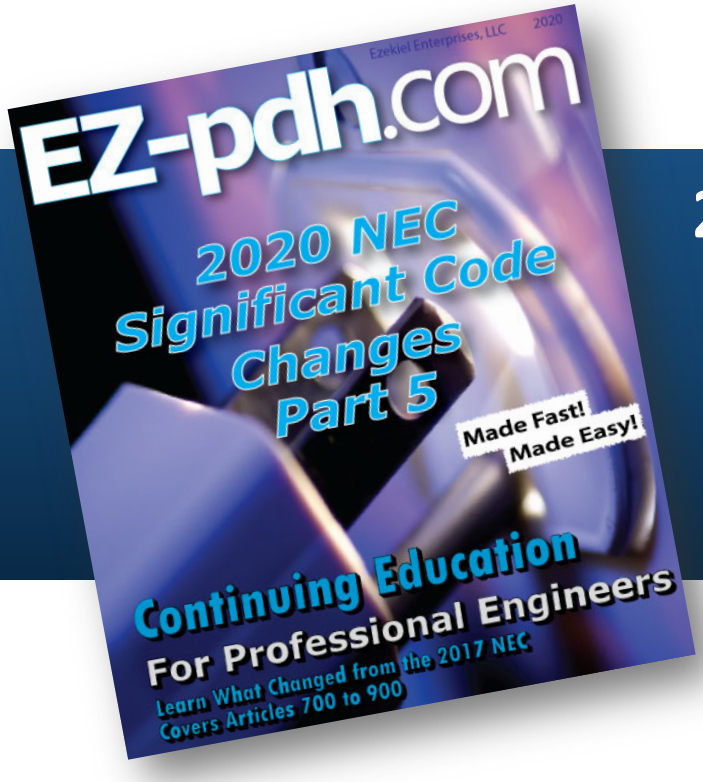

2020 NEC Significant Code Changes Part 5

Four (4) Continuing Education Hours
Course #EE2005

Approved Continuing Education for Licensed Professional Engineers

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Ezekiel Enterprises, LLC
301 Mission Dr. Unit 571
New Smyrna Beach, FL 32170
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Course Description:

The 2020 NEC Significant Code Changes Part 5 course satisfies four (4) hours of professional development.

The course is designed as a distance learning course that overviews the significant changes to the updated National Electrical Code (NEC).

Objectives:

The primary objective of this course is to enable the student to understand some of the significant changes including additions, deletions, and modification to Articles 700, 800. And 900 of the 2020 Edition of NFPA 70: National Electrical Code (NEC) from the 2017 Edition.

Grading:

Students must achieve a minimum score of 70% on the online quiz to pass this course. The quiz may be taken as many times as necessary to successful pass and complete the course.

A copy of the quiz questions are attached to last pages of this document.

Table of Contents

2020 NEC Significant Code Changes Part 5

Introduction

Every three years, the National Electrical Code® (NEC®) is revised and expanded. Initially the NFPA® received **3,730** public suggestions for changes, which resulted in **1,400** first revisions. There were **1,930** public comments submitted in response to these **1,400** first revisions, resulting in **635** second revisions. Changes included editorial clarification, expanded requirements, new requirements, deleted requirements, and the relocation of other requirements. Nine new articles were proposed, and four new articles were added to the 2020 NEC. With the fast pace of technology, it's more important than ever for anyone participating in the electrical industry to get up to speed with all the changes.

2020 National Electric Code (NEC)

- 5,660 Public Suggestions to 2014 NEC
- 2.035 Revisions Made
- Changes Included
  - Editorial Clarification,
  - Expanded Requirements,
  - New Requirements,
  - Deleted Requirements,
  - Relocation of Requirements
- Four New Articles Added

What to Expect

In this course the student will be presented an overview of the most significant changes found in the 2020 NEC. This is part 5 of a series of courses covering the changes and will progress through each chapter and its articles presenting the many important changes. The changes will be underlined for easy recognition and a short synopsis of the reason for the change is presented as well.

2020 NEC Major Additions

Article 242 Overvoltage Protection provides the general, installation, and connection requirements for overvoltage protection and overvoltage protective devices.

Article 311 Medium Voltage Conductors and Cable covers the use, installation, construction specifications and ampacities for medium voltage conductors and cable (Type MV).

Article 337 Type P Cable covers the use, installation, and construction specifications for up through 2000-volt Type P cable (armored and unarmored).

Article 800 General Requirements for Communications Systems combines common requirements previously found in Articles 800 (now Article 805) for communications circuits, 820 for community antenna television and radio distribution systems, 830 for network-powered broadband communications systems and 840 for premises-powered broadband communications systems into a new "general" article that applies to all of these articles unless modified by the forenamed articles.

Chapter 7. Special Conditions: Articles 700-770

700 – Emergency Systems

700.5(A)
Meter Mounted Transfer Switches

Change at a Glance: A new last sentence is added to clarify that meter mounted transfer switches are not permitted for use in emergency systems.

700.5 Transfer Equipment. (*Emergency Systems***)**

(A) General. Transfer equipment~~, including automatic transfer switches,~~ shall be automatic, ~~identified~~ listed, and marked for emergency use, and approved by the

authority having jurisdiction. Transfer equipment shall be designed and installed to prevent the inadvertent interconnection of normal and emergency sources of supply in any operation of the transfer equipment. Transfer equipment and electric power production systems installed to permit operation in parallel with the normal source shall meet the requirements of Article 705. Meter-mounted transfer switches shall not be permitted for emergency system use.

700.12(B)
Emergency System Equipment

Change at a Glance: The reference to spaces with a 1-hour fire rating is revised to 2-hour, to correlate with the requirements of 700.10(D) and NFPA 110. Previous List item (3) addressing "health care occupancies where persons are not capable of self-preservation" was deleted to resolve conflicts between this section and NFPA 99.

700.12 General Requirements. (*Sources of Power for Emergency Systems*)

(B) Equipment Design and Location. 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(C) through ~~(E)~~(H) shall be installed either in spaces fully protected by approved automatic fire ~~suppression systems (sprinklers, carbon dioxide systems, and so forth)~~ protection systems or in spaces with a ~~1-hour~~ 2-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)**~~**(3)** 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~~ 2018, 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~~ For information regarding power system reliability, see IEEE 3006.5-2014,

Recommended Practice for the Use of Probability Methods for Conducting a Reliability Analysis of Industrial and Commercial Power Systems.

700.12(H)
DC Microgrid Systems

Change at a Glance: New List Item (H) added to clarify that a dc microgrid system that is separate from the normal source of supply is permitted as an emergency system source.

