

### Introduction to the Significant Changes to the 2008 & 2011 National Electric Code



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### Welcome

- Instructor  
Rick Massicott



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### House Keeping

- **Emergency Exits**
- Please silence cell phones



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# DISCLAIMER

The views expressed here are not the views of the following:

- IBEW Local 90
- IBEW
- NECA
- NJATC
- NFPA
- NEMA
- ANSI
- IAEI
- UL
- CT Dept. of Consumer Protection
- CT Dept. of Labor
- CT Dept. of Construction Services
- CT General Assembly
- International Code Council
- Any Manufacturer
- Rick's Wife

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**Which Edition**

- Significant changes to the 2008 NEC will be represented with the 2008 NEC in the upper left corner of the slide.
- Significant changes to the 2011 NEC will be represented with the 2011 NEC in the upper left corner of the slide.

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## How Many Changes Since 2005 ?

	Proposals	Comments
2008	3,688	2,349
2011	<u>5,016</u>	<u>2,910</u>
Total	8,704	5,259

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### 500.2 Definitions: Combustible Dust

- New definition for "Combustible Dust" added at 500.2
- Definition extracted from NFPA 499 (*Recommended Practice for the Classification of Combustible Dusts and of Hazardous Locations for Electrical Installations in Chemical Process Areas*)
- This definition for combustible dust has been added or revised in a number of other NFPA documents
- Previous editions of the Code did not have a definition included that mentioned dust size and diameter
- New definition will serve to aid the designer or engineer in determining classification of area

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### 501.5, 502.5, and 503.5 Deleted Text

Chapter 1 - General  
Chapter 2 - Wiring and Protection  
Chapter 3 - Wiring Methods and Materials  
Chapter 4 - Equipment for General Use

Applies generally to all electrical installations

Supplements or modifies Chapters 1 through 4

Chapter 5 - Special Occupancies  
Chapter 6 - Special Equipment  
Chapter 7 - Special Conditions

Section 90.3 already provides the requirements that Chapters 1 through 4 apply generally and those rules are often modified by Chapters 5, 6, and 7.

This revision removes first paragraph and exception in each article to eliminate the unnecessary redundancy.

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**501.30(B) Types of EGCs (Class I, Div 1 and 2)**

Flexible metal conduit and liquidtight flexible metal conduit installed in Class I, Division 1 and 2 locations must include an equipment bonding jumper of the wire type in compliance with 250.102

Equipment bonding jumper inside conduit

Class I, Division 2 locations

Equipment bonding jumper outside conduit

*Exception: Equipment bonding jumper permitted to be deleted where listed liquidtight flexible metal conduit 1.8 m (6 ft) or less in length, with fittings listed for grounding, is used with overcurrent protection in the circuit is 10 amperes or less and the load is not a power utilization load*

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**503.30(B) Types of Equipment Grounding Conductors**

Liquidtight flexible metal conduit shall not be used as the sole ground-fault current path.

Where equipment bonding jumpers (internal or external) are installed, they shall comply with 250.102.

Class III, Divisions 1 and 2 locations

Equipment bonding jumper inside conduit

Equipment bonding jumper outside conduit

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**501.140(B)(4) Flexible Cords (Class I, Div 1 and 2)**

Revisions were made to 501.140(B)(4) to clarify the difference in requirements for cord connectors and attachment plugs between a Class I, Division 1 and Class I, Division 2 location

Explosionproof box

Class I, Division 1 locations

Cord connector listed for Class I, Division 1 location

Flexible cord

In Division 1 locations or in Division 2 locations with boxes, fittings, or enclosures that are required to be explosionproof; the cord must be terminated with a cord connector or attachment plug listed for the location or a cord connector installed with a seal listed for the location

In Division 2 locations where explosionproof equipment is not required, the cord shall be terminated with a listed cord connector or listed attachment plug

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**503.10(A)(3) Flexible Wiring Methods (Class III, Division 1)**

In Class III, Division 1 locations where it is necessary to employ flexible connections, **one or more of the following shall be permitted:**

- (1) Dusttight flexible connectors
- (2) Liquidtight flexible metal conduit
- (3) Liquidtight flexible nonmetallic conduit with listed fittings,
- (4) Interlocked armor Type MC cable having an overall jacket of suitable polymeric material and installed with listed dusttight termination fittings,
- (5) Flexible cord in compliance with 503.140



For flexible connection purposes, interlocked armor Type MC cable with listed dusttight termination fittings is now a permitted wiring method for Class III, Division 1 locations

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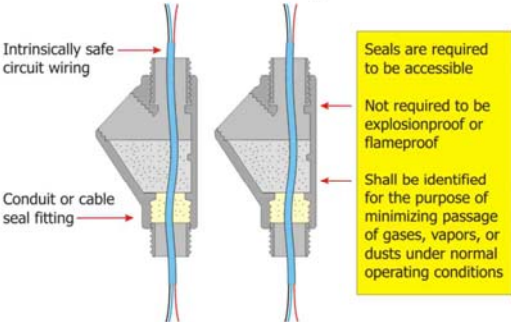
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**504.70 Sealing**



Intrinsically safe circuit wiring

Conduit or cable seal fitting

Seals are required to be accessible

Not required to be explosionproof or flameproof

Shall be identified for the purpose of minimizing passage of gases, vapors, or dusts under normal operating conditions

Conduit and cable seals for intrinsically safe circuits and wiring required to be sealed in accordance with 501.15, 502.15, 505.16, and 506.16, shall be sealed to minimize the passage of gases, vapors, or dusts.

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**511.2 and 511.3 Commercial Garages, Repair and Storage**

- Two new definitions of the terms *major repair garage* and *minor repair garage* have been added to create a new 511.2.
- Existing 511.3(A) and (B) have been rearranged in a more logical layout under the single heading of Area Classification.

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### 511.2 Major Repair Garage

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

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### 511.2 Minor Repair Garage

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

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### Table 514.3(B)(1) Class I Locations Motor Fuel Dispensing Facilities



- Revisions to Table 514.3(B)(1) have been implemented to coordinate with Table 8.3.1 of NFPA 30A (*Code for Motor Fuel Dispensing Facilities and Repair Garages*)
- This revision avoids conflicts between the *NEC* and NFPA 30A and recognizes the importance of consistent information
- Table 514.3(B)(1) in the *NEC* and Table 8.3.1 in NFPA 30A are now identical in their respective new editions
- Revised Table 514.3(B)(1) more clearly incorporates the Zone classification system

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**514.11 Circuit Disconnects (Motor Fuel Dispensing Facilities)**

Circuit disconnects must open simultaneously all conductors of the associated power (including any grounded conductor), communication, data, and video circuits supplying the dispensers

Handle ties on single-pole breakers are not acceptable for this purpose

This same basic change of adding communication, data, and video circuits to the disconnecting means requirement also occurred at 514.13 (Provisions for Maintenance and Servicing of Dispensing Equipment)

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**514.11 Circuit Disconnects (Motor Fuel Dispensing Facilities)**

- **(A) General.** Each circuit leading to or through dispensing equipment, including all associated power, communication, data, and video circuits, and equipment for remote pumping systems, shall be provided with a clearly identified and readily accessible switch or other approved means, located remote from the dispensing devices, to disconnect simultaneously from the source of supply, all conductors of the circuits, including the grounded conductor, if any.
- Single-pole breakers utilizing handle ties shall not be permitted.

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**517.2 Patient Care Vicinity**

- 517.2 Patient Care Vicinity. In an area in which patients are normally cared for, the patient care vicinity is the space with surfaces likely to be contacted by the patient or an attendant who can touch the patient. Typically in a patient room, this encloses a space within the room not less than 1.8 m (6 ft) beyond the perimeter of the bed in its nominal location, and extending vertically not less than 2.3 m (7-1/2 ft) above the floor. [NFPA 99:3.3.140]

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**517.2 Wet Procedure Location**

- The word *procedure* has been incorporated into the definition of *wet location* in 517.2 and in Sections 517.20(A) and 517.60 FPN.
- The defined term *wet procedure location* is provided under the general definition of *patient care area*.
- This change assist users with more specific and unique characteristics associated with health care facility procedures that produce wet conditions, such as operating room activity.
- Differentiates from the term *wet location* in Article 100.

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### 517.13(B) Grounding of Receptacles (Patient Care Areas of Health Care Facilities)

The following shall be **directly** connected to an insulated copper EGC that is installed with the branch-circuit conductors in the wiring methods as provided in 517.13(A)

- (1) The grounding terminals of all receptacles
- (2) Metal boxes and enclosures containing receptacles
- (3) All non-current-carrying conductive surfaces of fixed electrical equipment likely to become energized that are subject to personal contact, operating at over 100 volts

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- 517.13(B) rearranged for clarity and usability
- Metal box required to be directly connected to the insulated copper EGC required for grounding at patient care areas

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### 517.16 Receptacles with IG Terminals (Patient Care Areas - Health Care Facilities)

The installation of isolated grounding-type receptacles in patient care areas of health care facilities is now prohibited

Two effective ground-fault current paths required in patient care areas in accordance with 517.13

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Receptacles with insulated grounding terminals, as described in 250.146(D), shall **not be permitted**

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### 517.17(B) Feeder GFP (Health Care Facilities)

Where ground-fault protection is provided as specified by 230.95 or 215.10, an additional step of GFP is required in all next level feeder disconnecting means downstream toward the load

Additional levels of GFP shall not be installed as follows:

- (1) On the load side of an essential electrical system transfer switch
- (2) Between the on-site generating unit(s) described in 517.35(B) and the essential electrical system transfer switch(es)
- (3) On electrical systems that are not solidly grounded wye systems (greater than 150 volts to 600 volts phase-to-phase)

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**517.18(A) Patient Bed Locations**

Each patient bed location shall be supplied by at least two branch circuits, one from the emergency system and one from the normal system

The branch circuit serving patient bed locations shall not be part of a multiwire branch circuit

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**517.18(B) Patient Bed Location Receptacles**

"Quadruplex" has been added to the acceptable configuration of receptacles required at patient bed locations of health care facilities

Single      Duplex      Quadruplex

Each patient bed location to be provided with a minimum of four receptacles Permitted to be single, duplex, quadruplex, or any combination of the three All receptacles shall be listed "hospital grade" and so identified Connected to an insulated copper equipment grounding conductor

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**517.32(E) Generator Set and Transfer Switch Location**

Task illumination battery charger for battery-powered lighting unit(s) and selected receptacles is required at the generator set location and the transfer switch location.

Transfer switch location      Generator location

Note: Emergency lighting is often necessary for troubleshooting generators and transfer switches under emergency conditions.

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**517.32(F) Life Safety Branch**

- A new list item (F) covering generator accessories has been added to 517.32.
- (F) Generator set accessories as required for generator performance.
- Generator set accessories such as crankcase heaters, coolant heaters, lights, receptacles, and so forth, are permitted to be connected to the life safety branch where required for generator performance.

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**517.34(A) Equipment for Delayed Automatic Connection**

- (7) Supply, return, and exhaust ventilating systems for operating and delivery rooms.
- All ventilation systems for operating and delivery rooms are permitted to be connected to the equipment branch by delayed automatic connection.

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**517.63(A) Battery-Powered Lighting Units**

Battery-powered lighting units in anesthetizing locations are permitted to be connected to the critical lighting circuits and the word "emergency" and the reference to 700.12(F) were eliminated

**Battery-Powered Emergency Lighting Units** - One or more battery-powered emergency lighting units to be provided and permitted to be wired to the critical lighting circuit in the area and connected ahead of any local switches

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**517.160(A)(5) Conductor Identification**

Isolated power system circuit conductors are required to be identified by the colors specified in 517.160(A)(5) and include a distinctive colored stripe other than white, green, or gray.

