Public Input No. 2899-NFPA 70-2020 [New Definition after Definition: Automatic.]

TITLE OF NEW CONTENT

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 which supports practical electrical safety for the individual and the public. 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. 2821-NFPA 70-2020 [New Definition after Definition: Receptacle Outlet.]

TITLE OF NEW CONTENT

Type your content he

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 3006.2-2016 Recommended Practice for Evaluating the Reliability of Existing Industrial and Commercial Power Systems

Statement of Problem and Substantiation for Public Input

This Code will be improved if it recognizes that lack of electrical power is at least as much of a hazard as its presence. The reliability of a power system is its essential characteristic and contributes to the goal of practical safeguarding of persons and property. This proposed definition pairs with the proposed definition of "Availability".

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Public Input No. 2905-NFPA 70-2020 [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. 3143-NFPA 70-2020 [Section No. 110.9]

110.9 Interrupting Rating.

Equipment intended to interrupt current at fault levels shall have an interrupting rating at nominal circuit voltage at least equal to the current that is available at the line terminals of the equipment.

Equipment intended to interrupt current at other than fault levels shall have an interrupting rating at nominal circuit voltage at least equal to the current that must be interrupted.

Informational Note: Guidance for calculating fault current may be found in IEEE 3002.3-2018 - Recommended Practice for Conducting Short-Circuit Studies and Analysis of Industrial and Commercial Power Systems

Statement of Problem and Substantiation for Public Input

This is another slice of updated content from the legacy "Red Book" IEEE 141 mapped into the new IEEE 3000 Standards Collection. From the project prospectus:
"Activities related to short-circuit analysis, including design considerations for new systems, analytical studies for existing systems, as well as operational and model validation considerations for industrial and commercial power systems are addressed. Fault current calculation and device duty evaluation is included in short-circuit analysis. Accuracy of calculation results primarily relies on system modeling assumptions and methods used. The use of computer-aided analysis software with a list of desirable capabilities recommended to conduct a modern short-circuit study is emphasized. Examples of system data requirements and result analysis techniques are presented."

https://standards.ieee.org/standard/3002_3-2018.html

This is one of two possible locations where this reference will improve the NEC.

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Public Input No. 4257-NFPA 70-2020 [Section No. 110.10]

110.10 Circuit Impedance, Short-Circuit Current Ratings, 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: 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 that depend upon a reliable power source. Impedance grounded systems 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 a revision to a similar proposal last cycle to raise the visibility of system reliability as an essential characteristic of a power system. Everything we do is to assure safe and reliable power because lack of power -- the more frequent occurrence -- presents significant hazards to the public and to electricians who are put in harms way to remedy the cause of the outage. Reliability as an essential characteristic needs to be in the General Requirements of the NEC.

The new Informational Note in 250.36 is an improvement that recognizes the advantages of resistance grounding. The IEEE Education & Healthcare Facility Committee hosted an IEEE-TV presentation that is worth watching: Technical details about the University of California Berkeley power system are presented. It is a city-within-a-city and a near-perfect study unit for customer-owned premise wiring systems:

https://ieeetv.ieee.org/channels/ieee-ehfec

We cannot anticipate the hazards to which power systems in urban areas will be exposed in the near future. We do know the tools available to reduce city-wide electrical fires, however. For at least 3 NEC revision cycles -- starting in 2005 -- the University of Michigan devoted resources to "rightsizing" building premise wiring in the NEC. Three cycles after that, we now see other interest groups supporting that change. We hope that the NEC will evolve to fill the reliability gap at a faster pace; starting with the 2023 cycle.

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Public Input No. 4280-NFPA 70-2020 [New Section after 110.26(D)]

Emergency Illumination

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.

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 Section 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.

Electrical professionals should not rely upon the International Building Code to assure adequate illumination to rescue a fallen electrician.

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Public Input No. 4232-NFPA 70-2020 [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 , vault or similar enclosure that is accessible only to qualified persons.

(2) By permanent, substantial partitions or screens arranged so that only qualified persons have access to the space within reach of the live parts including from above . ~~Any~~ 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

This is a modification of a proposal made last cycle to strengthen the requirement to protect untrained persons from reaching into an exterior switchgear assembly with live parts. Many industrial class installations of regulated public utilities protect their switchgear from above with screening from animals and vandalism and untrained persons who may not understand electrical hazards. Oil-filled transformers, for example, do not have as loud a 60-cycle hum does not signal an electrical hazard as loudly as a dry-type transformer. I know of at least one example of an extreme electrical injury that was suffered by a young person who was unfamiliar with silent exterior switchgear that was live and could be accessed from above. Changes were made to the NEC several years ago when a young person drowned in a spa for lack of an emergency OFF switch nearby. The NEC should respond in a similar manner to protect untrained persons from accessing live exterior electrical equipment from above.

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Public Input No. 4044-NFPA 70-2020 [New Section after 220.1]

220.2 Definition

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)

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 demonstrated load in a new 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.

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Public Input No. 2339-NFPA 70-2020 [Section No. 220.12(B)]

(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 220.42 are not applied to the general lighting load.

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

Table 220.12 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[a]	18	1.7
Health care clinic	17	1.6
Hospital	17	1.6
Hotels and motels, including apartment houses without provisions for cooking by tenants[b]	18	1.7
Library	16	1.5
Manufacturing facility[c]	24	2.2
Motion picture theater	17	1.6
Museum	17	1.6
Office[d]	14	1.3
Parking garage[e]	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[f]	16	1.5
Retail[g,h]	20	1.9
School~~/university~~	33	3
Sports arena	33	3
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 when using the unit loads in this table for calculating the minimum lighting load for a specified occupancy.

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

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

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

[d]Banks are office-type occupancies.

[e]Garages — commercial (storage) are considered parking garage occupancies.

[f]Clubs are considered restaurant occupancies.

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

[h]Stores are considered retail occupancies.