700.12 General Requirements. (*Sources of Power for Emergency Systems*)

(H) DC Microgrid Systems. Sources connected to a dc microgrid system shall be permitted where the system is capable of being isolated from all non-emergency sources.

DC microgrid systems used as a source of power for emergency systems shall be of suitable rating and capacity to supply and maintain the total emergency load for not less than 2 hours of full-demand operation.

Where a dc microgrid system source serves as the normal supply for the building or group of buildings concerned, it shall not serve as the sole source of power for the emergency standby system.

700.32 Informational Note and Informational Note Figure 700.32
Informational Note Figure 700.32

Change at a Glance: A new informational note was added at 700.32 giving reference to a new Informational Note Figure 700.32, which gives an example of how emergency system overcurrent protective devices (OCPDs) selectively coordinate with all supply- side OCPDs.

700.32 Selective Coordination. (*Emergency Systems*)

Emergency system(s) overcurrent devices shall be selectively coordinated with all supply-side overcurrent protective devices. Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the

design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.

Exception: *Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.*

Informational Note: See Informational Note Figure 700.32 for an example of how emergency system overcurrent protective devices (OCPDs) selectively coordinate with all supply-side OCPDs.

(See NEC text and illustration provided for complete informational note text)

Figure Informational Note Figure 700.32 Emergency System Selective Coordination.

(See NEC text and illustration provided for complete informational note figure text)

702 – Optional Standby Systems

702.7(A)
Sign Indicating Optional Standby Power Source

Change at a Glance: A sign is required to be placed at the residential emergency disconnecting means required by 230.85 that indicates the location of each permanently installed on-site optional standby power source disconnect.

702.7 Signs. (*Optional Standby Systems*)

(A) Standby. A sign shall be placed at the service- entrance equipment for commercial and industrial installations that indicates the type and location of each on-site optional standby power source. For one- and two-family dwelling units, a sign shall ~~not~~ be ~~required for individual unit equipment for standby illumination~~ placed at the disconnecting means required in 230.85 that indicates the location of each permanently installed on-site optional standby power source disconnect or means to shut down the prime mover as required in 445.18(D).

705 – Interconnected Electric Power Production Sources

Article 705
Interconnected Electric Power Production Sources

Change at a Glance: Article 705 was extensively reorganized and revised for this *Code* cycle.

Article 705 Interconnected Electric Power Production Sources

Part I. General

705.1 Scope.
705.2 Definitions.
~~705.3 Other Articles.~~
~~Table 705.3 Other Articles~~
705.6 Equipment Approval.
705.8 System Installation.
705.10 ~~Directory~~ Identification of Power Sources.
705.11 Supply-Side Source Connections.

(A) Output Rating.
(B) Conductors.
(C) Overcurrent Protection.
(D) Bonding and Grounding. *(Subject to change per CAM 70-45)*
(E) Connections.
(F) Disconnecting Means. *(Subject to change per CAM 70-46)*
(G) Ground-Fault Protection.

705.12 Point of Connection Load-Side Source Connections.

(A) ~~Supply Side~~ Dedicated Overcurrent and Disconnect.
(B) ~~Load Side~~ Bus or Conductor Ampere Rating.
(C) Marking.
(D) Suitable for Backfeed.
(E) Fastening.

705.13 Power Control Systems.

(A) Monitoring.
(B) Setting.
(C) Overcurrent Protection.
(D) Single Power Source Rating.
(E) Access to Setting.

705.14 Output Characteristics.
705.16 Interrupting and Short-Circuit Current Rating.
705.20 Disconnecting Means, Sources.
~~**705.21 Disconnecting Means, Equipment.**~~
~~**705.22 Disconnect Device.**~~
~~**705.23 Interactive System Disconnecting Means.**~~
705.25 Wiring Methods.

(A) General.
(B) Flexible Cords and Cables.
(C) Multiconductor Cable Assemblies.

705.28 Circuit Sizing and Current.

(A) Calculation of Maximum Circuit Current.
(B) Conductor Ampacity.
(C) Neutral Conductor.

705.30 Overcurrent Protection.

(A) ~~**Solar Photovoltaic Systems**~~ **Circuit and Equipment.**
(B) ~~**Transformers**~~ **Overcurent Device Ratings.**
(C) ~~**Fuel Cell Systems**~~ **Power Transformers.**
~~**(D) Interactive Inverters.**~~
~~**(E)**~~ **(D) Generators.**

~~**705.31 Location of Overcurrent Protection.**~~
705.32 Ground-Fault Protection.
705.40 Loss of Primary Source.
705.45 Unbalanced Interconnections.

(A) Single Phase.
(B) Three Phase.

~~**705.42 Loss of 3-Phase Primary Source.**~~
~~**705.50 Grounding.**~~

Part II. ~~**Interactive Inverters**~~ **Microgrid Systems**

705.50 System Operation.
705.60 Primary Power Source Connection.
705.65 Reconnection to Primary Power Source.
705.70 Microgrid Interconnect Devices (MID).
~~**705.60 Circuit Sizing and Current.**~~

~~**(A) Calculation of Maximum Circuit Current.**~~
~~**(B) Ampacity and Overcurrent Device Ratings.**~~

~~**705.65 Overcurrent Protection.**~~

~~**(A) Circuits and Equipment.**~~
~~**(B) Power Transformers.**~~
~~**(C) Conductor Ampacity.**~~

~~**705.70 Interactive Inverters Mounted in Not Readily Accessible Locations.**~~
~~**705.80 Utility-Interactive Power Systems Employing Energy Storage.**~~
~~**705.82 Hybrid Systems.**~~
~~**705.95 Ampacity of Neutral Conductor.**~~

~~**(A) Neutral Conductor for Single Phase, 2-Wire Inverter Output.**~~
~~**(B) Neutral Conductor for Instrumentation, Voltage, Detection or Phase Detection.**~~

~~**705.100 Unbalanced Interconnections.**~~

~~**(A) Single Phase.**~~
~~**(B) Three Phase.**~~

~~**Part III. Generators**~~

~~**705.130 Overcurrent Protection.**~~
~~**705.143 Synchronous Generators.**~~

~~**Part IV. Microgrid Systems**~~

~~**705.150 System Operation.**~~
~~**705.160 Primary Power Source Connection.**~~
~~**705.165 Reconnection to Primary Power Source.**~~
~~**705.170 Microgrid Interconnect Devices (MID).**~~

706- Energy Storage Systems

706.1
Energy Storage Systems

Change at a Glance: The scope of Article 706 has been revised to provide clarity and to better express what is covered by the article.