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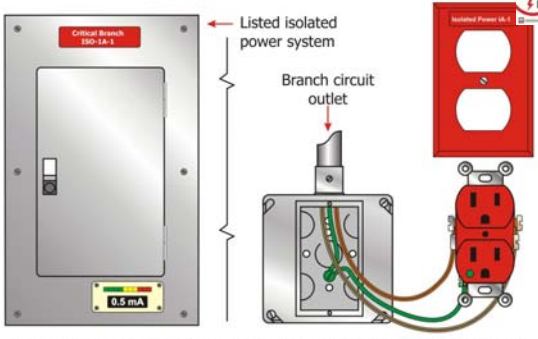
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**517.160(A)(5) Conductor Identification** 



Isolated power system circuit conductors required to be identified by colors specified in 517.160(A)(5) and include **at least one** distinctive colored stripe (other than white, green, or gray) **along the entire length of the conductor**

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**518.3(B) Temporary Wiring (Assembly Occupancies)** 

- All GFCI requirements of the Code apply to temporary display booths at assembly occupancies (*excluding GFCI requirements for temporary wiring*)
- Temporary wiring for display booths set up in convention centers or exhibit halls (*places of assembly*) is permitted to be installed in accordance with Article 590 (*Temporary Installations*)
- GFCI requirements of 590.6 (*GFCI requirements for temporary wiring installations*) do not apply to these display booth installations
- All other GFCI requirements of the Code do apply (*receptacles near sinks, adjacent to pools, vending machines, etc.*)

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**520.27(B) Neutral Conductor** 

- Section 520.27(B) has been structured into a list format to improve clarity and usability.
- The neutral conductor of feeders supplying solid-state, phase-control 3-phase, 4-wire dimming systems shall be considered as a current-carrying conductor for derating purposes.
- The neutral conductor of a solid-state, sine wave 3-phase, 4-wire dimming system does not have to be considered as a current-carrying conductor for derating purposes.

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**Article 522 Control Systems for Permanent Amusement Attractions**

- Control Systems for Permanent Amusement Attractions

Part I. General  
Part II. Control Circuits  
Part III. Control Circuit Wiring Methods

- The article covers requirements for control circuit power sources, conductors, and associated control wiring in or on all structures that are part of a permanent amusement attraction.

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**525.2 New Definitions**

**Operator.** The individual responsible for starting, stopping, and controlling an amusement ride or supervising a concession.

**Portable Structures.** Units designed to be moved including, but not limited to, amusement rides, attractions, concessions, tents, trailers, trucks, and similar units.

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**525.11 Multiple Sources of Supply**

Where separate power sources supply portable structures located less than 3.7 m (12 ft) apart, the equipment grounding conductors of all sources of supply shall be bonded together at the portable structures.

Less than 3.7 m (12 ft) apart

Bonding conductor not smaller than 6 AWG

Separate power sources, services, or combination

The size of the bonding conductor shall be not less than the values in Table 250.122 based on the rating of the largest overcurrent device supplying the structures, but not smaller than 6 AWG.

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**547.5(G) GFCI - Agricultural Buildings**

The omission of GFCI protection for an accessible receptacle supplying a dedicated load (located within 900 mm (3 ft) of a GFCI-protected receptacle) at agricultural buildings has been deleted.

All 125-volt, single-phase, 15- and 20-ampere general-purpose receptacles installed in agricultural building locations below shall have GFCI protection:

- Areas having an equipotential plane
- Damp or wet locations
- Dirt confinement areas for livestock
- Outdoors

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**547.9(A)(10) and 547.9(E)**

Utility Poles

Site-isolating device

Required to be identified as a site-isolating device

Permanent plaque or directory is required where site is supplied by more than one service and any of the services are less than 150 m (500 ft) apart

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**547.10 FPN No. 2 and 547.10(A)**

- A new fine print note has been added to clarify the required locations of equipotential planes associated with indoor and outdoor agricultural facilities.
- Equipotential planes are required to be installed in concrete slabs only in livestock confinement areas that contain metal parts that may become energized and are accessible to livestock.

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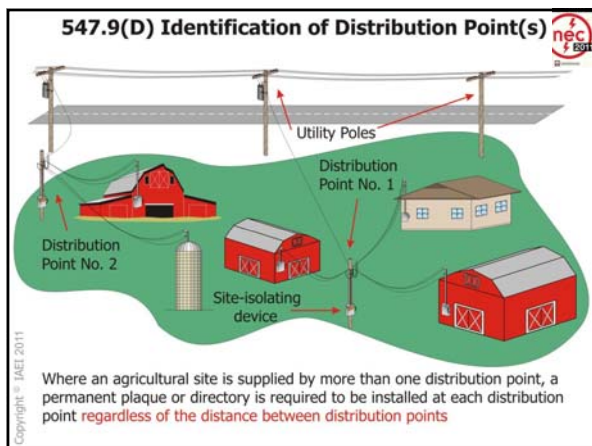
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**550.13(B) GFCIs (Mobile and Manufactured Homes)**

All 125-volt, single-phase, 15- and 20-ampere receptacle outlets installed in the following locations shall be provided with GFCI protection:

- (1) Outdoors;
- (2) In compartments accessible from outside the unit;
- (3) Bathrooms (including receptacles in luminaires);
- (4) Kitchen countertop receptacles;
- (5) Receptacle outlets located within 1.8 m (6 ft) of a wet bar sink

The exceptions in 210.8(A) shall be permitted



Overhead cut-away view of mobile home or manufactured home

⚡ = Required GFCI protected receptacles

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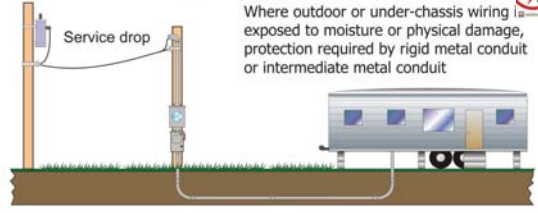
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**550.15(H) Under-Chassis Wiring**

Where outdoor or under-chassis wiring is exposed to moisture or physical damage, protection required by rigid metal conduit or intermediate metal conduit



- (1) Where closely routed against frames and equipment enclosures, reinforced thermosetting resin conduit (RTRC) listed for above ground use, Type MI cable, electrical metallic tubing or rigid polyvinyl chloride conduit (PVC) shall be permitted
- (2) Where extending vertically from a direct burial depth of at least 457 mm (18 in.) below grade and terminated to a factory installed conduit or enclosure, Schedule 80 PVC, or reinforced thermosetting resin conduit (RTRC) listed for exposure to physical damage permitted

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**550.25 AFCIs (Mobile and Manufactured Homes)**

All 120-volt branch circuits that supply 15- and 20-ampere outlets installed in family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, or similar rooms or areas of mobile homes and manufactured homes shall comply with 210.12 (AFCI)



Overhead cut-away view of mobile home or manufactured home

Red = Outlets requiring AFCI-protected branch circuits

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**551.4 General Requirements**

- Sections 551.4(A) and (B) now recognize 208Y/120-volt power sources for recreational vehicles and RV park services, feeders, and branch circuits.

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**552.44(D) Labeling at Electrical Entrance**

Labeling information on park trailers includes 208Y/120-Volt supplies in addition to 120/240-Volt supplies

THIS CONNECTION IS FOR 110-125-VOLT AC, 60 HZ, 30 AMPERE SUPPLY

Or

THIS CONNECTION IS FOR 208Y/120-VOLT OR 120/240-VOLT AC, 60 HZ, \_\_\_\_\_ AMPERE SUPPLY

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**555.3 Ground-Fault Protection (Marinas and Boatyards)**

GFCI protection on the main overcurrent protective device servicing a marina or boatyard is required or individual GFCI protection on each branch circuit or feeder is required

**555.3 Ground-Fault Protection:**

The main overcurrent protective device which feeds the marina shall have ground-fault protection not exceeding 100 mA

Ground-fault protection of each individual branch or feeder circuit shall be permitted as a suitable alternative

Courtesy of Eaton

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**555.9 Electrical Connections**

- A new second sentence has been added to 555.9 to expand the requirements for conductor splices at marina piers.
- **Conductor splices, within approved junction boxes, utilizing sealed wire connector systems listed and identified for submersion shall be permitted where located above the waterline but below the electrical datum plane field for floating piers.**

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**Table 555.12 Demand Factors**  
Load Calculations for Service and Feeder Conductors  
Marinas and Boatyards

Number of Shore Power Receptacles	Sum of the Rating of the Receptacles (%)
1-4	100
5-8	90
9-14	80
15-30	70
31-40	60
41-50	50
51-70	40
71-plus	30

Notes: (See NEC for text)

Table 555.12 has been revised to clearly indicate that the receptacles addressed by this table are shore power receptacles only

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**555.13(B)(4)(b) Portable Power Cables**

- A **listed marine power outlet employing terminal blocks/bars** is permitted in lieu of a required junction box when portable power cables are used for a wiring method at a marina or boatyard
- Whenever portable power cables are used at a marina or boatyard, the portable power cable must generally terminate in an approved junction box
- Revision will now permit a listed marine power outlet employing terminal blocks/bars in lieu of this required junction box
- Previous language required each section of a floating pier supplying pedestals for feeder extensions to the individual boats to include a junction box, regardless if the junction box is needed or not

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**555.21 Motor Fuel Dispensing Stations – Hazardous (Classified) Locations**

- The revision clarifies the extent of the Class I, Divisions 1 and 2 locations at docks, piers, and wharfs.
- Closed Construction.
- (a) The space above the surface of the floating dock, pier, or wharf shall be a Class I, Division 2 location with distances identified in Table 514.3(B)(1), Dispenser and Outdoor.
- (b) The space below the surface of a floating dock, pier, or wharf, having areas or enclosures such as tubs, voids, pits, vaults, boxes, depressions, fuel piping chases, or similar spaces where flammable liquid or vapor can accumulate shall be a Class I, Division 1 location.

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**555.21 Motor Fuel Dispensing Stations – Hazardous (Classified) Locations (cont.)**

- Open Construction.
- The area 450 mm (18 in.) above the surface of the dock, pier, or wharf and extending 6.0 m (20 ft) horizontally in all directions from the outside edge of the dispenser and down to the water level shall be Class I, Division 2.
- Enclosures such as tubs, voids, pits, vaults, boxes, depressions, fuel piping chases, or similar spaces where flammable liquid or vapor can accumulate within 6.0 m (20 ft) of the dispenser shall be a Class I, Division 1 location.

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**590.4(D) Receptacles**

- The second sentence has been revised to provide more specific criteria for the branch-circuit equipment grounding conductors connected to receptacles.
- Circuits for temporary wiring are required to include an equipment grounding conductor meeting the requirements in 250.118 and connected to the receptacle grounding conductor terminal.

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**590.4(D) Receptacles (Temporary Installations)**

In-use covers for receptacles installed in wet locations on an enclosure supported from grade will now require hood covers of the "extra-duty" type

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All 15- and 20-ampere, 125- and 250-volt receptacles installed in a wet location shall comply with 406.9(B)(1)

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**590.6 Ground-Fault Protection for Personnel**

Ground-fault protection for temporary wiring shall be provided to comply with 590.6(A) and 590.6(B).

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GFCI requirement applies to power derived from electric utility sources as well as power sources derived from an onsite generated power sources.

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### 590.6 Ground-Fault Protection for Personnel

590.6 has been revised into a more "user-friendly" format and will require receptacles on generators (15 kW or smaller) to have **integral GFCI protection**. This revision will also require **"in-use" covers** and **weather-resistant type receptacles** in damp and wet locations at construction sites.