Additional Proposed Changes

File Name	Description	Approved
.1597618435780		
IBC_2018_Section_303_Educational_Group_E_Screen_Capture.jpg	!BC 2018 Screen Capture of Education Group Definitions	

Statement of Problem and Substantiation for Public Input

Universities contain nearly all of the other occupancy types in this table. Striking the word university will clarify that the type of occupancy is a Section 305.1 Educational group E which defines use of the space as a building, or structure, or a portion thereof, by six or more persons at any one time for educational purposes through the 12th grade. See attached screen capture of Section 305 Group E text of the 2018 IBC.

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Public Input No. 4014-NFPA 70-2020 [New Section after 220.14(K)]

Educational Occupancies (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 persons at 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. 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 25+ year career as an electrical engineer at the University of Michigan which had day care and elementary education instructional space Isupports 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.
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

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Public Input No. 4047-NFPA 70-2020 [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.

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 authority having jurisdiction.

This section shall not apply to portable classroom buildings.

Table 220.86 Optional Method — Demand Factors for Feeders and Service Conductors for Schools

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

Statement of Problem and Substantiation for Public Input

This proposal is inspired by the solution provided in the Canadian Electrical Code for mitigating 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.

See: Canadian Electrical Code, Part 1, Installment 5

Free View Access to the Canadian Electrical Code was found at this link at the time this proposal was submitted:

https://store.csagroup.org/ccrz__ProductList?viewState=ListView&cartID=&portalUser=&store=&cclcl=en_US&categoryId=a0K1I000002IWGkUAO

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Copyright Assignment

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Public Input No. 4638-NFPA 70-2020 [New Section after 220.103]

VI. Optional Calculation Methods for HVAC Equipment

220.104 Electric Chillers. Where reduced load 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

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.

We have submitted a proposal to CMP-1 for a definition for "Demonstrated Load" which it identical to the Canadian Electrical Code which permits system designers to exercise engineering judgement in sizing building premise wiring. Without this option, building emergency power systems may be oversized, resulting in problems with generators that are underloaded. ASHRAE technical committees are also driving down HVAC electrical load.

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Public Input No. 4393-NFPA 70-2020 [Section No. 230.2(A)]

(A) Special Conditions.

Additional services shall be permitted to supply the following:

(1) Fire pumps

(2) Emergency systems

(3) Legally required standby systems

(4) Optional standby systems

(5) Parallel power production systems

(6) Systems designed for connection to multiple sources of supply for the purpose of enhanced reliability

Informational Note: See IEEE 3006.8 Recommended Practice for Analyzing Reliability Data for Equipment Used in Industrial and Commercial Power Systems

Additional Proposed Changes

File Name	Description	Approved
IEEE_IAS_Published_Paper_Why_Existing_Utility_Metrics_Do_Not_Work_for_Industrial_Reliability_Analysis_-_Schuerger_Arno_Dowling.pdf	To support analytic power system reliability solutions for the 2023 National Electrical Code NFPA 70	

Statement of Problem and Substantiation for Public Input

This is continuation of an effort to drive reliability perspective in electrical safety solution many of which originated in the legacy IEEE Color Books. Safety concepts in the Color Books have been in the process of being mapped into the IEEE 3000 Collection of best practice literature.

From the project scope:

This recommended practice describes data supporting the reliability evaluation of existing industrial and commercial power systems. It is likely to be of greatest value to the power-oriented engineer with limited experience in the area of reliability. It can also be an aid to all engineers responsible for the electrical design of industrial and commercial power systems.

https://standards.ieee.org/standard/3006_8-2018.html

Note that a supporting paper is attached to this proposal: "Why Existing Utility Metrics Do Not Work for Industrial Reliability Analysis" (Schuerger, Arno, Dowling)

ABSTRACT: Electrical utility reliability indices such as System Average Interruption Frequency Index, System Average Interruption Duration Index, Customer Average Interruption Duration Index, Customer Average Interruption Frequency Index, and Momentary Average Interruption Frequency Index are adequately defined in IEEE Std. 1366-2012, and serve the purpose for which they were developed. However, the explosive growth of the electronics industry moving toward internet of things, along with the data center development necessary to support such explosive growth, has had significant impact on an aging power distribution system. As the utility world evolves toward the notion of smart grid, several new reliability metrics are needed to evaluate the electrical power to the customer's side of the meter.

https://ieeexplore.ieee.org/document/7448901

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Public Input No. 3315-NFPA 70-2020 [Section No. 230.66(B)]

(B) Meter Sockets.

Meter sockets shall not be considered service equipment but shall be listed and rated for the voltage and current rating of the service.

Exception: Meter sockets supplied by and under the exclusive control of an electric utility shall not be required to be listed.

Informational Note: See IEEE 3001.8 Recommended Practice for the Instrumentation and Metering of Industrial and Commercial Power Systems for more information

Statement of Problem and Substantiation for Public Input

This is another slice of updated content from the legacy IEEE Color Books. While much guidance is provided by utilities on metering the line side of the service point; more depth may be found is provided by this title. From its prospectus:

"This recommended practice covers the instrumentation and metering of industrial and commercial power systems. It describes the importance of metering to achieve a successful energy management process, as well as considerations that must be made when applying the latest metering technology."

https://standards.ieee.org/standard/3001_8-2013.html

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Public Input No. 3295-NFPA 70-2020 [Section No. 230.200]

230.200 General.

Service conductors and equipment used on circuits exceeding 1000 volts, nominal, shall comply with all the applicable 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~~ Note1 : For clearances of conductors of over 1000 volts, nominal, see ANSI/IEEE C2-2017, *National Electrical Safety Code*.

Informational Note 2: For additional information see IEEE 3001.2 IEEE Recommended Practice for Evaluating the Electrical Service Requirements of Industrial and Commercial Power Systems

Statement of Problem and Substantiation for Public Input

This is another slice of updated content from the legacy "Red Book" IEEE 141 and "Gray Book: IEEE 241 into the new IEEE 3000 Standards Collection. From the 301.7 project prospectus:

"Commercial, institutional, and industrial design of electrical services, interconnecting with a utility distribution or transmission system is explored. The electrical system information needed by the designer concerning the utility's system characteristics, and the electrical load information needed by the utility to design a satisfactory electrical interface between the serving utility and the premise electrical distribution system is considered"

https://standards.ieee.org/standard/3001_2-2017.html

Note that this content could just as easily be placed at the head of Article 230; say under Section 230.1 as a second Informational Note..