706.1 Scope. (*Energy Storage Systems*)

This article applies to all ~~permanently installed~~ energy storage systems (ESS) ~~operating at over 50 volts ac or 60 volts dc that may be stand-alone or interactive with other electric power production sources~~ having a capacity greater than 3.6 MJ (1 kWh) that may be stand-alone or interactive with other electric power production sources. These systems are primarily intended to store and provide energy during normal operating conditions.

Informational Note No. 1: For batteries rated in ampere hours, kWh is equal to the nominal rated voltage times ampere-hour rating divided by 1000.

Informational Note No. 2: There can be a subtle distinction between a battery storing energy and an energy storage system. A battery storing energy is not necessarily an ESS. See Article 480. An ESS can be comprised of batteries storing energy. See Article 706.

Informational Note No. 3: The following standards are frequently referenced for the installation of energy storage systems: (*See NEC for complete list of standards added and deleted at this informational note*)

706.2
Energy Storage System (ESS)

Change at a Glance: Revision occurred to the previous definition of an Energy Storage System (ESS) to better define an what an ESS is and is not.

706.2 Definitions. (*Energy Storage System*)

Energy Storage System (ESS). One or more components assembled together capable of storing energy and providing electrical energy into the premises wiring system or an electric power production and distribution network ~~for use at a future time. ESS(s) can include but is not limited to batteries, capacitors, and kinetic energy devices (e.g., flywheels and compressed air). These systems can have ac or dc output~~

~~for utilization and can include inverters and converters to change stored energy into electrical energy.~~

Informational Note No. 1: ESS(s) can include but is not limited to batteries, capacitors, and kinetic energy devices (e.g., flywheels and compressed air). Energy Storage Systems can include inverters or converters to change voltage levels or to make a change between an ac or a dc system.

Informational Note No. 2: These systems differ from other storage systems such as a UPS system, which is a power supply used to provide alternating current power to a load for some period of time in the event of a power failure.

~~Energy Storage System, Self-Contained.~~ *~~Energy storage systems where the components such as cells, batteries, or modules and any necessary controls, ventilation, illumination, fire suppression, or alarm systems are assembled, installed, and packaged into a singular energy storage container or unit.~~*

~~Informational Note:~~ ~~Self-contained systems will generally be manufactured by a single entity, tested and listed to safety standards relevant to the system, and readily connected on site to the electrical system and in the case of multiple systems to each other.~~

~~Energy Storage System, Pre-Engineered of Matched Components.~~ *~~Energy storage systems that are not self-contained systems but instead are pre-engineered and field-assembled using separate components supplied as a system by a singular entity that are matched and intended to be assembled as an energy storage system at the system installation site.~~*

~~Informational Note:~~ ~~Pre-engineered systems of matched components for field assembly as a system will generally be designed by a single entity and comprised of components that are tested and listed separately or as an assembly.~~

~~Energy Storage System, Other.~~ *~~Energy storage systems that are not self-contained or pre-engineered systems of matched components but instead are composed of individual components assembled as a system.~~*

~~Informational Note:~~ ~~Other systems will generally be comprised of different components combined on site to create an ESS. Those components would generally be tested and listed to safety standards relevant to the application.~~

706.4
Nameplates for Energy Storage Systems

Change at a Glance: New marking requirements (nameplate information) added for energy storage systems. Marking requirement in this revision correlates with the marking requirements found in UL 9540.

706.4 System ~~Classification~~ Requirements. (*Energy Storage Systems*)

Each ESS shall be ~~classified as one of the types described as follows~~ provided with a nameplate plainly visible after installation and marked with the following:

(1) ~~ESS, self-contained~~ Manufacturer's name, trademark, or other descriptive marking by which the organization responsible for supplying the ESS can be identified

~~**Informational Note:** Some self-contained systems may be listed.~~

(2) ~~ESS, pre-engineered of matched components~~ Rated frequency
(3) ~~ESS, other~~ Number of phases, if ac
(4) Rating (kW or kVA)
(5) Available fault current derived by the ESS at the output terminals
(6) Maximum output and input current of the ESS at the output terminals
(7) Maximum output and input voltage of the ESS at the output terminals
(8) Utility-interactive capability, if applicable

706.7
Maintenance of Energy Storage Systems (ESS)

Change at a Glance: New provisions added calling for maintenance of energy storage systems (ESS).

706.7 Maintenance. (*Energy Storage Systems*)

Energy storage systems shall be maintained in proper and safe operating condition. The required maintenance shall be in accordance with the manufacturer's requirements and industry standards. A written record of the system maintenance shall be kept and shall include records of repairs and replacements necessary to maintain the system in proper and safe operating condition.

Informational Note: For information related to general electrical equipment maintenance and developing an effective electrical preventive maintenance (EPM)

program, see NFPA 70B-2016 Recommended Practice for Electrical Equipment Maintenance or ANSI/NETA ATS-2017, Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.

706.9
Maximum Voltage of an ESS

Change at a Glance: New section added to provide prescriptive requirements for the determination of maximum voltage of an ESS.

706.9 Maximum Voltage. (*Energy Storage Systems*)

The maximum voltage of an ESS shall be the rated ESS input and output voltage(s) indicated on the ESS nameplate(s) or system listing.

706.30(A)(1)
Nameplate-Rated Circuit Current

Change at a Glance: Revision occurred to clarify that an ESS may have two nameplates, each respectively indicating input or output circuit rating, or one nameplate showing input and output circuit ratings.

~~706.20~~ 706.30 Circuit Sizing and Current. (*Energy Storage Systems*)

(A) Maximum Rated Current for a Specific Circuit. The maximum current for the specific circuit shall be calculated in accordance with ~~706.20~~ 706.30(A)(1) through (A)(5).

(1) Nameplate-Rated Circuit Current. ~~The nameplate(s)-rated~~ Circuit current shall be the rated current indicated on the ESS nameplate(s) or system listing ~~for pre-engineered or self-contained systems of matched components intended for field assembly as a system.~~ Where the ESS has separate input (charge) and output (discharge) circuits or ratings, these shall be considered individually. Where the same terminals on the ESS are used for charging and discharging, the rated current shall be the greater of the two.

708 – Critical Operations Power Systems (COPS)

708.24(D)
Bypass Isolation Automatic Transfer Switches

Change at a Glance: New List Item (D) added to address bypass isolation automatic transfer switches where necessary for a designated COPS building.