590.6 Ground-Fault Protection for Personnel

(A) Receptacle Outlets

- (1) Receptacle Outlets Not Part of Permanent Wiring
- (2) Receptacle Outlets Existing or Installed as Permanent Wiring
- (3) Receptacles on 15 kW or less Portable Generators

(B) Use of Other Outlets

- (1) GFCI Protection
- (2) Assured Equipment Grounding Conductor Program



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## Chapter Six



### Special Equipment

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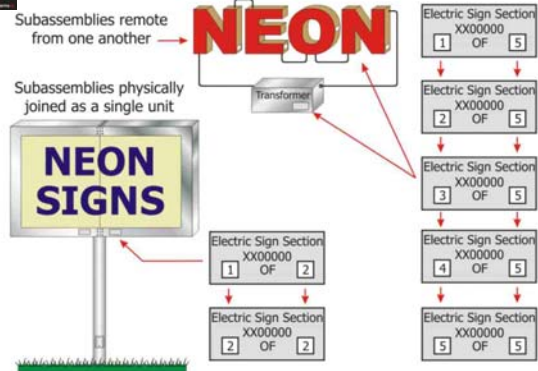
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### 600.2 Section Sign



Subassemblies remote from one another →

Subassemblies physically joined as a single unit

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**600.4 Markings - Electric Signs and Outline Lighting**

Signs and outline lighting systems required to be marked with such things as manufacturer's name, trademark, input voltage and current rating, maximum allowable lamp wattage per lampholder, and other means of identification



Markings and listing labels are not required to be visible after installation but must be permanently applied in a location visible during servicing

Marking and labels must be permanent, durable and when in wet locations shall be weatherproof

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**600.4 Markings  
(Electric Signs and Outline Lighting)**

- (A) **Signs and Outline Lighting Systems.** Signs and outline lighting systems shall be marked with the manufacturer's name, trademark, or other means of identification; and input voltage and current rating.
- (B) **Signs with Lampholders for Incandescent Lamps.** Signs and outline lighting systems with lampholders for incandescent lamps shall be marked to indicate the maximum allowable lamp wattage per lampholder. The markings shall be permanently installed, in letters at least 6 mm (¼ in.) high, and shall be located where visible during relamping.
- (C) **Visibility.** The markings required in (A) and listing labels shall not be required to be visible after installation but must be permanently applied in a location visible during servicing.
- (D) **Durability.** Marking labels shall be permanent, durable and, when in wet locations, shall be weatherproof.
- (E) **Section Signs.** Section signs shall be marked to indicate that field-wiring and installation instructions are required.




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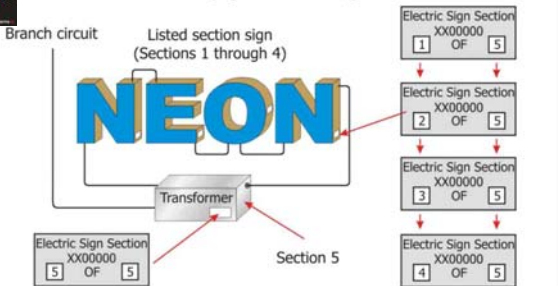
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**600.4(C) Section Signs**



Section signs are required to be marked to indicate that field-wiring and installation instructions are required [600.4(C)].

Listed equipment is required to be installed in accordance with installation instructions included in the listing [110.3(B)].

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### 600.5(B) Branch Circuit Ratings

Branch circuits that supply signs shall be considered to be continuous loads for the purposes of calculations

Fluorescent lamps  
NEON SIGNS  
Portable signs  
LED letters on raceway  
NEON SIGNS  
Sectional signs (individual letters)  
Field-installed skeleton neon tubing

Branch circuits supplying neon tubing installations shall not be rated greater than 30 amperes  
Branch circuits that supply all other signs and outline lighting systems shall not be rated greater than 20 amperes

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### 600.7 Bonding of Metal Parts (Signs)

Neon (with high voltage step up transformer)  
Metal parts of signs and outline lighting systems are generally required to be bonded together and to the associated transformer or power-supply equipment grounding conductor  
Nonmetallic raceway  
14 AWG bonding conductor not required for Class 2 power source  
Primary circuit with EGC

New exception eliminates the requirements for bonding of remote sections of a sign supplied by a Class 2 power source

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### 600.7 Bonding of Metal Parts (Signs)

LED sign  
Metal parts of signs and outline lighting systems are generally required to be bonded together and to the associated transformer or power-supply equipment grounding conductor  
Nonmetallic raceway with Class 2 wiring  
24 volt dc  
Class 2 Power Supply for LED Sign  
14 AWG bonding conductor not required for Class 2 power source  
Primary circuit with EGC

New exception eliminates the requirements for bonding of remote sections of a sign supplied by a Class 2 power source

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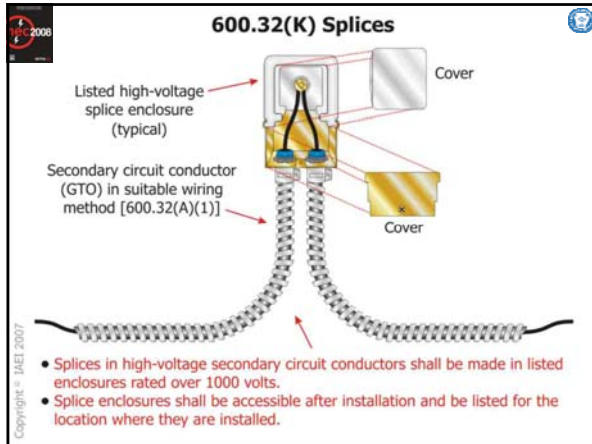
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### 600.33 LED Signs

**600.33 LED Sign Illumination Systems, Secondary Wiring (Electric Signs and Outline Lighting)**

The wiring methods and materials shall be installed in accordance with the sign manufacturer's installation instructions using any applicable wiring methods from Chapter 3 and the requirements for Class 2 circuits contained in Part III of Article 725.

- (A) Insulation and Sizing of Class 2 Conductors
- (B) Installation
- (C) Protection Against Physical Damage
- (D) Grounding and Bonding

(See NEC for complete text)



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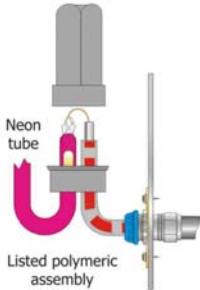
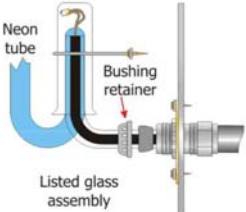
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### 600.42(A) Points of Transition

Listed assemblies are required at points of transition between neon high-voltage secondary conductors and the electrode connections at the tubing.



Listed assemblies are required to be suitable for the location where they are installed [110.3(B)]

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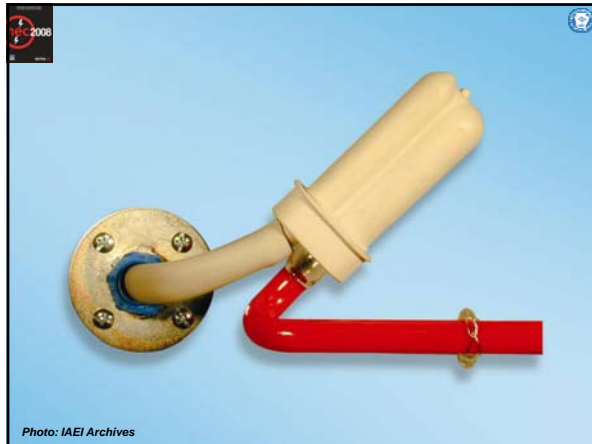
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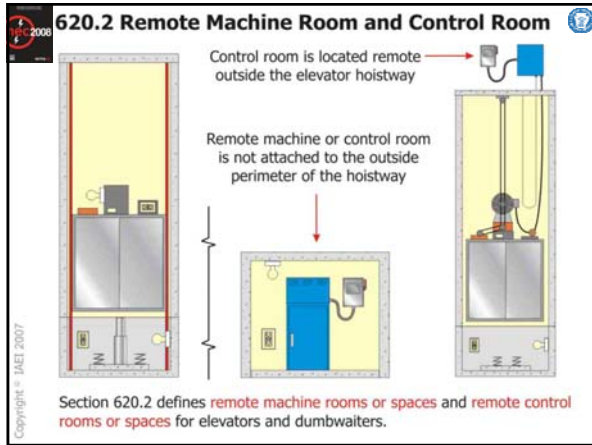
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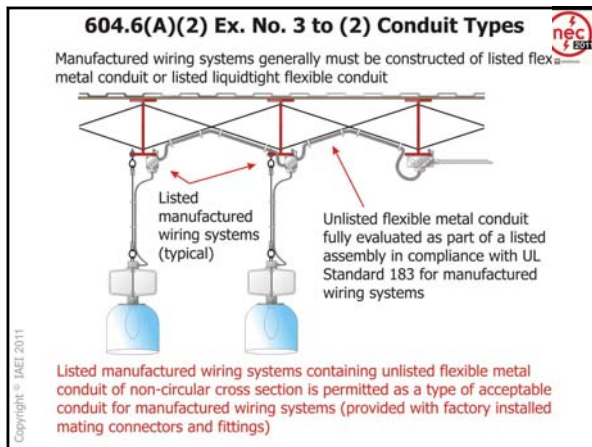
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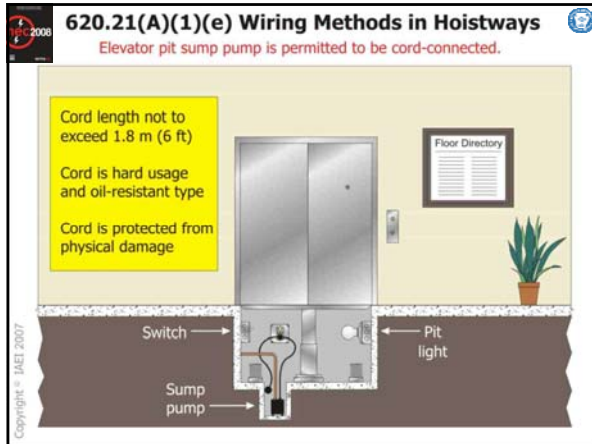
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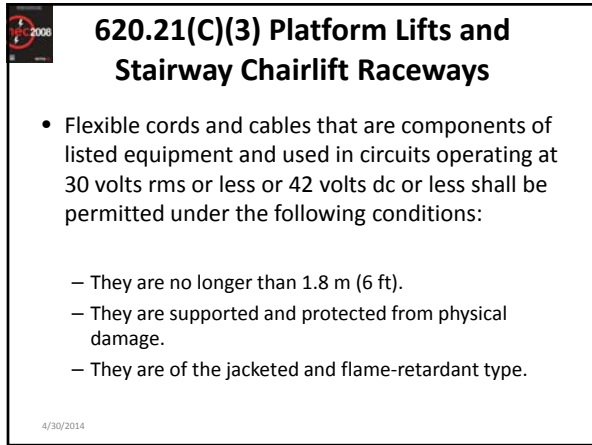
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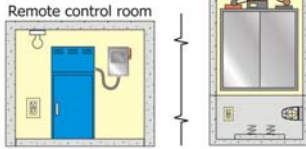
### 620.53 Exception (Elevator Disconnecting Means)

Elevators generally required to have a single means for disconnecting all ungrounded car light, receptacle(s), and ventilation power-supply conductors for that elevator car

A new exception has been added to permit the disconnecting means for an elevator to be in accordance with 430.109(C) where the circuit employs a stationary motor of 2-hp or less

430.109(C) permits as a disconnecting means the use of:

- (1) a general-use switch
- (2) general-use snap switch suitable only for use on ac where the motor FLA rating is not more than 80% of the ampere rating of the switch, or
- (3) a listed manual motor controller having a hp rating not less than the rating of the motor and marked "Suitable as Motor Disconnect"



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### 625.2 Definitions: Electric Vehicle

**Electric Vehicle:** An automotive-type vehicle for on-road use primarily powered by an electric motor that draws current from a rechargeable storage battery, fuel cell, photovoltaic array, or other source of electric current

Plug-in hybrid electric vehicles (PHEV) are considered electric vehicles



The definition of an "Electric Vehicle" has been revised to include a "Plug-in Hybrid Electric Vehicle" (PHEV)