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Public Input No. 3144-NFPA 70-2020 [Section No. 240.1]

240.1 Scope.

Parts I through VII of this article provide the general requirements for overcurrent protection and overcurrent protective devices not more than 1000 volts, nominal. Part VIII covers overcurrent protection for those portions of supervised industrial installations operating at voltages of not more than 1000 volts, nominal. Part IX covers overcurrent protection over 1000 volts, nominal.

Informational Note 1 : Overcurrent protection for conductors and equipment is provided to open the circuit if the current reaches a value that will cause an excessive or dangerous temperature in conductors or conductor insulation. See also 110.9 for requirements for interrupting ratings and 110.10 for requirements for protection against fault currents.

Informational Note 2: Guidance about determining fault current may be found in IEEE 3002.3-2018 Recommended Practice for Conducting Short-Circuit Studies and Analysis of Industrial and Commercial Power Systems

Statement of Problem and Substantiation for Public Input

This is another slice of updated content from the legacy "Red Book" IEEE 141 mapped into the new IEEE 3000 Standards Collection. From the project prospectus:
"Activities related to short-circuit analysis, including design considerations for new systems, analytical studies for existing systems, as well as operational and model validation considerations for industrial and commercial power systems are addressed. Fault current calculation and device duty evaluation is included in short-circuit analysis. Accuracy of calculation results primarily relies on system modeling assumptions and methods used. The use of computer-aided analysis software with a list of desirable capabilities recommended to conduct a modern short-circuit study is emphasized. Examples of system data requirements and result analysis techniques are presented."

https://standards.ieee.org/standard/3002_3-2018.html

This is one of two possible locations where this reference will improve the NEC.

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Public Input No. 3220-NFPA 70-2020 [Section No. 240.85]

240.85 Applications.

A circuit breaker with a straight voltage rating, such as 240V or 480V, shall be permitted to be applied in a circuit in which the nominal voltage between any two conductors does not exceed the circuit breaker's voltage rating. A two-pole circuit breaker shall not be used for protecting a 3-phase, corner-grounded delta circuit unless the circuit breaker is marked 1φ–3φ to indicate such suitability.

A circuit breaker with a slash rating, such as 120/240V or 480Y/277V, shall be permitted to be applied in a solidly grounded circuit where the nominal voltage of any conductor to ground does not exceed the lower of the two values of the circuit breaker's voltage rating and the nominal voltage between any two conductors does not exceed the higher value of the circuit breaker's voltage rating.

Informational Note 1 : Proper application of molded case circuit breakers on 3-phase systems, other than solidly grounded wye, particularly on corner grounded delta systems, considers the circuit breakers' individual pole-interrupting capability.

Informational Note 2: See IEEE 3005.-2014 Recommended Practice for the Application of Low-Voltage Circuit Breakers in Industrial and Commercial Power Systems for additional information.

Statement of Problem and Substantiation for Public Input

Information for selecting the proper circuit breaker for a particular application is provided. Application engineers are aided in specifying the type of circuit breaker, ratings, trip functions, and accessories. Circuit breakers for special applications, e.g., instantaneous only and switches are discussed. In addition, information for applying circuit breakers at different locations in the power system and for protecting specific components is provided

https://standards.ieee.org/standard/3004_5-2014.html

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Submittal Date: Sun Sep 06 19:29:17 EDT 2020
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Public Input No. 3300-NFPA 70-2020 [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

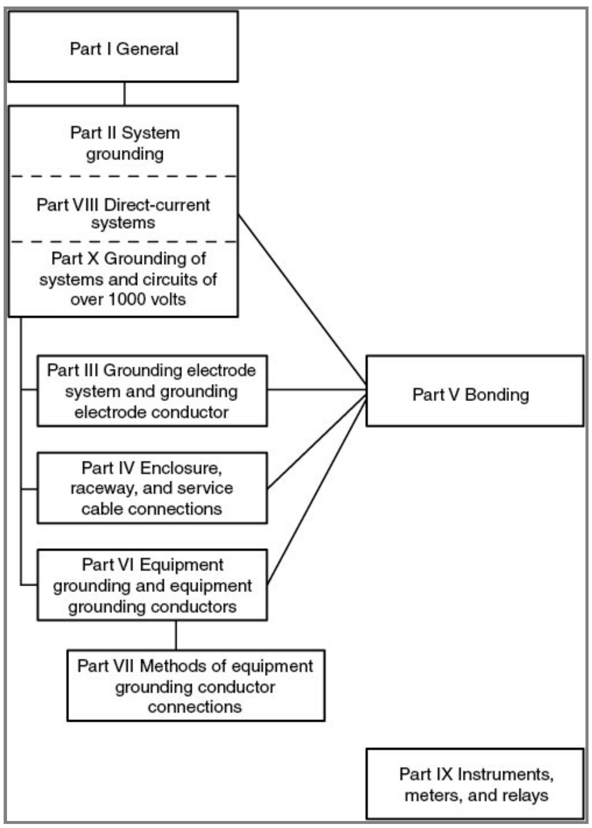
(5) Methods of grounding and bonding

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

Informational Note 1 : See Figure 250.1 for information on the organization of Article 250 covering grounding and bonding requirements.

Informational Note 2: See IEEE 3003.2 Recommended Practice for Equipment Grounding and Bonding in Industrial and Commercial Power Systems for additional information

Figure 250.1 Grounding and Bonding.



