational Note 2: For guidance about determining degree of reliability see IEEE 3006.5 Recommended Practice for the Use of Probability Methods for Conducting a Reliability Analysis of Industrial and Commercial Power Systems

Statement of Problem and Substantiation for Public Input

The stronger the linkage between the NFPA and IEEE on electrical power technology the better. This document is one of several that replaces content in IEEE 493 Design of Reliable Industrial and Commercial Power Systems -- the so-called "Gold Book", which is now being sunsetted and superseded by 3006.5.

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This method of development, of capturing and quickly conveying leading practice from transactions among academic experts and practitioners into our industry, supports the NFPA International mission of eliminating death, injury, property and economic loss due to fire, electrical and related hazards. My own experience with other international electrical standard developers suggests that closer coupling of the fire and electrical safety community in the US would be welcomed.

Details about this document is available at the link below:

https://standards.ieee.org/findstds/standard/3006.5-2014.html

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Public Input No. 3888-NFPA 70-2017 [Definition: Example D3 Store Building]

Example D3 Store, Mercantile or Business Building

A store, mercantile or business building, 50 ft by 60 ft, or 3000 ft^2, has 30 ft of show window. There are a total of 80 duplex receptacles. The service is 120/240 V, single phase 3-wire service. Actual connected lighting load is 8500 VA.

Calculated Load

(see 220.40)

Noncontinuous Loads	-	
Receptacle Load *(see 220.44)*	-	
80 receptacles at 180 VA		14,400 VA
10,000 VA at 100%		10,000 VA
14,400 VA - 10,000 VA = 4400 at 50%		2,200 VA
	Subtotal	12,200 VA
Continuous Loads		-
General Lighting*		-
3000 ft^2 at 3 VA/ft^2		9,000 VA
Show Window Lighting Load		-
30 ft at 200 VA/ft *[see 220.14(G)]*		6,000 VA
Outside Sign Circuit *[see 220.14(F)]*		1,200 VA
	Subtotal	16,200 VA
	Subtotal from noncontinuous	12,200 VA
	Total noncontinuous loads + continuous loads =	28,400 VA

*In the example, the actual connected lighting load (8500 VA) is less than the load from Table 220.12, so the minimum lighting load from Table 220.12 is used in the calculation. Had the actual lighting load been greater than the value calculated from Table 220.12, the actual connected lighting load would have been used.

Minimum Number of Branch Circuits Required

General Lighting: Branch circuits need only be installed to supply the actual connected load *[see 210.11(B)].*

8500 VA × 1.25 = 10,625 VA

10,625 VA ÷ 240 V = 44 A for 3-wire, 120/240 V

The lighting load would be permitted to be served by 2-wire or 3-wire, 15- or 20-A circuits with combined capacity equal to 44 A or greater for 3-wire circuits or 88 A or greater for 2-wire circuits. The feeder capacity as well as the number of branch-circuit positions available for lighting circuits in the panelboard must reflect the full calculated load of 9000 VA × 1.25 = 11,250 VA.

Show Window

6000 VA × 1.25 = 7500 VA

7500 VA ÷ 240 V = 31 A for 3-wire, 120/240 V

The show window lighting is permitted to be served by 2-wire or 3-wire circuits with a capacity equal to 31 A or greater for 3-wire circuits or 62 A or greater for 2-wire circuits.

Receptacles required by 210.62 are assumed to be included in the receptacle load above if these receptacles do not supply the show window lighting load.

Receptacles

Receptacle Load: 14,400 VA ÷ 240 V = 60 A for 3-wire, 120/240 V

The receptacle load would be permitted to be served by 2-wire or 3-wire circuits with a capacity equal to 60 A or greater for 3-wire circuits or 120 A or greater for 2-wire circuits.

Minimum Size Feeder (or Service) Overcurrent Protection

(see 215.3 or 230.90)

Subtotal noncontinuous loads		12,200 VA
Subtotal continuous load at 125% (16,200 VA × 1.25)		20,250 VA
	Total	32,450 VA

32,450 VA ÷ 240 V = 135 A

The next higher standard size is 150 A *(see 240.6).*

Minimum Size Feeders (or Service Conductors) Required

[see 215.2, 230.42(A)]

For 120/240 V, 3-wire system,

32,450 VA ÷ 240 V = 135 A

Service or feeder conductor is 1/0 Cu in accordance with 215.3 and Table 310.15(B)(16) (with 75°C terminations).