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### 625.2 Definitions: RESS

**Rechargeable Energy Storage System:** Any power source that has the capability to be charged and discharged

**Informational Note:** Batteries, capacitors, and electro mechanical flywheels are examples of rechargeable energy storage systems



A new definition has been added to Article 625 for "Rechargeable Energy Storage System"

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 **Article 626 Electrified Truck Parking Space**

- This new article resulted from concerns of regulatory agencies and environmental groups about reducing idling truck emissions.
- Part I. General
- Part II. Electrified Truck Parking Space Electrical Wiring Systems
- Part III. Electrified Truck Parking Space Supply Equipment
- Part IV. Transport Refrigerated Units (TRUs)

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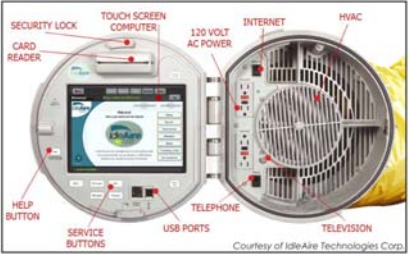
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**626.24(B)(1) Electrified Truck Parking Space** 

**Receptacles:** Each electrified truck parking space must be equipped with a **maximum of three** receptacles, each 2-pole, 3-wire grounding type and rated 20 amperes, 125 volts, and **two of the three** connected to **two separate** branch circuits



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Revised language permits the use of conventional GFCI duplex receptacles for GFCI protection of electrified truck parking spaces

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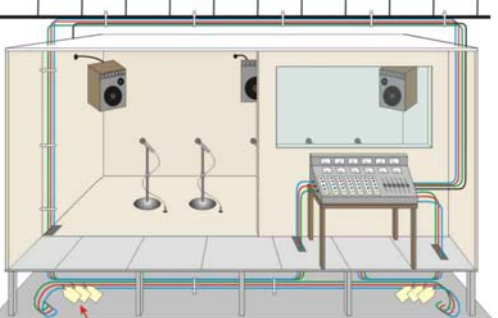
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**640.6 Mechanical Execution of Work** 



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Audio cables installed for future use must be identified with a tag of sufficient durability to withstand the environment involved. Cable ties are recognized as a means to secure audio cables.

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**645.2 Definition** 

- Abandoned Supply Circuits and Interconnecting Cables.
- Installed **supply circuits and interconnecting cables** that are not terminated at equipment and not identified for future use with a tag.

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**645.2 Definitions:**

**Information Technology Equipment Room**

- **Information Technology Equipment Room.** A room within the information technology equipment area that contains the information technology equipment. [75:3.3.9].
- **Informational Note:** Text that is followed by a reference in brackets has been extracted from NFPA 75-2009, *Standard for the Protection of Information Technology Equipment*. Only editorial changes were made to the extracted text to make it consistent with this Code.
- A new definition for "Information Technology Equipment Room" and an Informational Note have been added to Article 645



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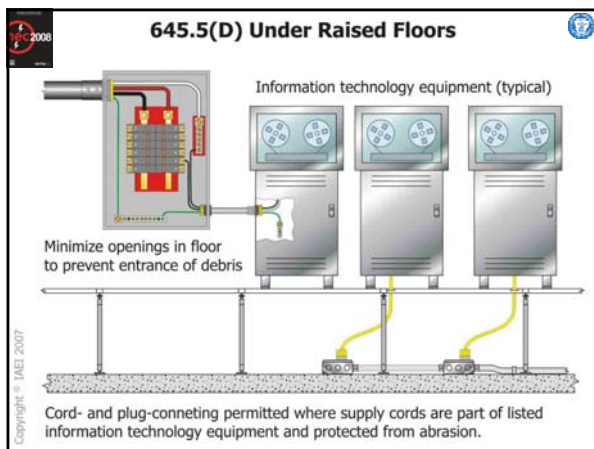
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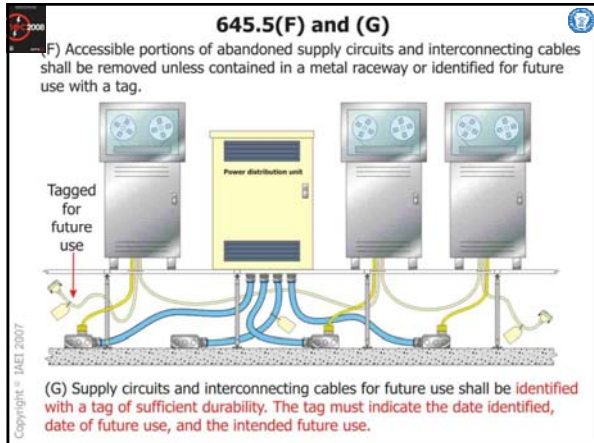
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## 645.10 Disconnecting Means

- Disconnecting means requirements for IT equipment rooms has been revised
- Single disconnecting means actuator permitted to be located at an approved alternative location
- 645.10 has been completely restructured by creating two new Items (A) and (B)
- New 645.10(A) (*Remote Disconnect Controls*) has nearly the same requirements as the 2008 *NEC*, except the placement of the Emergency Power Off (EPO) actuator can be located in any approved alternative location, as opposed to limiting the location at the principal exit doors per prior language
- New 645.10(B) is the highest level of criticality for the operations and is classed as a "Critical Operations Data System"

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**645.25 Engineering Supervision (IT Equipment)**

A new section has been added to allow alternative feeder and service load calculations under engineering supervision for IT equipment



As an alternative to the feeder and service load calculations required by Parts III and IV of Article 220, feeder and service load calculations for new or existing loads shall be permitted to be used if performed by qualified persons under engineering supervision

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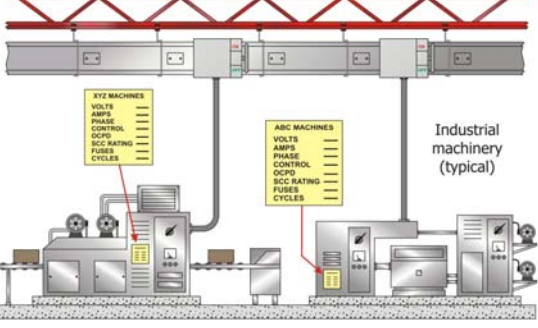
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**670.5 Short-Circuit Current Rating**

New section added requiring industrial machinery to be installed only where available fault current does not exceed its marked short-circuit current rating



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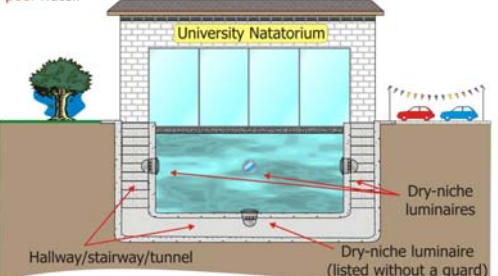
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**680.2 Definitions: Dry-Niche Luminaire**

**Dry-Niche Luminaire** - A luminaire intended for installation in the floor or wall of a pool, spa, or fountain in a niche that is sealed against the entry of pool water.



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The definition of a dry-niche luminaire was revised to permit installation in the floor or wall of a pool, spa, or fountain

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**680.12 Maintenance Disconnecting Means**

Approved disconnecting mean(s) must simultaneously disconnect all ungrounded conductors of the circuit.

Disconnecting mean(s) must be located a minimum of 1.5 m (5 ft) from inside wall of pool, spa, or hot tub

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**Table 680.10 Underground Wiring Location**

- Nonmetallic raceways listed for direct burial located under 100 mm (4 in.) of concrete were added to Table 680.10 [minimum burial depth of 150 mm (6 in.)]
- Previous language only addressed nonmetallic raceways listed for direct burial without concrete encasement [minimum burial depth of 450 mm (18 in.)]
- Underground wiring depth requirements within 1.5 m (5 ft) of outdoor swimming pools, spas or hot tubs, etc., are covered by 680.10 and companion Table 680.10

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**Table 680.10 Minimum Cover Depths**

Wiring Method	Minimum Cover	
	mm	in.
Rigid metal conduit	150	6
Intermediate metal conduit	150	6
Nonmetallic raceways listed for direct burial under minimum of 102 mm (4 in.) thick concrete exterior slab and extending not less than 162 mm (6 in.) beyond the underground installation	150	6
Nonmetallic raceways listed for direct burial without concrete encasement	450	18
Other approved raceways	450	18

\*Raceways approved for burial only where concrete encased shall require a concrete envelope not less than 50 mm (2 in.) thick.

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**680.22(B) GFCI Protection**

All 15 or 20-ampere, 125- or 250-volt, single-phase outlets supplying pool pump motors require GFCI protection whether supplied by a receptacle and cord connection or hard-wired to the branch-circuit outlet.

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**680.22(E) and FPN – Other Outlets**

- A new subdivision (E) and fine print note have been added to 680.22.
- Other outlets shall not be less than 3.0 m (10 ft) from the inside walls of the pool.
- Measurements shall conform to 680.22(A)(5).
- Other outlets include, but are not limited to, remote-control, signaling, fire alarm, and communications outlets.

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**680.25(A) Feeder Wiring Methods**

Aluminum conduit is not permitted to be installed for feeders in pool areas where subject to corrosion.

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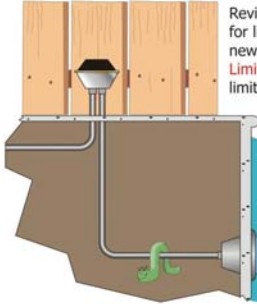
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**680.23(A)(3) GFCI - Underwater Luminaires** 



Revisions eliminate GFCI requirements for listed low-voltage luminaires meeting new definition of "Low Voltage Contact Limit", which replaces the previous voltage limit for GFCI protection of "over 15 volts"

GFCI protection required in the branch circuit supplying luminaires operating at more than the low voltage contact limit such that there is no shock hazard during relamping

**Low Voltage Contact Limit** - A voltage not exceeding the following values: (1) 15 volts (RMS) for sinusoidal ac, (2) 21.2 volts peak for nonsinusoidal ac, (3) 30 volts for continuous dc, or (4) 12.4 volts peak for dc that is interrupted at a rate of 10 to 200 Hz

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**680.26(B)(1)(b)(1) Copper Conductor Grid Equipotential Bonding (Permanent Pools)** 

- The copper conductor grid (if employed) is required to be bonded at all points of crossing in accordance with 250.8 or other approved means
- Previous language gave no details as to how to accomplish this bonding of the conductors "at all points of crossing"
- Revision to this section now states that this "bonding at all points of crossing" is to be accomplished in accordance with 250.8 or other approved means
- 250.8 (*Connection of Grounding and Bonding Equipment*) details eight acceptable methods of bonding components together (*listed pressure connectors, exothermic welding process, terminal bars, etc.*)

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**680.26(B)(1)(b)(2) Copper Conductor Grid Equipotential Bonding (Permanent Pools)** 

- The copper conductor grid (if employed) is required to be bonded at all points of crossing and it must conform to the contour of the pool, not the pool deck
- Previous language required the copper conductor grid to "conform to the contour of the pool and the pool deck"
- The phrase "and the pool deck" has been deleted from this requirement
- This will help further the division of the conductive pool shell (belly steel) and the perimeter surface (deck steel)
- The copper conductor grid system applies to the conductive pool shell only

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### 680.26(B)(1)(b) Copper Conductor Grid Equipotential Bonding for Conductive Pool Shell

The diagram shows a cross-section of an in-ground pool. On the left, there is a wooden deck with encapsulated structural steel. A copper conductor grid is shown bonded to the pool shell and extending under the pool deck. On the right, an 8 AWG copper conductor is shown bonding the perimeter surface of the pool shell. The pool is labeled 'In-ground pool (Side view)'. A copyright notice 'Copyright © IAEI 2011' is on the left.