Statement of Problem and Substantiation for Public Input

This is another slice of updated content from the legacy "Red Book" IEEE 141, "Gray Book: IEEE 241 and IEEE 142 "Green Book" into the new IEEE 3000 Standards Collection. This new standard is part of a larger project to revise and reorganize the technical content of the 13 existing IEEE Color Books. Benefits of the project include, but are not limited to: 1) the elimination of duplicate material that now exists in the various color books, 2) the
speeding up of the revision process by allowing Color Book content to be reviewed, edited and balloted in smaller segments, and 3) to accommodate more modern, efficient and cost effective physical publishing/distribution methodologies (i.e., the elimination of large and expensive to produce books.

From the project prospectus:

"The grounding and bonding of equipment in industrial and commercial power systems is covered in this recommended practice. The interconnection and grounding of the non-electrical metallic elements of a system is covered first. This is followed by a discussion of the objectives of equipment grounding and bonding, including minimizing electric shock hazard to personnel, providing adequate current carrying capability for ground faults, and ensuring the timely operation of overcurrent protection."

https://standards.ieee.org/standard/3003_2-2014.html

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Public Input No. 2620-NFPA 70-2020 [Section No. 250.36(C)]

(C) System Grounding Connection.

The system shall not be connected to ground except through the grounding impedance.

Informational Note: The impedance is normally selected to limit the ground-fault current to a value slightly greater than or equal to the capacitive charging current of the system. This value of impedance will also limit transient overvoltages to safe values. For guidance, refer to criteria for limiting transient overvoltages in ~~ANSI/~~ **IEEE** ~~142-2007, Recommended~~ **3003.1-2019 R** ***ecommended Practice for System Grounding of Industrial and Commercial Power Systems .***

Statement of Problem and Substantiation for Public Input

IEEE 3003.1 is the title that replaces the IEEE 142, the so-called Green Book. From the 3003.1 scope statement: "Discussed in this recommended practice is the system grounding of industrial and commercial power systems. The recommended practices in this document are intended to provide explanations of how electrical systems operate. It can also be an aid to all engineers responsible for the electrical design of industrial and commercial power systems."

Here is the link for complete information:

https://standards.ieee.org/standard/3003_1-2019.html

Note a related title on equipment grounding which the committee may choose to reference to another section in Article 250 -- IEEE 3002.2-2014:

https://standards.ieee.org/standard/3003_2-2014.html

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Public Input No. 3309-NFPA 70-2020 [Section No. 250.36(C)]

(C) System Grounding Connection.

The system shall not be connected to ground except through the grounding impedance.

Informational Note: The impedance is normally selected to limit the ground-fault current to a value slightly greater than or equal to the capacitive charging current of the system. This value of impedance will also limit transient overvoltages to safe values. For guidance, refer to criteria for limiting transient overvoltages in ~~ANSI/IEEE 142-2007,~~ IEEE 3003.1 IEEE Recommended Practice for System Grounding of Industrial and Commercial Power Systems ~~.~~

Statement of Problem and Substantiation for Public Input

This is another slice of updated content from the legacy Color Books now mapping into the IEEE 3000 Standards Collection. From the project prospectus:

"Discussed in this recommended practice is the system grounding of industrial and commercial power systems. The recommended practices in this document are intended to provide explanations of how electrical systems operate. It can also be an aid to all engineers responsible for the electrical design of industrial and commercial power systems."

https://standards.ieee.org/standard/3003_1-2019.html

IEEE's Industrial Applications Society has determined a need for reorganizing the IEEE's Color Books Series, 13 books that currently cover various topics that fall under the purview of the Industrial and Commercial Power Industry. This comprehensive initiative, driven by the volunteer leadership of I&CPS, acknowledges that the continued and long-term maintenance of IEEE's Color Books has been affected by significant attrition due to declining volunteer resources, the complexity involved in updating each book, and content duplication among the books. The existing content will be integrated into a newly proposed structure by technical topics that will allow for easy updating, more streamlined content, and elimination of duplicative material.
[Note: This purpose will not be included in the document]

This new standard is part of a larger project to revise and reorganize the technical content of the 13 existing IEEE Color Books. Benefits of the project include, but are not limited to:

1) the elimination of duplicate material that now exists in the various color books,
2) the speeding up of the revision process by allowing Color Book content to be reviewed, edited and balloted in smaller segments,
3) to accommodate more modern, efficient and cost effective physical publishing/distribution methodologies (i.e., the elimination of large and expensive to produce books).

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Public Input No. 3246-NFPA 70-2020 [Section No. 250.170]

250.170 Instrument Transformer Circuits.

Secondary circuits of current and potential instrument transformers shall be grounded where the primary windings are connected to circuits of 300 volts or more to ground and, where installed on or in switchgear and on switchboards, shall be grounded irrespective of voltage.

Exception No. 1: Circuits where the primary windings are connected to circuits of 1000 volts or less with no live parts or wiring exposed or accessible to other than qualified persons.

Exception No. 2: Current transformer secondaries connected in a three-phase delta configuration shall not be required to be grounded.

Informational Note 1: See IEEE 3004.1 Recommended Practice for the Application of Instrument Transformers in Industrial and Commercial Power Systems for more information.

Statement of Problem and Substantiation for Public Input

This is another slice of updated content from the legacy "Red Book" IEEE 141 and "Gray Book: IEEE 241 into the new IEEE 3000 Standards Collection. From the project prospectus:

"The selection and application of instrument transformers used in industrial and commercial power systems are covered in this recommended practice."

https://standards.ieee.org/standard/3004_1-2013.html

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Public Input No. 3252-NFPA 70-2020 [Section No. 408.1]

408.1 Scope.

This article covers switchboards, switchgear, and panelboards. It does not apply to equipment operating at over 1000 volts, except as specifically referenced elsewhere in the *Code*.

Informational Note: See IEEE 3004.11 Recommended Practice for Bus and Switchgear Protection in Industrial and Commercial Power Systems for additional information.