708.24 Transfer Equipment. [*Critical Operations Power Systems (COPS)*]

(A) General. *(See NEC for complete Code text)*

(B) Bypass Isolation Switches. *(See NEC for complete Code text)*

(C) Automatic Transfer Switches. *(See NEC for complete Code text)*

(D) Bypass Isolation Automatic Transfer Switches. Where loads are supplied by only one automatic transfer switch, the automatic transfer switch shall include a bypass isolation switch to facilitate maintenance as required in 708.6(C) without jeopardizing continuity of power. When the bypass isolation transfer switch is in the bypass mode, either it shall automatically initiate transfer between power sources upon loss of the connected power source or it shall remain actively supervised by a qualified person who can manually initiate a transfer between power sources.

(E) Use. *(See NEC for complete Code text)*

(F) Documentation. *(See NEC for complete Code text)*

710 – Stand Alone Systems

710.15
Stand-Alone Systems With Three-Phase Applications

Change at a Glance: New *Code* language has been added at 710.15 to recognize that stand-alone systems can deliver power to three-phase applications as well as single-phase systems.

710.15 General. (*Stand-Alone Systems*)

Premises wiring systems shall be adequate to meet the requirements of this *Code* for similar installations supplied by a feeder or service. The wiring on the supply side of

the building or structure disconnecting means shall comply with the requirements of this *Code*, except as modified by 710.15(A) through ~~(F)~~(G).

(A) Supply Output. Power supply to premises wiring systems fed by stand-alone or isolated microgrid power sources shall be permitted to have less capacity than the calculated load. The capacity of the sum of all sources of the stand-alone supply shall be equal to or greater than the load posed by the largest single utilization equipment connected to the system. Calculated general lighting loads shall not be considered as a single load.

Informational Note: For general-use loads the system capacity can be calculated using the sum of the capacity of the firm sources, such as generators and ESS inverters. For specialty loads intended to be powered directly from a variable source, the capacity can be calculated using the sum of the variable sources, such as PV or wind inverters, or the combined capacity of both firm and variable sources.

(B) Sizing and Protection. The circuit conductors between a stand-alone source and a building or structure disconnecting means shall be sized based on the sum of the output ratings of the standalone source(s). For three-phase interconnections, the phase loads shall be controlled or balanced to be compatible with specifications of the sum of the power supply capacities.

(C) Single 120-Volt Supply. Stand-alone and isolated microgrid systems shall be permitted to supply 120 volts to single-phase, 3-wire, 120/240-volt service equipment or distribution panels where there are no 240-volt outlets and where there are no multiwire branch circuits. In all installations, the sum of the ratings of the power sources shall be less than the rating of the neutral bus in the service equipment. This equipment shall be marked with the following words or equivalent:

WARNING: SINGLE 120-VOLT SUPPLY. DO NOT CONNECT MULTIWIRE BRANCH CIRCUITS!

The warning sign(s) or label(s) shall comply with 110.21(B).

(D) Three-phase Supply. Stand-alone and microgrid systems shall be permitted to supply threephase, 3-wire or 4-wire systems.

(E) Energy Storage or Backup Power System Requirements. Energy storage or backup power supplies shall not be required.

(F) Back-fed Circuit Breakers. Plug-in-type back-fed circuit breakers connected to an interconnected supply shall be secured in accordance with 408.36(D). Circuit breakers marked “line” and “load” shall not be back-fed.

(G) Voltage and Frequency Control. The standalone or isolated microgrid supply shall be controlled so that voltage and frequency remain within suitable limits for the connected loads.

712 – Direct Current Microgrids

712.2
Grounded, Functionally

Change at a Glance: The term "Resistively Grounded" in Article 712 was revised to "Grounded, Functionally" to correlate with the same definition in Article 690.

712.2 Definitions. (*Direct Current Microgrids*)

The definitions in this section shall apply only within this article.

~~**Resistively**~~ **Grounded, Functionally.** A system ~~with a high-resistance connection between the current carrying conductors and the equipment grounding system~~ that has an electrical ground reference for operational purposes that is not solidly grounded.

Informational Note: Examples of operational reasons for functionally grounded systems include ground-fault detection and performance-related issues for some power sources.

712.10(B)
Building Directory for Direct Current Microgrids

Change at a Glance: New outdoor plaque or directory requirement added to denote all sources of dc power to a building installed at each outside service equipment location or at an approved readily visible location.

712.10 Directory. (*Direct Current Microgrids*)

(A) Source Directory. A permanent directory denoting all dc electric power sources operating to supply the dc microgrid shall be installed at each source location capable of acting as the primary dc source.

(B) Building Directory. A building supplied by a dc microgrid system shall have a permanent plaque or directory installed outside the building at each service equipment location or at an approved readily visible location. The plaque or directory shall denote the location of each power source disconnecting means on or in the building or be grouped with other plaques or directories for other on-site sources.

Exception: *Multiple power production sources that are grouped at one location shall be permitted to be identified as a group.*

725 – Class 1, Class 2, and Class 3 Remote-Control, Signaling, and Power-Limited Circuits

725.48(B)(1)
Class 1 Circuits and Power-Supply Circuits

Change at a Glance: Revision permits Class 1 circuits to share enclosure space with conductors of electric light, power, non–power-limited fire alarm and medium power network-powered broadband communications circuits as long as separated by a barrier.

725.48 Conductors of Different Circuits in the Same Cable, Cable Tray, Enclosure, or Raceway. (*Class 1, Class 2, and Class 3 Remote-Control, Signaling, and Power-Limited Circuits*)

Class 1 circuits shall be permitted to be installed with other circuits as specified in 725.48(A) and (B).

(A) Two or More Class 1 Circuits. *(see NEC for complete Code text)*

(B) Class 1 Circuits with Power-Supply Circuits. Class 1 circuits shall be permitted to be installed with power-supply conductors as specified in 725.48(B)(1) through (B)(4).

(1) In a Cable, Enclosure, or Raceway. Class 1 circuits and power-supply circuits shall be permitted to occupy the same cable, enclosure, or raceway without a barrier

only where the equipment powered is functionally associated. Class 1 circuits shall be permitted to be installed together with the conductors of electric light, power, non-power-limited fire alarm, and medium power network-powered broadband communications circuits where separated by a barrier.

725.144 and Table 725.144
Transmission of Power and Data

Change at a Glance: Extensive revision occurred for 725.144, Table 725.144, 725.144(A), and 725.144(B) dealing with transmission of power and data on Class 2, Class 3, Class 2-LP, or Class 3-LP cables.

725.144 Transmission of Power and Data (*Class 1, Class 2, and Class 3 Remote-Control, Signaling, and Power-Limited Circuits*)

725.144 Transmission of Power and Data. The ~~requirements of~~ Sections 725.144(A) and (B) shall apply to Class 2 and Class 3 circuits that transmit power and data to a powered device. ~~The requirements of Parts I and III of Article 725 and~~ Section 300.11 and Parts I and III of Article 725 shall apply to Class 2 and Class 3 circuits that transmit power and data. The conductors that carry power for the data circuits shall be copper. The current in the power circuit shall not exceed the current limitation of the connectors.