Copper conductor grid for bonding conductive pool shell shall be min. 8 AWG bare solid copper conductors bonded to each other at all points of crossing and conform to the contour of the pool and the pool deck

The bonding shall be in accordance with 250.8 or other approved means

Arranged in a 300 mm (12 in.) by 300 mm (12 in.) network, uniformly spaced in a perpendicular grid pattern with a tolerance of 100 mm (4 in.) and secured within or under the pool 150 mm (6 in.) from the outer contour of the pool shell

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### 680.26(B)(2) Bonded Parts of Perimeter Surface

The diagram shows a cross-section of a pool with a permanent wall on the right side. The wall is 1.5 m (5 ft) in height. The perimeter surface is bonded to the pool shell. A copyright notice 'Copyright © IAEI 2011' is on the left.

The perimeter surface shall extend for 1 m (3 ft) horizontally beyond the inside walls of the pool and shall include unpaved surfaces as well as poured concrete surfaces and other types of paving

Permanent wall 1.5 m (5 ft) in height

Perimeter surfaces less than 1 m (3 ft) separated by a permanent wall or building 1.5 m (5 ft) in height or more shall require equipotential bonding on the pool side of the permanent wall or building

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### 680.26(B)(7) Fixed Metal Parts

The diagram shows a cross-section of a pool with a permanently installed pool. Fixed metal parts are shown bonded to the equipotential bonding grid. A copyright notice 'Copyright © IAEI 2011' is on the left.

All fixed metal parts within 1.5 m (5 ft) horizontally and 3.7 m (12 ft) vertically of permanently installed pools must be bonded to the equipotential bonding grid

This would include but not limited to metal sheathed cables and raceways, metal piping, metal awnings, metal fences, and metal door and window frames

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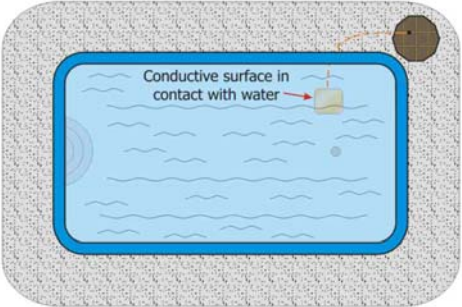
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**680.26(C) Bonding of Pool Water**

An intentional bond of a minimum conductive surface area of 5806 mm<sup>2</sup> (9 in.<sup>2</sup>) shall be installed in contact with the pool water.



Conductive surface in contact with water

Nonconductive pool shell in the ground (top view)

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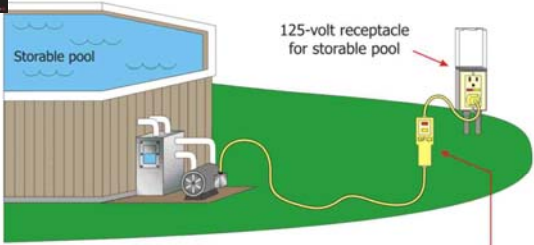
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**680.31 Pumps**



Storable pool

125-volt receptacle for storable pool

- Cord- and plug-connected filter pumps shall be provided with a ground-fault circuit interrupter that is an integral part of the attachment plug or located in the power supply cord within 300 mm (12 in.) of attachment plug.
- All 125-volt receptacles located within 6.0 m (20 ft) of the inside walls of a storable pool shall be protected by ground-fault circuit-interrupter protection

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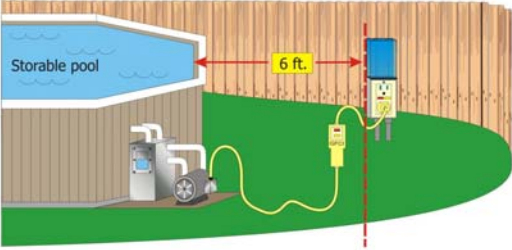
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**680.32 GFCI Requirements - Storable Pools**

Revisions occurred to 680.32 to more clearly defined the receptacles required to comply with GFCI protection requirements



Storable pool

6 ft

All 125-volt, 15- and 20-ampere receptacles located within 6.0 m (20 ft) of the inside walls of a storable pool shall be GFCI-protected

Receptacles shall not be located less than 1.83 m (6 ft) from the inside walls of a storable pool [680.34]

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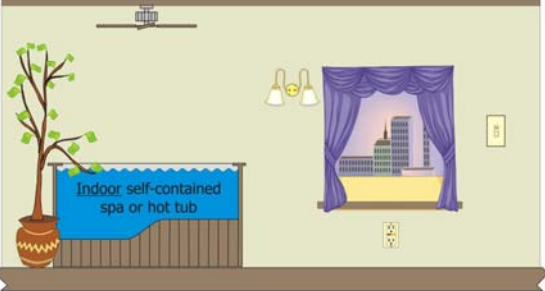
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**680.43 Ex. No. 2 Indoor Spas and Hot Tubs** 



Indoor self-contained spa or hot tub

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A new Ex. No. 2 was added to 680.43 specifying that equipotential bonding requirements for listed self-contained spa or hot tub installed indoors above a finished floor is not required

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**680.43, Ex. No. 2 Indoor Installations (Spas and Hot Tubs)** 

A spa or hot tub installed indoors shall comply with the provisions of Parts I and II of this article except as modified by this section and shall be connected by the wiring methods of Chapter 3.

**Exception No. 1:** Listed spa and hot tub packaged units rated 20 amperes or less shall be permitted to be cord-and-plug-connected to facilitate the removal or disconnection of the unit for maintenance and repair.

**Exception No. 2:** The equipotential bonding requirements for perimeter surfaces in 680.26(B)(2) shall not apply to a listed self-contained spa or hot tub installed above the finished floor.

- A new exception to 680.43 eliminates equipotential bonding requirements for listed self-contained spa or hot tub installed indoors above the finished floor

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**680.62 Exception: Bonding of Therapeutic Tubs** 

Therapeutic tubs in normal use or that are fastened or otherwise secured at a specific location, including associated piping systems are generally required to be bonded



Small conductive surfaces not likely to become energized, such as air and water jets, drain fittings not connected to metallic piping, towel bars, mirror frames, and similar non-electrical equipment not connected to metal framing, shall not be required to be bonded

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**680.71 Protection**

- Hydromassage bathtubs and their associated electrical components shall be on an individual branch circuit(s) and protected by a readily accessible ground-fault circuit interrupter.
- All 125-volt, single-phase receptacles not exceeding 30 amperes and located within 1.83 m (6 ft) measured horizontally of the inside walls of a hydromassage tub shall be protected by a ground-fault circuit interrupter(s).

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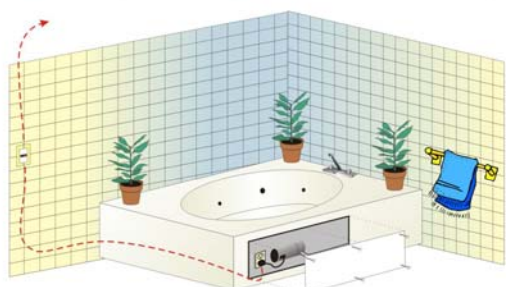
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**680.73 Hydromassage Bathtub - Accessibility**



A receptacle for a cord- and plug-connected hydromassage bathtub, located under the tub and accessible only through an access opening, must be installed so that the receptacle face is within direct view from the access opening and located not more than 300 mm (1 ft) from the opening.

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**680.74 Bonding**

- A new last sentence clarifies the bonding requirements for hydromassage bathtubs.
- Bonding applies to all metal piping systems and all grounded metal parts in contact with the circulating water.
- The 8 AWG or larger solid copper bonding jumper is required for equipotential bonding in the hydromassage bathtub area.
- The bonding jumper is not required to be extended to any remote panelboard, service equipment, or grounding electrode.

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### 680.74 Hydromassage Bathtub - Bonding

All metal piping systems and all grounded metal parts in contact with the circulating water shall be bonded together using a solid copper bonding jumper, insulated, covered, or bare, not smaller than 8 AWG

Double insulated pump motor

An 8 AWG or larger solid copper bonding jumper long enough to terminate on a replacement non-double insulated pump motor is required when a double insulated pump motor is employed at a hydromassage bathtub

This bonding jumper is to terminate to the equipment grounding conductor of the branch circuit of the motor

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### 682.14(A) Type of Disconnecting Means

Disconnecting means for floating structure

1.5 m (5 ft) min.

Floating structure

Keith's Fishing Pier

Disconnecting means for a floating structure or submersible electrical equipment is permitted to consist of circuit breakers, switches, or both that simultaneously open all ungrounded circuit conductors, and is properly identified as to the structure or equipment it controls.

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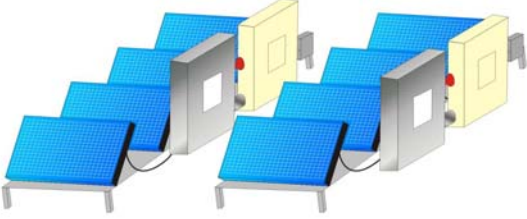
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**690.4(A) Installation - Photovoltaic Systems** 

Photovoltaic system(s) shall be permitted to supply a building or other structure in addition to any other electricity supply system(s)



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More than one photovoltaic (PV) system can serve a building or structure as well as other sources of electrical supply

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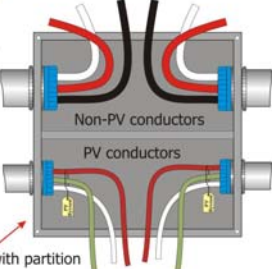
**690.4(B) Conductors of Different Systems** 

Photovoltaic modules

New requirements for separation and marking requirements for photovoltaic (PV) circuits installed in a building or structure were added at 690.4(B)

PV system conductors not to be mixed with non-PV conductors unless:

- Separated by a partition
- Identified and grouped
- Identified by color coding, marking tape, tagging
- Identified at all points of termination, connection, and splices



Junction box with partition

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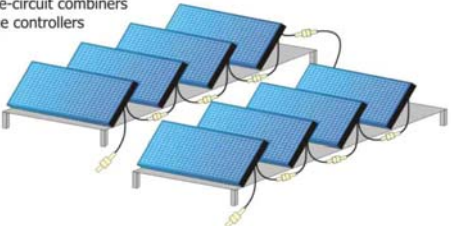
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**690.4(D) Equipment**  

Required to be listed and identified for the application:

- Inverters
- Motor generators
- Photovoltaic modules
- Photovoltaic panels
- AC photovoltaic modules
- Source-circuit combiners
- Charge controllers



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### 690.4(E) Wiring and Connections (Solar Photovoltaic Systems)



**(E) Wiring and Connections.** The equipment and systems in 690.4(A) through (D) and all associated wiring and interconnections shall be installed only by qualified persons.

**Informational Note:** See Article 100 for the definition of *qualified person*.

- “Qualified persons” required to perform the described work on Photovoltaic (PV) systems

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### 690.4(E) Wiring and Connections



“Qualified persons” required to perform the described work on photovoltaic (PV) systems



**Qualified Person:** One who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved

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### 690.4(F) Circuit Routing (Solar Photovoltaic Systems)



- New requirements were added for visibility and roof marking requirements on certain PV circuits
- Firefighting community has expressed concern about the safety of ventilating roofs where PV circuits are present
- Routing PV circuits along the building structural members will lower probability that the structural members will be compromised by the firefighting process during a fire
- When PV module system circuits are integrated into the roof, PV associated circuits are to be clearly marked on the surface of the roof as a visual aid for firefighters and other maintenance personnel

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**690.4(F) Circuit Routing  
(Solar Photovoltaic Systems)**



- **(F) Circuit Routing.** Photovoltaic source and PV output conductors, in and out of conduit, and inside of a building or structure, shall be routed along building structural members such as beams, rafters, trusses, and columns where the location of those structural members can be determined by observation. Where circuits are imbedded in built-up, laminate, or membrane roofing materials in roof areas not covered by PV modules and associated equipment, the location of circuits shall be clearly marked.