Statement of Problem and Substantiation for Public Input

The committee may want to revisit the word "store" in the title of this example. For the benefit of the committee here is a list of occupancies that appear in the 2012 International Building Code that seem to align with what is intuitively understood as a store building:

BUSINESS GROUP B 304.1 Business Group B. Business Group B occupancy includes, among others, the use of a building or structure, or a portion thereof, for office, professional or service-type transactions, including storage of records and accounts. Business occupancies shall include, but not be limited to, the following: Airport traffic control towers Ambulatory care facilities Animal hospitals, kennels and pounds Banks Barber and beauty shops Car wash Civic administration Clinic, outpatient Dry cleaning and laundries: pick-up and delivery stations and self-service Educational occupancies for students above the 12th grade Electronic data processing Laboratories: testing and research Motor vehicle showrooms, Post offices Print shops Professional services (architects, attorneys, dentists, physicians, engineers, etc.) Radio and television stations Telephone exchanges Training and skill development not within a school or academic program

SECTION 309 MERCANTILE GROUP M 309.1 Mercantile Group M. Mercantile Group M occupancy includes, among others, the use of a building or structure or a portion thereof, for the display and sale of merchandise and involves stocks of goods, wares or merchandise incidental to such purposes and accessible to the public. Mercantile occupancies shall include, but not be limited to, the following: Department stores Drug stores Markets Motor fuel-dispensing facilities Retail or wholesale stores Sales rooms

Anywhere it is possible to harmonize the NEC with the dominant building code in the US, the opportunity should be taken -- especially the "easy shots" like this. Note that this proposal is a modification of the public input from the 2017 revision cycle.

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Public Input No. 3407-NFPA 70-2017 [Annex F [Excluding any Sub-Sections]]

This informative annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

Informational Note: For information regarding power system reliability see IEEE 3006.5 Recommended Practice for the Use of Probability Methods for Conducting a Reliability Analysis of Industrial and Commercial Power Systems

Statement of Problem and Substantiation for Public Input

The stronger the linkage between the NFPA and IEEE on electrical power technology the better. This document is one of several that replaces content in IEEE 493 Design of Reliable Industrial and Commercial Power Systems -- the so-called "Gold Book", which is now being sunsetted and superseded by 3006.5.

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Details about this document is available at the link below:

https://standards.ieee.org/findstds/standard/3006.5-2014.html

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Public Input No. 3177-NFPA 70-2017 [Section No. 80.1]

80.1 Scope.

The following functions are covered:

(1) The inspection of electrical installations as covered by 90.2

(2) The investigation of fires caused by electrical installations

(3) The review of construction plans, drawings, and specifications for electrical systems

(4) The design, alteration, modification, construction, maintenance, and testing of electrical systems and equipment

(5) The regulation and control of electrical ~~installations at~~ installation safety at special events including but not limited to exhibits, trade shows, amusement parks, and other similar special occupancies

Statement of Problem and Substantiation for Public Input

Clarifies that the limit of Article 80 pertains to safety issues only.

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Public Input No. 3884-NFPA 70-2017 [Section No. 80.21(C)]

(C) Responsibility of the Authority Having Jurisdiction.

It shall be the responsibility of the authority having jurisdiction to promulgate rules that cover the following:

(1) Review of construction documents and drawings shall be completed within established time frames for the purpose of acceptance or to provide reasons for nonacceptance.

(2) Review and approval by the authority having jurisdiction shall not relieve the applicant of the responsibility of compliance with this *Code*.

(3) Where field conditions necessitate any substantial change from the approved plan, the authority having jurisdiction shall be permitted to require that the corrected plans be submitted for approval.

(4) <u>The authority having jurisdiction shall be permitted to determine the scope of electrical power system rehabilitation independent of the requirements of the building code.</u>

Statement of Problem and Substantiation for Public Input

The education facilities industry is the largest non-residential building construction market in the United States; building and renovating campus square footage at a clip of about $80 billion per year. Construction activity at the University of Michigan alone (with 36 million square feet under management and the largest campus in the US in terms of building square-footage) runs at an annual rate of $600 million to $ 1.2 billion annually so the evolution of electrical systems is in plain sight on a daily basis.