[See NEC for complete text of (6) informational notes following 725.144]

Table 725.144 Ampacities of Each Conductor in Amperes in 4-Pair Class 2 or Class 3 Data Balanced Twisted-Pair Cables Based on Copper Conductors at an Ambient Temperature of 30°C (86°F) with All Conductors in All Cables Carrying Current, 60°C (140°F), 75°C (167°F), and 90°C (194°F) Rated Cables

(See Illustrated table provided and NEC for complete text of Table 725.144 and informational notes)

(A) Use of Class 2 or Class 3 Cables to Transmit Power and Data. Where Types CL3P, CL2P, CL3R, CL2R, CL3, or CL2 transmit power and data, the ~~following shall apply, as applicable:~~ rated current per conductor of the power source shall not exceed ~~(1)~~ the ~~ampacity ratings~~ ampacities in Table 725.144 shall ~~apply to the nominal current~~ at an ambient temperature of 30°C (86°F). (2) For ambient temperatures above 30°C (86°F), the correction factors of ~~310.15(B)(2)~~ in Table 310.15(B) (1) or Equation 310.15(B) shall apply.

Exception: *Compliance with Table 725.144 shall not be required for installations where conductors are 24 AWG or larger and the rated current per conductor of the power source does not exceed 0.3 amperes.*

Informational Note: One example of the use of Class 2 cables is a network of closed-circuit TV cameras using 24 AWG, 60°C rated, Type CL2R, Category 5e ~~local area network (LAN) cables~~ balanced twisted-pair cabling.

(B) Use of Class 2-LP or Class 3-LP Cables to Transmit Power and Data. Types CL3PLP, CL2P-LP, CL3R-LP, CL2R-LP, CL3-LP, or CL2-LP shall be permitted to supply power to equipment ~~at~~ from a ~~current level~~ power source with a rated current per conductor up to the marked ampere limit located immediately following the suffix "-LP" and shall be permitted to transmit data to the equipment. Where the number of bundled LP cables is 192 or less and the selected ampacity of the cables in accordance with Table 725.144 exceeds the marked current limit of the cable, the ampacity determined from the table shall be permitted to be used. For ambient temperatures above 30°C (86°F), the correction factors of Table 310.15(B)(1) or Equation 310.15(B) shall apply. The Class 2-LP and Class 3-LP cables shall comply with the following, as applicable:

~~**Informational Note 1:** The "(xxA)" following the suffix -LP indicates the ampacity of each conductor in a cable.~~

~~**Informational Note 2:** An example of a limited power (LP) cable is a cable marked Type CL2- LP (0.5A), 23 AWG. A Type CL2- LP (0.5), 23 AWG could be used in any location where a Type CL2 could be used; however, the LP cable would be suitable for carrying up to 0.5 A per conductor, regardless of the number of cables in a bundle. If used in a 7-cable bundle, the same cable could carry up to 1.2 amperes per conductor.~~

(1) Cables with the suffix "-LP" shall be permitted to be installed in bundles, raceways, cable trays, communications raceways, and cable routing assemblies.
(2) Cables with the suffix "-LP" and a marked ~~ampere level~~ current limit shall follow the substitution hierarchy of Table 725.154 and Figure 725.154(A) for the cable type without the suffix "-LP" and without the marked ~~ampere level~~ current limit.
(3) System design shall be permitted by qualified persons under engineering supervision.

Informational Note: An example of a limited power (LP) cable is a cable marked Type CL2-LP (0.5A), 23 AWG.

760 – Fire Alarm Systems

760.121(B)
Fire Alarm Circuit Disconnect for Power-Limited Fire Alarm (PLFA) Circuits

Change at a Glance: New sentence added to permit the fire alarm branch-circuit disconnecting means for Power Limited Fire Alarm (PLFA) circuits to be secured in the "on" position.

760.121 Power Sources for PLFA Circuits. (*Fire Alarm Systems*)

(B) Branch Circuits. The branch circuit supplying the fire alarm equipment(s) shall supply no other loads. The location of the branch-circuit overcurrent protective device shall be permanently identified at the fire alarm control unit. The circuit disconnecting means shall have red identification, shall be accessible only to qualified personnel, and shall be identified as "FIRE ALARM CIRCUIT." The red identification shall not damage the overcurrent protective devices or obscure the manufacturer's markings. This branch circuit shall not be supplied through ground-fault circuit interrupters or arc-fault circuit interrupters. The fire alarm branch-circuit disconnecting means shall be permitted to be secured in the "on" position.

770 – Optical Fiber Cables

770.24
Optical Fiber Cable

Change at a Glance: Revision will require optical fiber cable to conform to all of 300.4 and 300.11 [*not just 300.4(D) through (G)*].

770.24 Mechanical Execution of Work. (*Optical Fiber Cable*)

Optical fiber cables shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal

building use. Such cables shall be secured by hardware, including straps, staples, cable ties, hangers, or similar fittings, designed and installed so as not to damage the cable. The installation shall also conform with to 300.~~4(D) through (G)~~ and 300.11. Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables in other spaces used for environmental air (plenums) shall be listed as having low smoke and heat release properties in accordance with 300.22(C).

Informational Note No. 1: Accepted industry practices are described in ~~ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling; ANSI/ NECA/FOA 301-2009, Standard for Installing and Testing Fiber Optic Cables; and other ANSI-approved installation standards.~~ ANSI/ TIA-568.0-D-2015, Generic Telecommunications Cabling for Customer Premises, and ANSI/TIA 568.3-D-2016; and Optical Fiber Cabling and Components Standard.

Informational Note No. 2: See ~~4.3.11.2.6.5 and 4.3.11.5.5.6 of~~ NFPA 90A-~~2012~~ 2018, Standard for the Installation of Air-Conditioning and Ventilating Systems, for discrete combustible components installed in accordance with 300.22(C).

Informational Note No. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber cable properties.

770.110(D)
Optical Fiber Cables in Cable Tray Systems

Change at a Glance: New section added permitting optical fiber cables to be installed in metal or listed nonmetallic cable tray systems.

770.110 Raceways and, Cable Routing Assemblies, and Cable Trays for Optical Fiber Cables.

(A) Types of Raceways. *(See NEC for complete text)*

(B) Raceway Fill for Optical Fiber Cables. *(See NEC for complete text)*

(C) Cable Routing Assemblies. *(See NEC for complete text)*

(D) Cable Trays. Optical fiber cables shall be permitted to be installed in metal or listed nonmetallic cable tray systems.