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**690.4(H) Multiple Inverters  
(Solar Photovoltaic Systems)**



**(H) Multiple Inverters.** A PV system shall be permitted to have multiple utility-interactive inverters installed in or on a single building or structure. Where the inverters are remotely located from each other, a directory in accordance with 705.10 shall be installed at each dc PV system disconnecting means, each ac disconnecting means and at the main service disconnecting means showing the location of all ac and dc PV system disconnecting means in the building.

*Exception:* A directory shall not be required where all inverters and PV dc disconnecting means are grouped at the main service disconnecting means.

- **New provisions for more than one utility-interactive inverter on a building or structure have been added**

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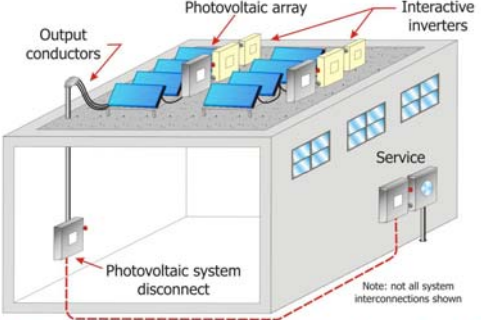
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**690.4(H) Multiple Inverters (PV Systems)**

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A PV system is permitted to have multiple utility-interactive inverters installed in or on a single building or structure

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**690.31(F) Flexible, Fine-Stranded Cables**

Flexible fine-stranded cable

Listed lugs

Flexible, fine-stranded cable shall be terminated only with terminals, lugs, devices, or connectors that are listed and identified for such use.

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**690.10(E) Back-Fed Circuit Breakers (Stand-Alone PV Systems)**

- New requirements were put in place to ensure that plug-in-type back-fed circuit breakers used with stand-alone solar photovoltaic systems (PV) are secured in place
- Previous language specified that listed plug-in-type circuit breakers back-fed from utility-interactive inverters were permitted to omit the additional fastener normally required by 408.36(D) (*Panelboard Back-Fed Devices*)
- New provisions will now require plug-in-type back-fed circuit breakers connected to a stand-alone inverter output to be secured in accordance with 408.36(D)
- 408.36(D) requires plug-in-type back-fed overcurrent protection devices to be secured in place by an “additional fastener” that requires other than a pull to release the device from the mounting means (*bus bar*)

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**690.10(E) Back-Fed Circuit Breakers (PV Systems)**

Plug-in-type overcurrent protection devices for stand-alone PV systems that are back-fed and used to terminate field-installed ungrounded supply conductors are required to be secured in place by an “additional fastener” that requires other than a pull to release the device from the mounting means on the panel

Note: not all system interconnections shown

Branch circuit(s)

From photovoltaic system source

Back-fed circuit breaker

Identified fastener for back-fed circuit breaker

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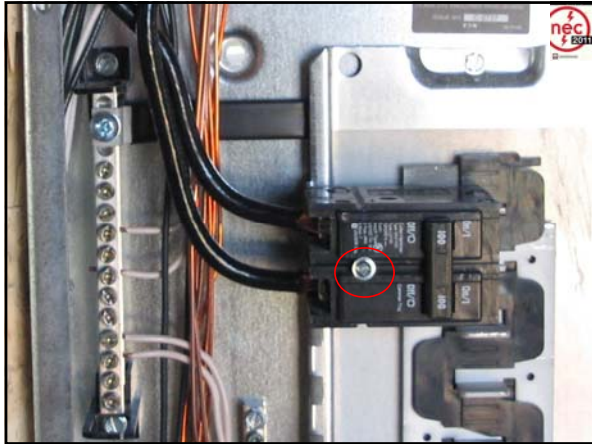
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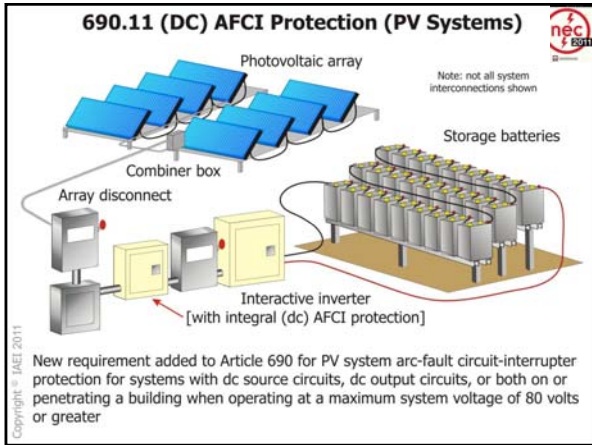
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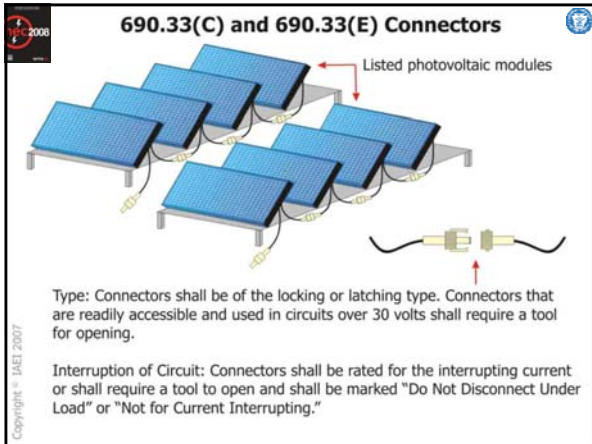
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### 690.43 Equipment Grounding (PV Systems)

Equipment grounding conductors and devices shall comply with (A) through (F)

- (A) Equipment Grounding Required
- (B) Equipment Grounding Conductor Required
- (C) Structure as Equipment Grounding Conductor
- (D) PV Mounting Systems and Devices
- (E) Adjacent Modules
- (F) All Conductors Together



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The equipment grounding requirements for PV systems have also been rearranged and revised for clarity and usability

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### 690.45(B) and FPN

- (B) Ground-Fault Protection **Not** Provided.
- For **other than dwelling units** where ground-fault protection is not provided in accordance with 690.5(A) through (C), **each equipment grounding conductor shall have an ampacity of at least two (2) times the temperature and conduit fill corrected circuit conductor ampacity.**
- Note: The short-circuit current of photovoltaic modules and photovoltaic sources is slightly above the full-load normal output rating.

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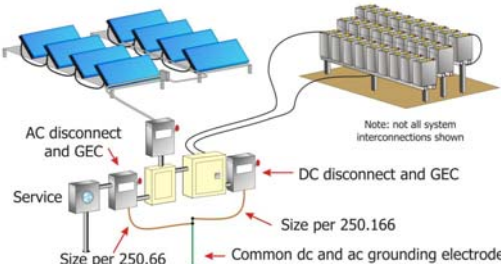
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### 690.47(C) Systems with Alternating Current and Direct-Current Grounding Requirements



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Grounding electrode system requirements for PV systems with both ac and dc grounding electrode systems have been revised

If both ac and dc systems are installed, they must be bonded together or utilize of a common electrode system

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**690.53 Direct-Current Power Source**



Photovoltaic modules

A permanent label is required for the direct-current power source to indicate the following:

- (1) Rated maximum power-point current
- (2) Rated maximum power-point voltage
- (3) Maximum system voltage
- (4) Short-circuit current
- (5) Maximum rated output current of the charge controller (if installed)

Locate field-installed label at the photovoltaic source disconnecting means

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**Article 694 Small Wind Electric Systems**

- Part I - General
- Part II - Circuit Requirements
- Part III - Disconnecting Means
- Part IV - Wiring Methods
- Part V - Grounding
- Part VI - Marking
- Part VII - Connection to Other Sources
- Part VIII - Storage Batteries
- Part IX - Systems Over 600 Volts



A new article was added covering requirement for small wind electric systems

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### 695.3 Power Source(s) for Fire Pumps

A revision of 695.3 provides a more logical approach to the power sources for fire pumps while providing correlation between Article 695 and NFPA 20

- (A) Individual Sources
  - (1) Electric Utility Service Connection
  - (2) On-Site Power Production Facility
  - (3) Dedicated Feeder
- (B) Multiple Sources
  - (1) Individual Sources
  - (2) Individual Source and On-site Standby Generator
- (C) Multibuilding Campus-Style Complexes
  - (1) Feeder Sources
  - (2) Feeder and Alternate Source
  - (3) Selective Coordination
- (D) On-Site Standby Generator as Alternate Source
  - (1) Capacity
  - (2) Connection
  - (3) Adjacent Disconnects
- (E) Arrangement
- (F) Phase Converters

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### 695.4 Continuity of Power (Fire Pumps)

Circuits that supply electric motor-driven fire pumps shall be supervised from inadvertent disconnection as covered in 695.4(A) or (B)

- (A) Direct Connection
- (B) Connection Through Disconnecting Means and Overcurrent Device
  - (1) Number of Disconnecting Means
    - (a) General
    - (b) Feeder Sources
    - (c) On-Site Standby Generator
  - (2) Overcurrent Device Selection
    - (a) Individual Sources
    - (b) On-Site Standby Generators
  - (3) Disconnecting Means
    - (a) Features and Location
    - (b) Disconnect Marking
    - (c) Controller Marking
    - (d) Supervision

695.4 was revised to make it more usable and to remove the perceived conflicts  
Titles have been provided to better direct the users to the specific rule that applies to the specific installation of fire pumps

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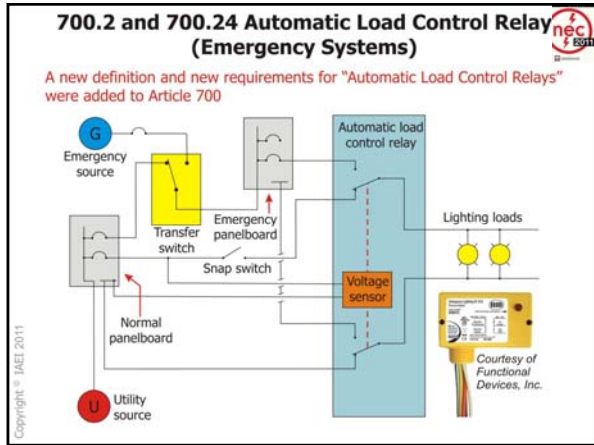
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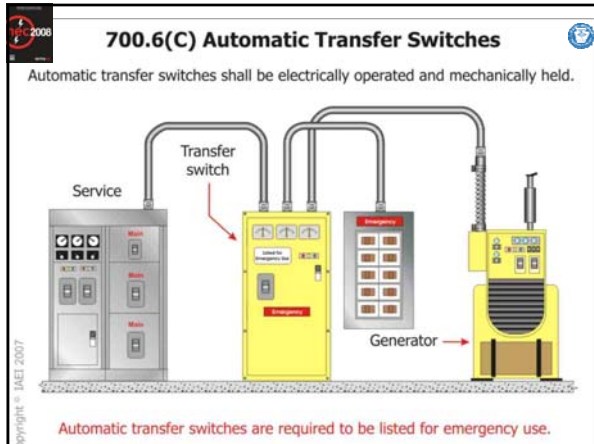
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### 700.9(B)(5) Wiring

- A new item (5) has been added to Section 700.9(B).
- From the source to the loads or from the source distribution overcurrent protection to the loads, it is required to maintain separation unless modified by any of the provisions in items (1) – (5).
- The revised text clarifies that it is permitted to supply any combination of emergency, legally required, or optional loads from a single feeder or from multiple feeders or from separate vertical sections of a switchboard that are supplied by either a common bus or individually.