Statement of Problem and Substantiation for Public Input

This is another slice of updated content from the legacy "Red Book" IEEE 141 and "Gray Book: IEEE 241 into the new IEEE 3000 Standards Collection. From the project prospectus:

"Covered in this recommended practice is the protection of bus and switchgear used in industrial and commercial power systems. Also provided are fault protection and isolation strategies for the substation bus and switchgear, including the bus, circuit breakers, fuses, disconnecting devices, transformers, and the structures on which they are mounted."

https://standards.ieee.org/standard/3004_11-2019.html

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Public Input No. 3297-NFPA 70-2020 [Section No. 409.1]

409.1 Scope.

This article covers industrial control panels intended for general use and operating at 1000 volts or less.

Informational Note 1 : ANSI/UL 508A, *Standard for Industrial Control Panels*, is a safety standard for industrial control panels.

Informational Note 2: See IEEE 3001.11 Recommended Practice for Application of Controllers and Automation to Industrial and Commercial Power Systems

Statement of Problem and Substantiation for Public Input

This is another slice of updated content from the legacy "Red Book" IEEE 141 and "Gray Book: IEEE 241 into the new IEEE 3000 Standards Collection. From the project prospectus:

"The selection and application of controllers and automation to industrial and commercial power systems is covered by this recommended practice. It is likely to be of greatest value to the power-oriented engineer with limited experience with this equipment. It can also be an aid to all engineers responsible for the electrical design of industrial and commercial power systems."

https://standards.ieee.org/standard/3001_11-2017.html

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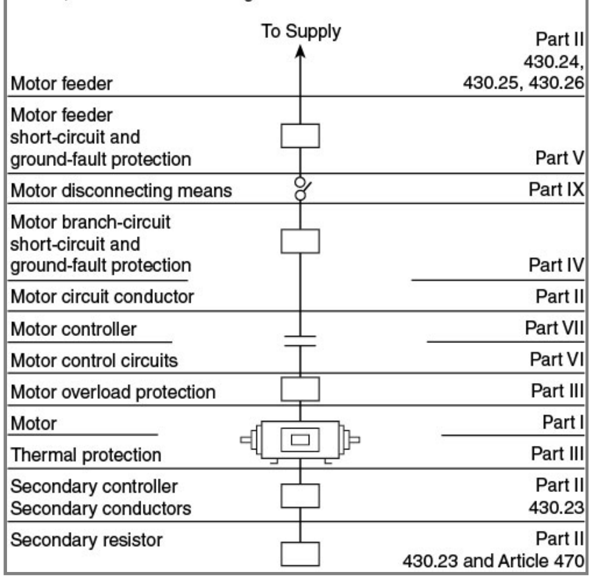
Public Input No. 3146-NFPA 70-2020 [Section No. 430.1]

430.1 Scope.

This article covers motors, motor branch-circuit and feeder conductors and their protection, motor overload protection, motor control circuits, motor controllers, and motor control centers.

Figure 430.1 Article 430 Contents.

General, 430.1 through 430.18	Part I
Motor Circuit Conductors, 430.21 through 430.29	Part II
Motor and Branch-Circuit Overload Protection, 430.31 through 430.44	Part III
Motor Branch-Circuit Short-Circuit and Ground-Fault Protection, 430.51 through 430.58	Part IV
Motor Feeder Short-Circuit and Ground-Fault Protection, 430.61 through 430.63	Part V
Motor Control Circuits, 430.71 through 430.75	Part VI
Motor Controllers, 430.81 through 430.90	Part VII
Motor Control Centers, 430.92 through 430.99	Part VIII
Disconnecting Means, 430.101 through 430.113	Part IX
Adjustable-Speed Drive Systems, 430.120 through 430.131	Part X
Over 1000 Volts, Nominal, 430.221 through 430.227	Part XI
Protection of Live Parts—All Voltages, 430.231 through 430.233	Part XII
Grounding—All Voltages, 430.241 through 430.246	Part XIII
Tables, Tables 430.247 through 430.252	Part XIV



Informational Note No. 1: Installation requirements for motor control centers are covered in 110.26(E). Air-conditioning and refrigerating equipment are covered in Article 440.

Informational Note No. 2: Figure 430.1 is for information only.

<u>Informational Note No. 3: Additional guidance on motor supply circuits may be found in IEEE 3004.8-2016 - Recommended Practice for Motor Protection in Industrial and Commercial Power Systems</u>

Statement of Problem and Substantiation for Public Input

This is another slice of updated content from the legacy "Red Book" IEEE 141 mapped into the new IEEE 3000 Standards Collection. From the project prospectus:

"The protection of motors used in industrial and commercial power systems is covered. It is likely to be of greatest value to the power-oriented engineer with limited experience in the area of protection and control. It can also be an aid to all engineers responsible for the electrical design of industrial and commercial power systems."

https://standards.ieee.org/standard/3004_8-2016.html

This content might also be appropriately located at the head of Part III Motor and Branch Circuit Overload Protection

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Copyright Assignment

Public Input No. 2721-NFPA 70-2020 [Section No. 430.51]

430.51 General.

Part IV specifies devices intended to protect the motor branch-circuit conductors, the motor control apparatus, and the motors against overcurrent due to short circuits or ground faults. These rules add to or amend Article 240. The devices specified in Part IV do not include the types of devices required by 210.8, 230.95, and 590.6.

Informational Note 1 : See Informative Annex D, Example D8.

Informational Note 2: See IEEE 3004.8 Recommended Practice for Motor Protection in Industrial and Commercial Power Systems

Informational Note 3: See IEEE 3002.7 Recommended Practice for Conducting Motor-Starting Studies and Analysis of Industrial and Commercial Power Systems

Part IV shall not apply to motor circuits rated over 1000 volts, nominal.

Informational Note: For over 1000 volts, nominal, see Part XI.

Statement of Problem and Substantiation for Public Input

Content that formerly existed in the legacy Color Books (Red Book Std. 141 and Gray Book Std. 241) have been mapped into smaller titles such as these two. IEEE Color Books have been in the process of this transformation for at least two NEC cycles now. The transformation into smaller blocks of content is similar to the IEC best practice titles and aligns with the scope of this section of the NEC.