This proposal is intended to generate discussion about the degree to which the scope of electrical renovation/rehabilitation shall be permitted to be scaled according the site specific conditions that govern safety and economy. For example, many building codes may require that a 50% change in the square footage affected by a rehabilitation/renovation project may require a corresponding change in the electrical system. That change may or may not be justified on the basis of safety considerations alone. Conversely, the 50% criterion may not be a sufficient threshold to guarantee safety. While this model language for electrical administration may always be subordinate to the building codes, some model language that has been vetted through ANSI processes; that makes scalability a possibility would be welcomed from the standpoint of both both safety and economy

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Public Input No. 3178-NFPA 70-2017 [Section No. 80.33]

~~**80.33** Repeal of Conflicting Acts.~~

~~All acts or parts of acts in conflict with the provisions of Article 80 are hereby repealed.~~

Statement of Problem and Substantiation for Public Input

This provision suggests that Article 80 might supersede another safety regulation such as the International Building Code which customarily incorporates by reference the NEC and seems out of place. Its removal will likely not be missed and may actually strengthen Article 80 because its model provisions are limited. .

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Public Input No. 3880-NFPA 70-2017 [Annex H [Excluding any Sub-Sections]]

Informative Annex H is not a part of the requirements of this NFPA document and is included for informational purposes only. This ~~informative~~ annex is ~~informative unless specifically adopted by the local jurisdiction~~ intended to provide a template and sample language for local jurisdictions adopting the National Electrical Code®.

Statement of Problem and Substantiation for Public Input

This clarification mimics the front page of many International Code Council products and may hasten the creation of administrative structures necessary to fully realize the stated purpose of the 2020 NEC.

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Public Input No. 3881-NFPA 70-2017 [Annex H [Title Only]]

Informative Annex A. Administration and Enforcement

Statement of Problem and Substantiation for Public Input

Admittedly, placing the Administration and Enforcement ahead of all the other Annexes is a large undertaking. I was a member of CMP-1 representing APPA.ORG during the original creation and was on the Task Group considered at length its numbering and placement so I understand the trade-offs. This public input is submitted simply to place it on the CMP agenda for consideration and re-consideration from time to time. .

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Public Input No. 3195-NFPA 70-2017 [Part II.]

Part II. Development and Implementation of Functional Performance Tests (FPTs) for Critical Operations Power Systems Development of FPT

(1) Submit Functional Performance Tests (FPTs). System/component tests or FPTs are developed from submitted drawings, systems operating documents (SODs), and systems operation and maintenance manuals (SOMMs), including large component testing (i.e., transformers, cable, generators, UPS), and how components operate as part of the total system. The commissioning authority develops the test and cannot be the installation contractor (or subcontractor).

As the equipment/components/systems are installed, quality assurance procedures are administered to verify that components are installed in accordance with minimum manufacturers' recommendations, safety codes, and acceptable installation practices. Quality assurance discrepancies are then identified and added to a “commissioning action list” that must be rectified as part of the commissioning program. These items would usually be discussed during commissioning meetings. Discrepancies are usually identified initially by visual inspection.

(2) Review FPTs. The tests must be reviewed by the customer, electrical contractors, quality assurance personnel, maintenance personnel, and other key personnel (the commissioning team). Areas of concern include, among others, all functions of the system being tested, all major components included, whether the tests reflect the system operating documents, and verification that the tests make sense.

(3) Make Changes to FPTs as Required. The commissioning authority then implements the corrections, questions answered, and additions.

(4) FPTs Approval. After the changes are made to the FPTs, they are submitted to the commissioning team. When it is acceptable, the customer or the designated approval authority approves the FPTs. It should be noted that even though the FPT is approved, problems that arise during the test (or areas not covered) must be addressed.

Testing Implementation for FPTs. The final step in the successful commissioning plan is testing and proper execution of system-integrated tests.

(1) Systems Ready to Operate. The FPTs can be implemented as various systems become operative (i.e., test for the generator system) or when the entire system is installed. However, the final “pull the plug” test is performed only after all systems are completely installed. If the electrical contractor (or subcontractor) implements the FPTs, a witness must initial each step of the test. The electrical contractor cannot employ the witness directly or indirectly.

(2) Perform Tests (FPTs). If the system fails the test, the problem must be resolved and the equipment or system retested or the testing requirements re-analyzed until successful tests are witnessed. Once the system or equipment passes testing, it is verified by designated commissioning official.

(3) Customer Receives System. After all tests are completed (including the “pull the plug” test), the system is turned over to the customer.

<u>Informational Note: For information regarding reliability of critical operations power systems, see IEEE 3006.2 Recommended Practice for Evaluating the Reliability of Existing Industrial and Commercial Power Systems</u>

Statement of Problem and Substantiation for Public Input

Quantitative approaches to maintaining the reliability of critical operations power systems requires special consideration in the later years of a protected facility life cycle. Nowhere in the built environment is continuity of power more essential than in critical operations power systems that support public safety.

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If accepted, I assume that the placement of this reference will be determined by style editors at the NFPA

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