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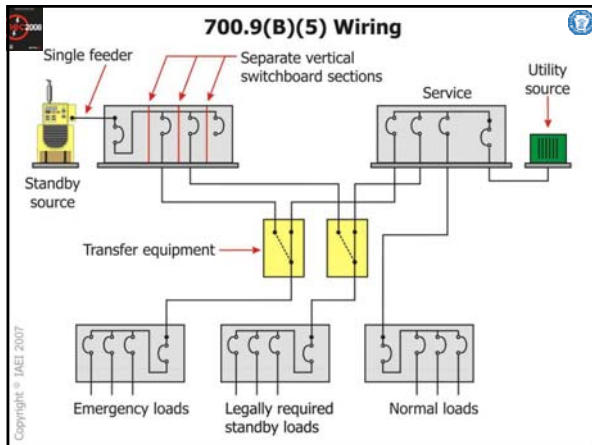
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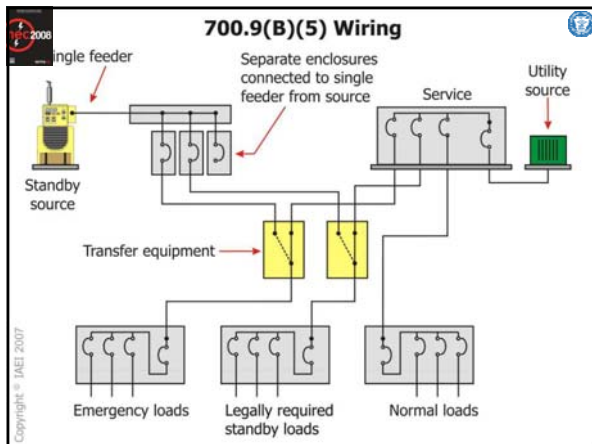
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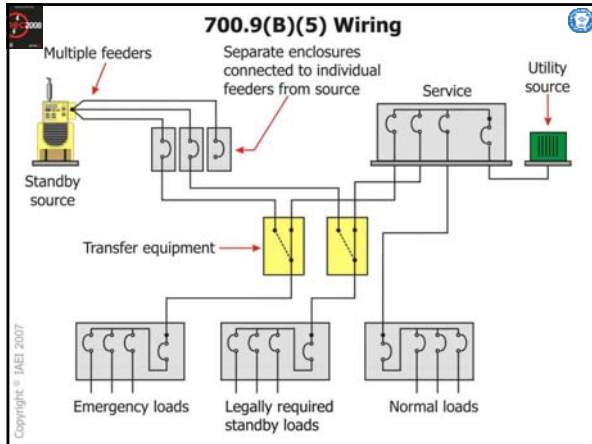
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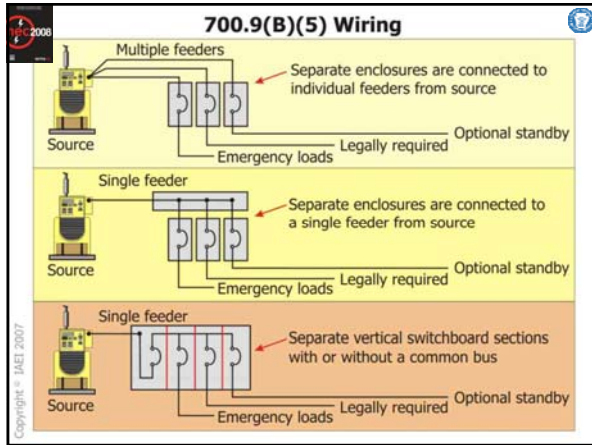
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**700.9(D)(1)(2) FPN**

- A new fine print note that references UL Guide Information category (FHIT) has been added to 700.9(D)(1)(2).
- FPN: UL guide information for electrical circuit protection systems (FHIT) contains information on proper installation requirements to maintain the fire rating.

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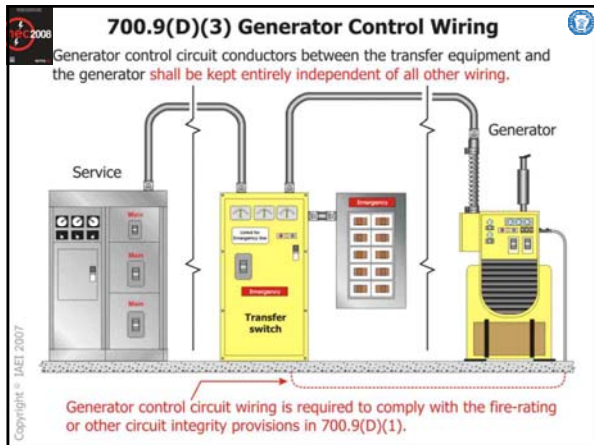
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**700.10(D)(1) Feeder-Circuit Wiring (Emergency System)**

- Revision increases the fire rating time from 1 hour to 2 hours for emergency system wiring
- Safe and systematic operation of emergency electrical systems is critical for heavily populated buildings and for high-rise occupancies
- Fire protection requirements for emergency system feeder circuits help maintain the reliability as well as the performance of the emergency electrical system
- Revision increases reliability and performance by providing more time to safely evacuate the building in an emergency

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**700.10(D)(1) Feeder-Circuit Wiring**

Feeder-circuit wiring shall meet one of the following conditions:

- (1) Be installed in spaces fully protected by an approved automatic fire suppression system
- (2) Be a listed electrical circuit protective system with a min. 2-hour fire rating
- (3) Be protected by a listed (electrical system) thermal barrier system with a min. 2-hour fire rating
- (4) Be protected by a listed fire-rated assembly (min. fire rating of 2 hours) containing only emergency wiring circuits
- (5) Be encased in a min. of 50 mm (2 in.) of concrete
- (6) Be a cable listed to maintain circuit integrity for not less than 1-hour

Feeder circuit wiring requiring fire protection  
Note: Wiring supports are not shown

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**700.12(B)(6) Outdoor Generator Sets**

Generator disconnect is permitted as required disconnect for the circuit supplying or passing through the building or structure.

Additional disconnect is not required where the disconnecting means located on an outdoor housed generator is "readily accessible."

Transfer switch

Within sight

The disconnecting means on the generator is required to be suitable for use as service equipment in accordance with 225.36.

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**700.12(F) Ex. No. 2 Unit Equipment**

The unit equipment is required to be connected to the branch circuit serving the normal lighting in the area and connected ahead of any local switches

Panel LA

Exterior emergency lighting

Unit equipment

Outdoor lighting

Exterior exit door

A new exception permits exterior emergency lighting to be supplied by the unit equipment serving the area immediately inside the exit door

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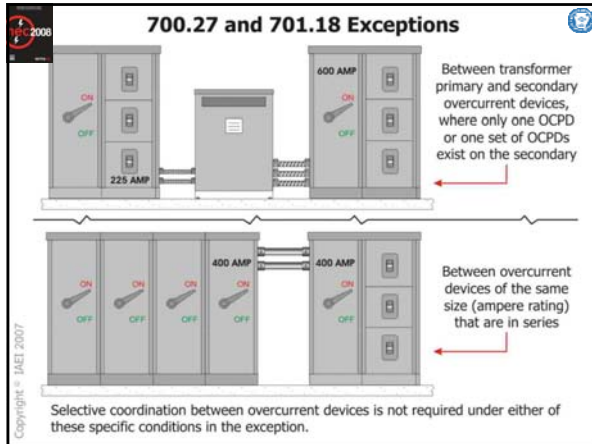
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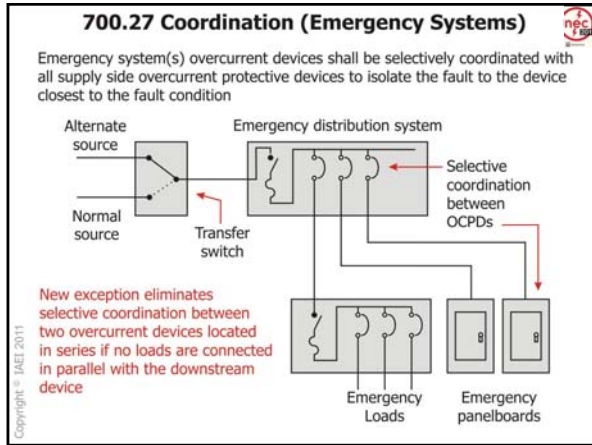
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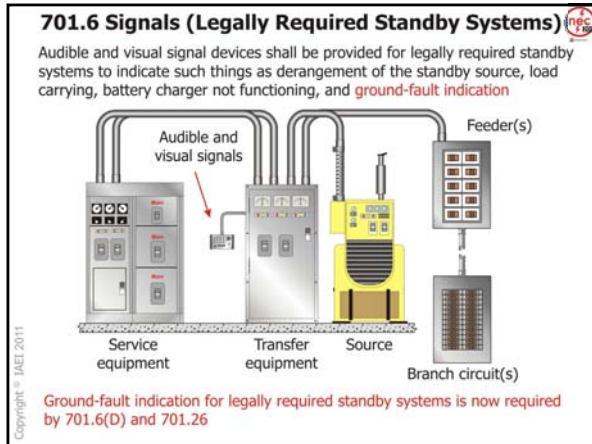
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**Article 708 Critical Operations Power Systems (COPS)**

- This new article is the result of work by the NEC TCC-assigned Task Group on Emergency and Standby Power Systems for Homeland Security.
- The objectives were to identify current minimum requirements that do not adequately address the level of integrity and quality for power sources, power distribution, and signaling systems required due to threats and/or acts of terrorism, manmade disasters and natural disasters.
- Article 708 Critical Operations Power Systems (COPS)
  - Part I. General
  - Part II. Circuit Wiring and Equipment
  - Part III. Power Sources and Connection
  - Part IV. Overcurrent Protection
  - Part V. System Performance and Analysis

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**Scope and Applicability**

- Critical operations power systems are those systems **classed as critical by a municipal, state, federal, other governmental agency having jurisdiction or by facility engineering documentation establishing the necessity for such a system.**
- Vital infrastructure facilities that if destroyed or incapacitated would **disrupt national security, the economy, public health or safety;** and where enhanced electrical infrastructure for continuity of operation has been **deemed necessary by governmental authority.**
- See Annexes F and G for additional information.

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**708.10 Feeder and Branch Circuit Wiring [Critical Operations Power Systems (COPS)]**

**Receptacle Identification:** In a building in which COPS are present with other types of power systems, the cover plates for the receptacles or the receptacles themselves supplied from the COPS shall have a distinctive color or marking so as to be readily identifiable

Designated critical operations area (DCOA)

Non-critical operations area

**Exception:** If the COPS supplies power to a DCOA that is a stand-alone building, receptacle distinctive marking not required

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**708.14 Wiring of HVAC, Fire Alarm, Security, Emergency Communications, and Signaling System**

Revisions added to 708.14 to clarify which HVAC, fire alarm, security, emergency communications, and signaling systems cable types at critical operations power system (COPS) facilities require shielded twisted pairs, and which require riser ratings

Shaft

Shielded twisted pair cable

Rigid metal conduit

Listed 2-hour electrical circuit system with riser rated cable

Listed 2-hour electrical cable (with riser rated cable)

Riser (CMR) rated cable

Shielded twisted pair cable

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**725.3(I) Vertical Support for Fire-Rated Cables and Conductors (Class 1, 2, and 3 Circuits)**

New requirements added to 725.3 which now requires vertical support of circuit-integrity cables and similar rated conductors

Vertical raceway cable support per 300.19

Type CL2R-CI Cable

Vertical installations of circuit integrity (CI) cables and conductors installed in a raceway or conductors and cables of electrical protective systems shall be installed in accordance with 300.19

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**725.130(B) Exception No. 3**

Listed intrusion protection system  
ABC Security Systems

Building openings such as skylights, windows, or others

Bare Class 2 conductors (enlarged for clarity)

Bare Class 2 conductors are permitted where they are part of a listed intrusion protection system.

Installed in accordance with the installation instructions [110.3(B)]

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**727.6 Construction FPN**

- A new fine print note has been added to 727.6 referencing UL 1685-2000 *Standard for Safety for Vertical -Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*.
- The new information provides users with an explanation of the required testing for physical damage, smoke release, and fire spread in order for Type ITC cables to be listed as resistant to the spread of fire.