From the prospectus of these titles:

3004.8-2016: The protection of motors used in industrial and commercial power systems is covered. It is likely to be of greatest value to the power-oriented engineer with limited experience in the area of protection and control. It can also be an aid to all engineers responsible for the electrical design of industrial and commercial power systems.

https://standards.ieee.org/standard/3004_8-2016.html

3002.7 2018: Activities related to motor-starting studies including design considerations for new systems, analytical studies for existing systems, as well as operational and model-validation considerations for industrial and commercial power systems are described. Motor-starting analysis includes evaluation of motor-starting current and voltage drop. Accuracy of calculation results primarily relies on system modeling assumptions and methods used. The use of computer-aided analysis software, with a list of desirable capabilities recommended to conduct a modern motor-starting study, is emphasized. Examples of system data requirements and result-analysis techniques are presented. Benefits obtained from motor-starting studies are discussed, and various types of computer-aided motor-starting studies are examined. Data or information required for these studies, as well as the expected results of a motor-starting study effort, are also reviewed.

https://standards.ieee.org/standard/3002_7-2018.html

This proposal is intended to align IEEE and NFPA electrical safety standards.

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Public Input No. 3257-NFPA 70-2020 [Section No. 445.1]

445.1 Scope.

This article contains installation and other requirements for generators.

Informational Note: See IEEE 3002.2 Recommended Practice for Conducting Load-Flow Studies and Analysis of Industrial and Commercial Power Systems for additional information.

Statement of Problem and Substantiation for Public Input

Generator manufacturers and electricians are sensitive to the specifics of running generators in parallel but it may be wise to direct users of the NEC toward reactive power (circulating current) issues; among others. From the 3002.2 prospectus:

"Activities related to load flow analysis, including design considerations for new systems, analytical studies for existing systems, as well as operational and model validation considerations for industrial and commercial power systems are addressed. Load flow analysis includes steadystate power flow and voltage analysis along with considerations for optimal power flow calculations. The use of computer-aided analysis software, with a list of desirable capabilities recommended to conduct a modern load-flow study, is emphasized. Examples of system data requirements and result analysis techniques are presented."

https://standards.ieee.org/standard/3002_2-2018.html

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Public Input No. 3266-NFPA 70-2020 [Section No. 450.3 [Excluding any Sub-Sections]]

Overcurrent protection of transformers shall comply with 450.3(A), (B), or (C). As used in this section, the word *transformer* shall mean a transformer or polyphase bank of two or more single-phase transformers operating as a unit.

Informational Note No. 1: See 240.4, 240.21, 240.100, and 240.101 for overcurrent protection of conductors.

Informational Note No. 2: Nonlinear loads can increase heat in a transformer without operating its overcurrent protective device.

Informational Note No. 3. See IEEE 3002.8 Recommended Practice for Conducting Harmonic Studies and Analysis of Industrial and Commercial Power Systems for additional information.

Statement of Problem and Substantiation for Public Input

This is another slice of updated content from the legacy "Red Book" IEEE 141 and "Gray Book: IEEE 241 into the new IEEE 3000 Standards Collection. From the project prospectus:

"Harmonic studies and analysis of industrial and commercial power systems are described. The basic concepts involved in such studies are described first. This is followed by a discussion of how to determine the need for a harmonic study, how to assemble the required data, how to recognize potential problems, and how to implement corrective measures."

https://standards.ieee.org/standard/3002_8-2018.html

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Public Input No. 4652-NFPA 70-2020 [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: 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
.1599769577481 NFPA_FPRF_minutes_-_electric_circuit_data_collection.pdf	Mazzetti FPRF Project Meeting Minutes September 2020	

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 which permits a broader application of engineering judgement. The intent is to "rightsize" health care facilities power chain by giving design experts more freedom than presently allowed in Chapter 2. Oversized building premise wiring and equipment is not safe.

Last cycle the TCC referred similar proposals to a study group which provided inspiration for a study now underway, administered by the Fire Protection Research Foundation and performed by Mazzetti Associates. The oversight committee is still active, as is the research. Minutes of the most recent meeting are attached herewith.

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Public Input No. 4512-NFPA 70-2020 [Section No. 517.41(B)]

(B) Types of Power Sources.

Where the normal source consists of generating units on the premises, the alternate source shall be either another generating set or an external utility service. [**99:**6.7.1.2.3]

Informational Note: See IEEE 3006 Standards Collection for information about power system reliability.

Additional Proposed Changes

File Name	Description	Approved
IEEE_IAS_Published_Paper_Why_Existing_Utility_Metrics_Do_Not_Work_for_Industrial_Reliability_Analysis_-_Schuerger_Arno_Dowling.pdf	This paper identifies the need to expand the vocabulary for power system reliability on both sides of the service point; with special consideration for healthcare facilities.	

Statement of Problem and Substantiation for Public Input

This is continuation of an effort to drive reliability perspective that originated in the legacy IEEE Color Books into the NEC. Safety concepts in the Color Books have been in the process of being mapped into the IEEE 3000 Collection of best practice literature for several years now.

Reliable power (Available power) is an essential characteristic of electrical safety. Note the relevant titles in the header link for the reliability titles: https://standards.ieee.org/products-services/3000/index.html

IEEE 3006.2™-2016 Recommended Practice for Evaluating the Reliability of Existing Industrial and Commercial Power Systems
IEEE 3006.3™-2017 Recommended Practice for Determining the Impact of Preventative Maintenance on the Reliability of Industrial and Commercial Power Systems
IEEE 3006.5™-2014 Recommended Practice for the Use of Probability Methods for Conducting a Reliability Analysis of Industrial and Commercial Power Systems
IEEE 3006.7™-2013 Recommended Practice for Determining the Reliability of 7x24 Continuous Power Systems in Industrial and Commercial Facilities
IEEE 3006.8™-2018 Recommended Practice for Analyzing Reliability Data for Equipment Used in Industrial and Commercial Power Systems
IEEE 3006.9™-2013 Recommended Practice for Collecting Data for Use in Reliability, Availability, and Maintainability Assessments of Industrial and Commercial Power Systems
IEEE P3006.1™ Recommended Practice for Reliability Planning and Design of Industrial and Commercial Power Systems

Our point in listing these is to demonstrate that the 3006 Collection is a significant update of the Orange Book (IEEE 446 Recommended Practice for Emergency and Standby Power for Industrial & Commercial Applications) and the White Book (IEEE 602 Recommended Practice for Electric Systems in Health Care Facilities) -- on the specific topic of reliability.