770.133(A) and (B)
Optical Fiber Cables and Electrical Conductors

Change at a Glance: The previous requirements of 770.133(A) that permitted optical fiber cables to occupy the same cable tray and raceway as conductors for electric light, power, Class 1, non-power-limited fire alarm, etc. (with five exceptions) has been reorganized and relocated throughout 770.133(A) and new 770.133(B) (with no exceptions).

770.133 Installation of Optical Fibers and Electrical Conductors.

(A) ~~With Conductors for Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, or Medium Power Network-Powered Broadband Communications Circuits~~ In Cable Trays and Raceways. ~~When optical fibers are within the same composite cable for electric light, power, Class 1, non–power-limited fire alarm, or medium- power network-powered broadband communications circuits operating at 1000 volts or less, they shall be permitted to be installed only where the functions of the optical fibers and the electrical conductors are associated.~~

Conductive optical fiber cables contained in an armored or metal-clad–type sheath and nonconductive optical fiber cables shall be permitted to occupy the same cable tray or raceway with conductors for electric light, power, Class 1, non–power-limited fire alarm, Type ITC, or medium- power network-powered broadband communications circuits operating at 1000 volts or less. Conductive optical fiber cables without an armored or metal-clad-type sheath shall not be permitted to occupy the same cable tray or raceway with conductors for electric light, power, Class 1, non–power-limited fire alarm, Type ITC, or medium- power network-powered broadband communications circuits, unless all of the conductors of electric light, power, Class 1, non-power-limited fire alarm, and medium-power network-powered broadband communications circuits are separated from all of the optical fiber cables by a permanent barrier or listed divider. *[last added text was previous 770.133(A) Ex. No. 5]*

~~Optical fibers in composite optical fiber cables containing only current-carrying conductors for electric light, power, or Class 1 circuits rated 1000 volts or less shall be permitted to occupy the same cabinet, cable tray, outlet box, panel, raceway, or other termination enclosure with conductors for electric light, power, or Class 1 circuits operating at 1000 volts or less.~~

~~Nonconductive optical fiber cables shall not be permitted to occupy the same cabinet, outlet box, panel, or similar enclosure housing the electrical terminations of an~~

~~electric light, power, Class 1, non-power-limited fire alarm, or medium-power network-powered broadband communications circuit.~~

[See 2017 NEC for complete text of (5) deleted exceptions]

(B) In Cabinets, Outlet Boxes, and Similar Enclosures. Nonconductive optical fiber cables shall not be permitted to occupy the same cabinet, outlet box, panel, or similar enclosure housing the electrical terminations of an electric light, power, Class 1, non-power-limited fire alarm, or medium-power network-powered broadband communications circuit unless one or more of the following conditions exist: *[was 4th paragraph of previous 770.133(A)]*

(1) The nonconductive optical fiber cables are functionally associated with the electric light, power, Class 1, non-power-limited fire alarm, or medium-power network-powered broadband communications circuit. *[was previous 770.133(A) Ex. No. 1]*
(2) The conductors for electric light, power, Class 1, non-power-limited fire alarm, Type ITC, or medium-power network-powered broadband communications circuits operate at 1000 volts or less.
(3) The nonconductive optical fiber cables and the electrical terminations of electric light, power, Class 1, non-power-limited fire alarm, or medium-power network-powered broadband communications circuit are installed in factory- or field-assembled control centers. *[was previous 770.133(A) Ex. No. 2]*
(4) The nonconductive optical fiber cables are installed in an industrial establishment where conditions of maintenance and supervision ensure that only qualified persons service the installation. *[was previous 770.133(A) Ex. No. 3]*

When optical fibers are within the same composite cable for electric light, power, Class 1, non-power-limited fire alarm, or medium-power network-powered broadband communications circuits operating at 1000 volts or less, they shall be permitted to be installed only where the functions of the optical fibers and the electrical conductors are associated. *[was 1st paragraph of previous 770.133(A)]*

Optical fibers in composite optical fiber cables containing only current-carrying conductors for electric light, power, or Class 1 circuits rated 1000 volts or less shall be permitted to occupy the same cabinet, cable tray, outlet box, panel, raceway, or other termination enclosure with conductors for electric light, power, or Class 1 circuits operating at 1000 volts or less. *[was 3rd paragraph of previous 770.133(A)]*

Optical fibers in composite optical fiber cables containing current-carrying conductors for electric light, power, or Class 1 circuits rated over 1000 volts shall be permitted to occupy the same cabinet, cable tray, outlet box, panel, raceway, or other termination enclosure with conductors for electric light, power, or Class 1 circuits in industrial

establishments, where conditions of maintenance and supervision ensure that only qualified persons service the installation. *[was previous 770.133(A) Ex. No. 4]*

Chapter 8. Communication System: Article 800-840

800 – General Requirements for Communications Systems

Article 800
General Requirements for Communications Systems

Change at a Glance: New Article 800 (General Requirements for Communications Systems) combines common requirements previously found in Articles 800, 820, 830 and 840 into a new "general" article that applies to all of these articles.

Article 800 General Requirements for Communications Systems

Part I. General

800.1 Scope. This article covers general requirements for communications systems. These general requirements apply to communication circuits, and equipment community antenna television and radio distribution systems, network-powered broadband communication systems, and premises-powered broadband communication systems unless modified by Articles 805, 820, 830, or 840.
800.2 Definitions.
800.3 Other Articles.
800.21 Access to Electrical Equipment Behind Panels Designed to Allow Access.
800.24 Mechanical Execution of Work. 800.25 Abandoned Cables.
800.26 Spread of Fire or Products of Combustion.
800.27 Temperature Limitations of Wires and Cables.

Part II. Wires and Cables Outside and Entering Buildings

800.44 Overhead (Aerial) Wires and Cables.
800.49 Metal Entrance Conduit Grounding.
800.53 Separation from Lightning Conductors.

Part III. Grounding Methods

800.100 Cable and Primary Protector Bonding and Grounding.
800.106 Primary Protector Grounding and Bonding at Mobile Homes. Part IV. Installation Methods Within Buildings
800.110 Raceways, Cable Routing Assemblies, and Cable Trays.
800.113 Installation of Wires, Cables, Cable Routing Assemblies, and Communications Raceways.
800.154 Applications of Listed Communications Wires, Cables, and Raceways, and Listed Cable Routing Assemblies. Table
800.154(a) Applications of Listed Communications Wires, Cables, and Network-Powered Broadband Communications System Cables in Buildings
Table 800.154(b) Applications of Listed Communications Raceways in Buildings.
Table 800.154(c) Applications of Listed Cable Routing Assemblies in Buildings.
800.179 Plenum, Riser, General-Purpose, and Limited Use Cables.

Part V. Listing Requirements

800.180 Grounding Devices.
800.182 Cable Routing Assemblies and Communications Raceways.
Table 800.182(a) Cable Routing Assembly Markings
Table 800.182(b) Communications Raceway Markings

(See NEC for complete text of Article)

800.2
Communications Circuit

Change at a Glance: The definition of a "Communications Circuit" was revised to remove the "list" of service types offered by a communications circuit.

800.2 Definitions. (*General Requirements for Communications Systems*)

Communications Circuit. The circuit that extends service ~~voice, audio, video, data, interactive services, telegraph (except radio), outside wiring for fire alarm and burglar alarm~~ from the communications utility or service provider to and including the

customer's communications equipment ~~up to and including terminal equipment such as a telephone, fax machine, or answering machine.~~

800.3
General Requirements for Communications Systems

Change at a Glance: New text was added to reinforce the independence of Article 800 and Chapter 8. Only those sections of Chapters 1 through 7 referenced in Article 800 shall apply to communications systems.

800.3 Other Articles. (*General Requirements for Communications Systems*)

Only those sections of Chapters 1 through 7 referenced in Chapter 8 shall apply to Chapter 8.

(A) Hazardous (Classified) Locations. ~~Communications~~ Circuits and equipment installed in a location that is classified in accordance with 500.5 and 505.5 shall comply with the applicable requirements of Chapter 5.

(B) Wiring in Ducts for Dust, Loose Stock, or Vapor Removal. The requirements of 300.22(A) shall apply.

(C) Equipment in Other Space Used for Environmental Air. The requirements of 300.22(C)(3) shall apply.

(D) Installation and Use. The requirements of 110.3(B) shall apply.

~~**(E) Network-Powered Broadband Communications Systems.** Article 830 shall apply to network- powered broadband communications systems.~~

~~**(F) Premises-Powered Broadband Communications Systems.** Article 840 shall apply to premises- powered broadband communications systems.~~

~~**(G)**~~ **(E) Optical Fiber Cable.** Where optical fiber cable is used, ~~either in whole or in part,~~ to provide a communications circuit within a building, Article 770 shall apply ~~to the installation of the optical fiber portion of the communications circuit.~~

~~**(H) Temperature Limitation of Conductors.** Section 310.15(A)(3) shall apply.~~

(F) Other Communications Systems. As appropriate for the system involved, communications systems shall also comply with the requirements of the following:

(1) Communications Circuits — Article 800
(**2**) Radio and Television Equipment — Article 810

(3) Community Antenna Television and Radio Distribution Systems — Article 820
(4) Network-Powered Broadband Communications Systems — Article 830
(5) Premises-Powered Broadband Communications Systems — Article 840

(G) Reconditioned Equipment. The requirements of 110.21(A)(2) shall apply.

800.27
Temperature Limitation of Wire and Cables

Change at a Glance: New section added to specify that no communication wire or cable be used in such a manner that its operating temperature exceeds that of its rating.

800.27 Temperature Limitation of Wire and Cables. (*General Requirements for Communications Systems*)

No wire or cable shall be used in such a manner that its operating temperature exceeds that of its rating.

800.44(C) and (D)
Overhead (Aerial) Communications Wires and Cables

Change at a Glance: Requirements were added for all communications circuits pertaining to attachment above-the-roof raceway mast and cables extending between buildings or structures.

800.44 Overhead (Aerial) Communications Wires and Cables. (*General Requirements for Communications Systems*)

Overhead (aerial) communications wires and cables entering buildings shall comply with 800.44(A) through and ~~(B)~~(D).

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017, National Electrical Safety Code, Part 2 Safety Rules for Overhead Lines.

(A) On Poles and In-Span. *(see NEC for complete Code text)*

(B) Above Roofs. *(see NEC for complete Code text)*

(C) On Masts. Overhead (aerial) communications and CATV type coaxial cables shall be permitted to be attached to an above-the-roof raceway mast that does not enclose or support conductors of electric light or power circuits.

(D) Between Buildings. Communications and CATV type coaxial cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified and shall have sufficient strength to withstand the loads to which they might be subjected.

Exception: *Where the coaxial cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they might be subjected.*

805 – Communications Circuits

805.179(D)
Limited Power (LP) Cables

Change at a Glance: Provisions were added at 805.179(D) to permit limited power (LP) cables to act as a substitute for Class 2 and Class 3 cables.

805.179 Communications Wires and Cables. (*Communications Circuits*)

Communications wires and cables shall be listed in accordance with 805.179(A) through (F) and marked in accordance with Table 805.179 and 805.179(G). Conductors in communications cables, other than coaxial cable, shall be copper. Communications wires and cables shall have a voltage rating of less than 300 volts. The insulation for the individual conductors, other than the outer conductor of a coaxial cable, shall be rated for 300 volts minimum. The cable voltage ratings shall not be marked on the cable or on the under-carpet communication wire. ~~Communications wires and cables shall have a temperature rating of not less than 60°C (140°F). The temperature rating shall be marked on the jacket of communications cables that have a temperature rating exceeding 60°C (140°F).~~

Exception: *Voltage markings shall be permitted where the cable has multiple listings and voltage marking is required for one or more of the listings.*

Informational Note: *Voltage markings on cables may be misinterpreted to suggest that the cables may be suitable for Class 1, electric light, and power applications.*

(D) Type CMP-LP, CMR-LP, CMG-LP, and CM-LP Limited Power (LP) Cables. Type CMP-LP, CMR-LP, CMG-LP, and CM-LP communications limited power cables shall be listed as suitable for carrying power and data up to a specified current limit for each conductor without exceeding the temperature rating of the cable where the cable is installed in cable bundles in free air or installed within a raceway, cable tray, or cable routing assembly. The cable shall be marked with the suffix "-LP(XXA)," where XX designates the current limit in amperes per conductor.

Informational Note: An example of the marking on a communications cable with an LP rating is "CMP-LP (0.6A) (75°C) 23AWG 4 pair" which indicates that it is a 4-pair plenum cable with 23 AWG conductors, a temperature rating of 75°C, and a current limit of 0.6 ampere.

840 – Premises-Powered Broadband Communications Systems

840.2
Premises-Powered Broadband Communications Systems

Change at a Glance: Two new definitions were added to 840.2 to define the terms "Broadband" and "Premises-Powered."

840.2 Definitions. (*Premises-Powered Broadband Communications Systems*)

The definitions in 805.2, and 820.2 shall apply. The definitions in this section shall apply only within Article 840.