The primary source of power to healthcare facilities should require a quantitative risk analysis. The paper, attached herewith, describes some considerations when evaluating the availability of the utility source; the subject of Section 517.41

"Why Existing Utility Metrics Do Not Work for Industrial Reliability Analysis" (Schuerger, Arno, Dowling)

ABSTRACT: Electrical utility reliability indices such as System Average Interruption Frequency Index, System Average Interruption Duration Index, Customer Average Interruption Duration Index, Customer Average Interruption Frequency Index, and Momentary Average Interruption Frequency Index are adequately defined in IEEE Std. 1366-2012, and serve the purpose for which they were developed. However, the explosive growth of the electronics industry moving toward internet of things, along with the data center development necessary to support such explosive growth, has had significant impact on an aging power distribution system. As the utility world evolves toward the notion of smart grid, several new reliability metrics are needed to evaluate the electrical power to the customer's side of the meter.

https://ieeexplore.ieee.org/document/7448901

The committee may opt to locate this content elsewhere.

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Public Input No. 2430-NFPA 70-2020 [New Section after 630.34]

630.35 Ground-Fault Circuit-Interrupter Protection for Personnel in welding shops. All 125-volt, single-phase, 15- and 20-ampere receptacles installed in work areas where welders are operated, for electrical hand tools or portable lighting equipment, shall have ground-fault circuit-interrupter protection for personnel.

Statement of Problem and Substantiation for Public Input

Secondary and trade schools and community colleges have branch circuiting for welding equipment that is used by students who pose an elevated risk. The requirement for GFCI protection for people with hand tools should be expanded here. As noted previous public input on this issue, this change would create consistency with other sections of the code.

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Public Input No. 3286-NFPA 70-2020 [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 99-2018, *Health Care Facilities Code*.

Informational Note No. 3: For specification of locations where emergency lighting is considered essential to life safety, see NFPA *101*-2018, *Life Safety Code*.

Informational Note No. 4: For further information regarding performance of emergency and standby power systems, see NFPA 110-2019, *Standard for Emergency and Standby Power Systems*.

Informational Note No. 5: For further information regarding power system reliability, see IEEE 3006.2 Recommended Practice for Evaluating the Reliability of Existing Industrial& Commercial Power Systems

Informational Note No. 6: For further information, see IEEE 3005.4 Recommended Practice for Design and Operational Considerations for Improving the Reliability of Emergency and Stand-By Power Systems

Statement of Problem and Substantiation for Public Input

These are more slices of updated content from the legacy "Red Book" IEEE 141, "Gray Book": IEEE 241 and "Orange Book" IEEE 446 which are now being mapped into the IEEE 3000 Standards Collection. From the project prospectuses:

3006.2: Data supporting the reliability evaluation of existing industrial and commercial power systems are described. This recommended practice is likely to be of greatest value to the power-oriented engineer with limited experience in the area of reliability. It can also be an aid to all engineers responsible for the electrical design of industrial and commercial power systems.

https://standards-stg.ieee.org/standard/3006_2-2016.html

3005.4 This recommended practice describes how to improve the reliabiity of emergency and stand-by power systems. Some of the factors examined include the specific application of the emergency or standby equipment, environmental concerns, specification and acceptance testing of the equipment, and the operations and maintenance of the equipment. (Note that this title has been approved and it near formal release; which should happen before the Public Comment period)

https://standards.ieee.org/standard/3005_4-2020.html

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

Public Input No. 3783-NFPA 70-2020 [Section No. 700.4]

700.4 Capacity and Rating.

(A) Application

Under engineering supervision microgrid systems identified in Article 705 shall be permitted to be used as emergency systems subject to all other criteria indentified in this Article.

(B) Rating.

The emergency system equipment shall be suitable for the available fault current at its terminals.

(~~B~~ C) Capacity.

An emergency system shall have adequate capacity in accordance with Article 220 or by another approved method.

(~~C~~ D) Selective Load Pickup, Load Shedding, and Peak Load Shaving.

The alternate power source shall be permitted to supply emergency, legally required standby, and optional standby system loads where the source has adequate capacity or where automatic selective load pickup and load shedding is provided as needed to ensure adequate power to (1) the emergency circuits, (2) the legally required standby circuits, and (3) the optional standby circuits, in that order of priority. The alternate power source shall be permitted to be used for peak load shaving, provided these conditions are met.

Peak load shaving operation shall be permitted for satisfying the test requirement of 700.3(B), provided all other conditions of 700.3 are met.

Statement of Problem and Substantiation for Public Input

Many colleges and universities have district energy plants identified as the primary source of power but run in parallel with a regulated utility. NFPA 110 permits use of a utility as an emergency source where approved by the Authority Having Jurisdiction. Independence of fuel supply may be a site specific criteria.

A selection of research supporting this proposal is listed below:

1. Microgrid Reliability Evaluation Using Distributed Energy Storage Systems | https://ieeexplore.ieee.org/document/8881068

Abstract: Reliability assessment of power systems is a very important factor to judge utilities and suppliers. Many suppliers lose millions of dollars because of the failure happening in their systems. Although these failures are out of control and cannot be avoided strictly, there are methods developed to enhance the reliability of power systems to minimize the number of failures and they work very efficiently. Integrating an energy storage system (ESS) with the power system is one of these methods to enhance the reliability. This paper presents the effects of integrating an ESS with a microgrid on the reliability evaluation and compares between the reliability indices of the microgrid without the ESS and with it. Also, dynamic programming is used to solve the unit commitment problem in both cases to calculate the production cost in both cases. The simulation results and numerical analysis depict the effectiveness of the proposed approach.