Broadband. Wide bandwidth data transmission that transports multiple signals, protocols, and traffic types over various media types.

Premises-Powered. Using power provided locally from the premises.

840.94 and 840.102
Premises Circuits Leaving the Building

Change at a Glance: Two new sections (840.94 and 840.102) were added to Article 840 to provide requirements for premises-powered broadband communication system circuits when they leave the building to power equipment remote to that building.

840.94 Premises Circuits Leaving the Building. (*Premises-Powered Broadband Communications Systems*)

Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, 805.90 and 805.93 shall apply. Informational Note: See NFPA 780-2017, Standard for the Installation of Lightning Protection Systems, for the application of the term rolling sphere.

840.102 Premises Circuits Leaving the Building. Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, the installation of communications wires and cables shall comply with 800.100 and 800.106, and the installation of coaxial cables shall comply with 820.100 and 800.106.

Informational Note: See NFPA 780-2017, Standard for the Installation of Lightning Protection Systems, for the application of the term rolling sphere.

840.160
Premises-Powered Broadband Communication Systems

Change at a Glance: Revised text identifies listing provisions for communications cables, powered communications equipment, and the power source.

840.160 Powering Circuits. (*Premises-Powered Broadband Communication Systems*)

Communications cables listed in accordance with 805.179, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment listed in accordance with 805.170. The power source shall be listed in accordance with 840.170(G). Installation of the listed 4-pair

communications cables for a communications circuit or installation where 4-pair ~~Where the power supplied over a communications cable to communications equipment is greater than 60 watts, communication cables and the power circuit shall comply with 725.144 where~~ communications cables are substituted ~~used in place of~~ for Class 2 and Class 3 cables in accordance with 725.154(A) shall comply with 725.144.

Exception: *Installing communications cables in compliance with 725.144 shall not be required for listed 4-pair communications cables where the rated current of the power source does not exceed 0.3 amperes in any conductor 24 AWG or larger.*

Informational Note: A typical communications cable for this application is a 4-pair cable sometimes referred to as Category 5e (or higher) LAN cable or balanced twisted pair cable. These types of cables are often used to provide Ethernet- and Power over Ethernet (PoE)–type services. A large number of such powering cables bundled together can cause overheating of the wiring if not controlled as described in Table 725.144.

Chapter 9. Tables and Informative Annexes

Chapter 9, Notes to Tables, Note (2)
Complete Conduit or Tubing Systems

Change at a Glance: Revision to Note (2) now indicates that Table 1 does not apply to exposed wiring ***or cable*** when used in incomplete sections of conduit or tubing to protect from physical damage.

Chapter 9 Tables

Notes to Tables

(2) Table 1 applies only to complete conduit or tubing systems and is not intended to apply to sections of conduit or tubing used to protect exposed wiring and cable from physical damage.

Quiz Questions

1. **Meter-mounted transfer switches shall _____ for emergency system use.?**

   - be permitted
   - not be permitted
   - be solely used
   - contain optional provisions

2. **What emergency power system can now be used as an emergency power source?**

   - Geothermal
   - Nuclear
   - AC microgrid
   - DC microgrid

3. **Which of the following do not require a sign at the emergency disconnect of an on-site optional standby power source?**

   - One-and two-family dwelling units
   - Commercial installations
   - Industrial installations
   - None of the above

4. **An Energy Storage System (ESS) is defined as a system that?**

   - Operates over 50 volts AC
   - Operates over 60 volts DC
   - Has a capacity greater than 1kWh
   - Has a capacity greater than 3.6 kWh

5. **A nameplate for an ESS requires which of the following?**

   - Manufacturer's name
   - Rating
   - Max/min output current
   - All of the above

6. **Stand-alone systems can deliver power to?**

   - Single- phase systems
   - Three-phase systems
   - None of the above
   - Three-phase & single-phase systems

7. **The maximum voltage of an ESS shall be the rated ESS _____ indicated on the ESS nameplate(s) or system listing.?**

   - input voltage
   - output voltage
   - input and output voltage(s)

8. **What is called an electrical ground reference for operational purposes that is not solidly grounded?**

   - Grounded, Functionally
   - Resistively Grounded
   - Resistively, Functionally
   - Functionally Grounded

9. **Regarding DC mircogrids on buildings, what is required on the building directory plaque located at service equipment locations?**

   - DC shock hazards
   - Directory of all service equipment locations
   - Locations of AC disconnecting means
   - Locations of DC disconnecting means

10. **The fire alarm branch-circuit disconnecting means shall be permitted to be secured in the _____ position.**

    - “off”
    - “interim”
    - "on"
    - Any of the above

11. **Can optical fiber cables now be permitted to be installed in metal or listed nonmetallic cable tray systems?**

    - Yes
    - No
    - Only if isolated from other cables
    - None of the above

12. **New Article 800 combines common requirements previously found in Articles 800, 820, 830 and 840 into a new “general” article that applies to all of these articles, what is the subject?**

    - General Requirements for Optical cables
    - General Requirements for Communications Systems
    - General Requirements for Emergency Systems
    - General Requirements for Special Equipment

13. **What article should be referenced for radio & television equipment requirements?**

    - 810
    - 820
    - 830
    - 840

14. **What is the purpose of article 800.27?**

- To specify that no communication wire or cable be used in such a manner that its operating current exceeds that of its rating
- To specify that no communication wire or cable be used in such a manner that its operating voltage exceeds that of its rating
- To specify that no communication wire or cable be used in such a manner that its operating temperature exceeds that of its rating
- All of the above

15. **What is permitted to be attached to an above-the-roof raceway mast that does not enclose or support conductors of electric light or power circuits?**

- Overhead (aerial) communications cables
- Electric light cables
- CATV type coaxial cables
- Both A & C

16. **Communications wires and cables shall have a temperature rating of not less than?**

- 60°C (140°F)
- 0°C (-32°F)
- 100°C (212°F)
- Requirement was deleted

17. **What is defined as wide bandwidth data transmission that transports multiple signals, protocols, and traffic types over various media types?**

- Wi-Fi
- Premises-powered
- LAN

  Broadband

18. **What is the typical 4-pair communications cable used for Premises-Powered Broadband Communication Systems?**

- Base terminal conductors
- Category 5e (or higher) LAN cable
- Air terminal conductors
- CATV cable

19. **Informative Annex A is part of the NEC why?**

- Shows requirements
- References mandatory requirements
- Informational purposes only
- None of the above

20. **What informative annex is intended to provide a template and sample language for local jurisdictions.**

- Annex B
- Annex F
- Annex H
- Annex Z