2. Economic and Environmental Advantages of Renewable-based Microgrids over Conventional Microgrids | https://ieeexplore.ieee.org/document/8767146

Distributed generation is one of the best and most practical ways to achieve power supply reliability. Yet, the best method to maximize this benefit is by utilizing the distributed energy resources within smart microgrids, where these resources, and nearby loads are efficiently controlled via the “Microgrid Controller,” which consists the heart of a microgrid. Distributed energy resources could be any type of generation from a typical fossil-fueled generator to the most recent form of a renewable energy generation system. The objective of this study is to highlight the economic superiority of renewable-energy-based microgrids over the traditional microgrids, utilizing only conventional fossil-fuel-based energy resources. This is in addition to the resulting environmental benefit of avoiding large amounts of CO_2 emissions. Simulation results for the four case studies prove the economic feasibility of renewable-based microgrids over diesel- generator-based microgrid in all cases. The economic analysis shows that including renewable energy systems within the microgrids reduced the Net present cost (NPC) of the conventional microgrid in this study by up to 44%. The chosen disparate locations for the smart microgrids are Yuma/AZ/USA, Boston/MA/USA, Ma'an/Jordan, and Plymouth/England.

3. Networked Microgrids: State-of-the-Art and Future Perspectives | https://ieeexplore.ieee.org/document/8536454

The operation of multiple microgrids (MGs) in coordination with distribution system enables high penetration of locally available distributed energy resources (DERs). This approach enhances the reliability and resiliency of the power supply significantly. Also, the overall cost of energy gets reduced because of the integration of cost-free power from photovoltaic panels and wind turbines. The most effective utilization of DERs can be achieved through networked MGs. However, the implementation of the concepts of networked MGs requires extensive research. This paper presents a comprehensive literature review of the most important research works on networked MGs. Major benefits and challenges related to this new and highly exploring area have been analyzed. Also, some of the most important research areas related to networked MGs have been highlighted and discussed as the future perspectives.

Hundreds of papers have been presented on this subject in the past 5 years. Conveying the findings into building premise wiring will improve the NEC and align it more closely with national energy security policy.

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Public Input No. 3339-NFPA 70-2020 [New Section after B.7]

TITLE OF NEW CONTENT

B8. Cable Aging Criteria

Informational Note: See "The In-Op Design of Electrical Distribution Systems Based on Microsystem Criteria" for information about including conductor age in the design of premise wiring systems. **IEEE Transactions on Industry Applications Volume: 54 , Issue: 1 , Jan.-Feb. 2018**

Statement of Problem and Substantiation for Public Input

The Terra System prohibits positioning this content an appropriate location so the committee may opt to locate the informational reference elsewhere. This research offers other approaches to building premise power distribution wiring; a consideration that may require further review in light of the expansion of DC wiring and power-over-ethernet wiring for equipment loads. The abstract of the paper speaks for itself; reproduced below:

ABSTRACT. This paper deals with an innovative design strategy of building power systems by introducing criteria based on both the “installation approach” and the “operating approach” applying plan-do-check-act (PDCA) cycle. The In-Op design of the electrical power systems takes care of the worst cases of configurations, adequate gaps on load in selecting the rating of components, the actual mean losses to evaluate their energetic operation, and to avoid excessive gaps on the lifetime of components. With this aim, the authors suggest consideration of the thermal aging model of Arrhenius to review the actual gap on load in selecting the rating of components. In reference to IEC standards, this paper underlines in the circuits design the cable steady and transient current densities, the load current torque density as “natural” parameters that allow applying a thumb rule in the classic sizing of the cross-sectional area of circuit conductors. Microsystem criteria in power systems design allow structuring their configuration with components of smaller size to reduce radically the volume of circuit conductors with more sensitive results in the branch distribution. The authors suggest why not reconsider the series of commercial cross section areas of power cables.

Authors: Giuseppe Parise + Luigi Parise (Sapienza University of Rome, Italy) & Michael A. Anthony + James R. Harvey (University of Michigan)

Link to the Abstract:

https://ieeexplore.ieee.org/document/8014496

Arrangements to obtain permission from IEEE to get copies of the full article to the committee are now underway and should be distributed to the appropriate person well ahead of the First Draft Meetings.

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Public Input No. 2617-NFPA 70-2020 [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) The authority having jurisdiction shall be permitted to determine the scope of electrical power system rehabilitation.

Statement of Problem and Substantiation for Public Input

This is a revision of the P.I. submitted last cycle. The education 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 distribution system 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. 2591-NFPA 70-2020 [Part V.]

Part V. System Performance and Analysis

Informational Note: IEEE 3006.8-2018 Recommended Practice for Analyzing Reliability Data for Equipment Used in Industrial and Commercial Power Systems This recommended practice describes data supporting the reliability evaluation of existing industrial and commercial power systems.

Statement of Problem and Substantiation for Public Input

This recommended practice describes data supporting the reliability evaluation of existing industrial and commercial power systems. It is likely to be of greatest value to the power-oriented engineer with limited experience in the area of reliability. It can also be an aid to all engineers responsible for the electrical design of industrial and commercial power systems.

See: https://standards.ieee.org/standard/3006_8-2018.html

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Public Input No. 2675-NFPA 70-2020 [New Part after VI.]

TITLE OF NEW CONTENT

Informational Note: 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

Link to the standard that replaces the IEEE Green Book, referenced elsewhere in NFPA electrical safety literature:

https://standards.ieee.org/standard/3003_2-2014.html

It expires at the end of 2024 and will likely be re-affirmed for use in future NEC revision cycles. From the 3003.2 prospectus:

The grounding and bonding of equipment in industrial and commercial power systems is covered in this recommended practice. The interconnection and grounding of the non-electrical metallic elements of a system is covered first. This is followed by a discussion of the objectives of equipment grounding and bonding, including minimizing electric shock hazard to personnel, providing adequate current carrying capability for ground faults, and ensuring the timely operation of overcurrent protection.

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