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**760.3 Other Articles (Fire Alarm Systems)**

Circuits and equipment shall comply with 760.3(A) through (K). Only those sections of Article 300 referenced in this article shall apply to fire alarm systems.

- (A) Spread of Fire or Products of Combustion - Section 300.21
- (B) Ducts, Plenums, and Other Air-Handling Spaces - Section 300.22
- (C) Hazardous (Classified) Locations - Articles 500 through 516 and Article 517
- (D) Corrosive, Damp, or Wet Locations - Sections 110.11, 300.6, and 310.10(G)
- (E) Building Control Circuits - Article 725
- (F) Optical Fiber Cables - Article 770
- (G) Installation of Conductors with Other Systems - Section 300.8
- (H) Raceways or Sleeves Exposed to Different Temperatures - Section 300.7(A)
- (I) Vertical Support for Fire Rated Cables and Conductors - Section 300.19
- (J) Number and Size of Cables and Conductors in Raceway - Section 300.17
- (K) Bushing - Section 300.15(C)

References to Article 300 provisions applying to fire alarm circuits were expanded

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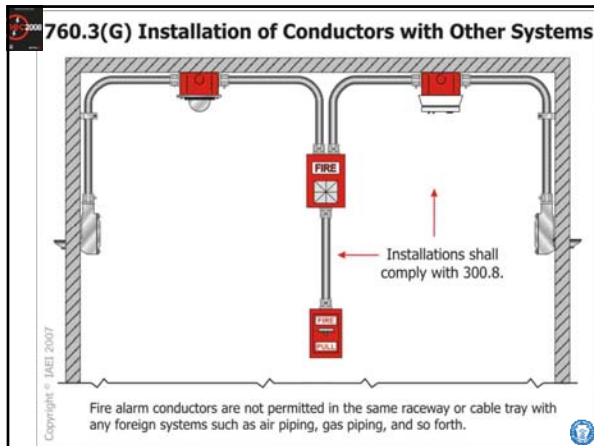
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### 760.41(B) and 760.121(B) Branch Circuit

- Sections 760.21 and 760.41 have been renumbered as a result of the reorganization of Article 760.
- Branch circuits supplying PLFA and NPLFA systems shall not be supplied through ground-fault circuit interrupters or arc-fault circuit interrupters.
- The revisions to these sections result in a requirement that individual branch circuits be used to supply NPLFA and PLFA systems.

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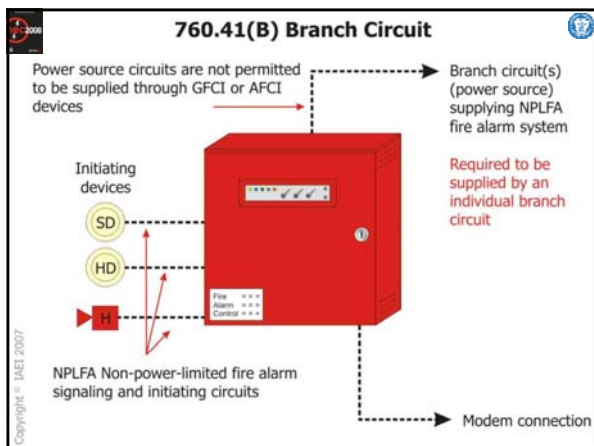
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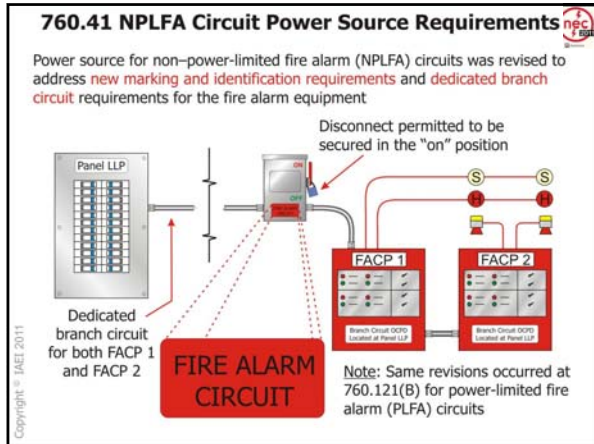
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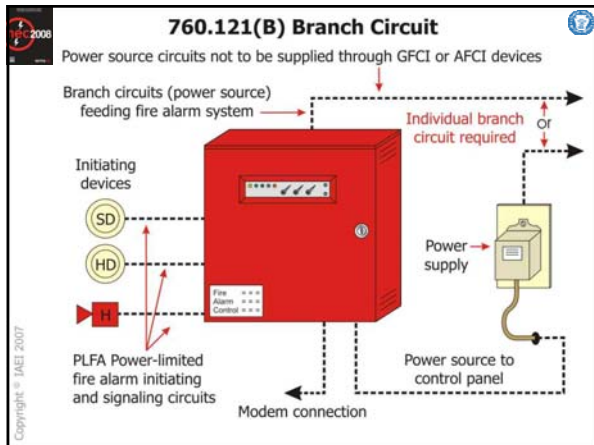
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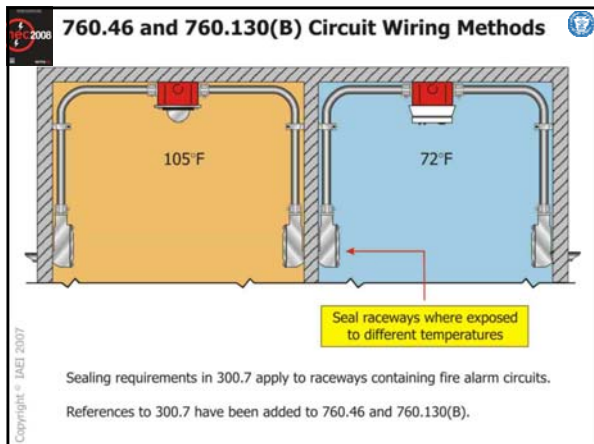
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**760.139 Installation of Conductors of Different PLFA Circuits, Class 2, Class 3, and Communications Circuits in the Same Cable, Enclosure, Cable Tray or Raceway**

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**760.176 Listing and Marking of NPLFA Cables**

Fire alarm cables used in wet locations must be listed for wet location use or have a moisture impervious metal sheath.

Requirement applies to NPLFA cables [760.176] and PLFA cables [760.179].

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**770.2 Definitions: Cable Routing Assembly (Optical Fiber Cables and Raceways)**

A new definition for "Cable Routing Assembly" and application and installation rules have been introduced in Articles 770, 800, and 820

Courtesy of Panduit

**Cable Routing Assembly** - A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support, route and protect high densities of wires and cables, typically communications wires and cables, optical fiber and data (Class 2 and Class 3) cables associated with information technology and communications equipment

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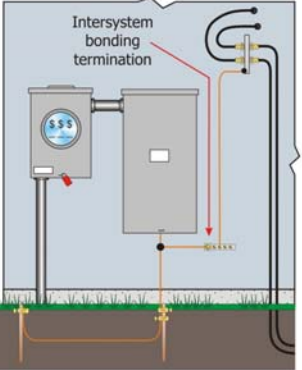
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**770.100(B)(1) Intersystem Bonding Termination** 

A reference to 250.94 and a new informational note has been incorporated into sections in Chapters 7 and 8 that pertain to intersystem bonding terminations

770.100(B)(1)  
800.100(B)(1)  
820.100(B)(1)  
830.100(B)(1)



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**770.100 Bonding and Grounding (Optical Fiber Cables and Raceways)** 

**770.100 Entrance Cable Bonding and Grounding (Optical Fiber Cables and Raceways)** Where required, the non-current-carrying metallic members of optical fiber cables entering buildings shall be bonded or grounded as specified in 770.100(A) through (D).

**(B) Electrode.** The bonding conductor and grounding electrode conductor shall be connected in accordance with 770.100(B)(1), (B)(2), or (B)(3).

**(1) In Buildings or Structures with an Intersystem Bonding Termination.** If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor or grounding electrode conductor shall be connected to the intersystem bonding termination.

**Informational Note:** See Article 100 for the definition of Intersystem Bonding Termination.

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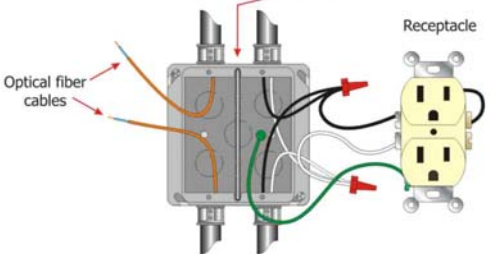
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**770.133(A) Exception No. 5**  

Permanently installed barriers or listed divider



Optical fiber cable is permitted in the same raceway, outlet box, or enclosure as electric light, power, Class 1, non-power-limited fire alarm, and medium power network-powered broadband communications circuits where separated by a permanent barrier or listed divider.

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**770.154(D) Hazardous (Classified) Locations**

Optical fiber cable  
Listed conduit sealing fitting  
Listed sealing compound  
Listed damming fiber

Note: Conduit sealing fitting shown is for use in the vertical position only

Cables installed in hazardous (classified) locations shall be any type indicated in Table 770.154.  
Cables shall be sealed in accordance with the requirements of 501.15, 502.15, 505.16 or 506.16, as applicable.

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Chapter Eight

Communications Systems

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**800.2 Definitions: Communications Raceways**

A new definition for "Communication Raceway" was added to Article 800

Return Air  
Ceiling  
Environmental air space (plenum)

**Communications Raceway:** An enclosed channel of nonmetallic materials designed for holding communications wires and cables in plenum, riser and general-purpose applications

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**800.24 Mechanical Execution of Work**

- Listed and non-listed securing methods and hardware are permitted to be used with network-powered broadband communications circuits.
- Cable ties are now recognized as a securing means for NPBCS cables.

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**800.100(A)(1), 820.100(A)(1), 830.100(A)(1)**

- Physical Protection. The grounding conductor shall be protected where exposed to physical damage.
- Where the grounding conductor is run in a metal raceway, both ends of the raceway shall be bonded to the grounding conductor or the same terminal or electrode to which the grounding conductor is connected.

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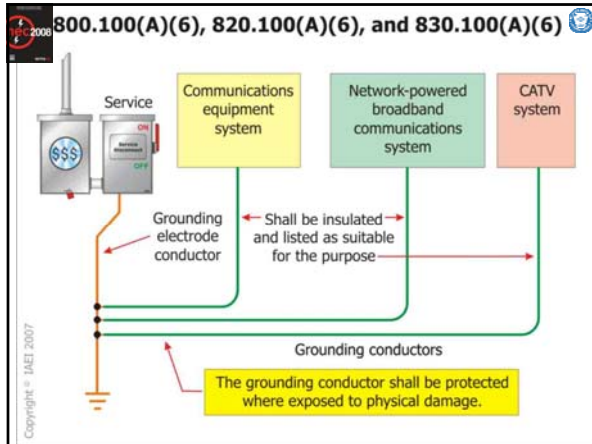
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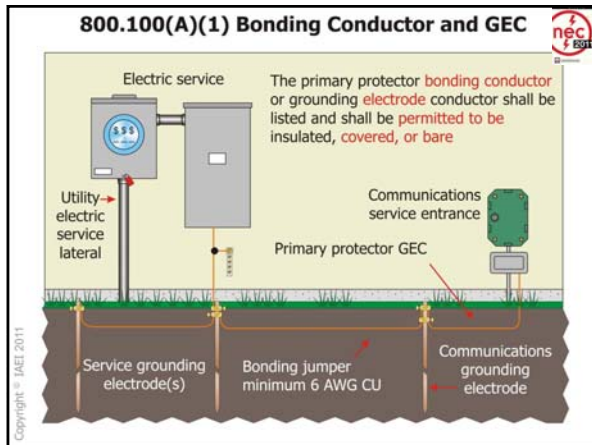
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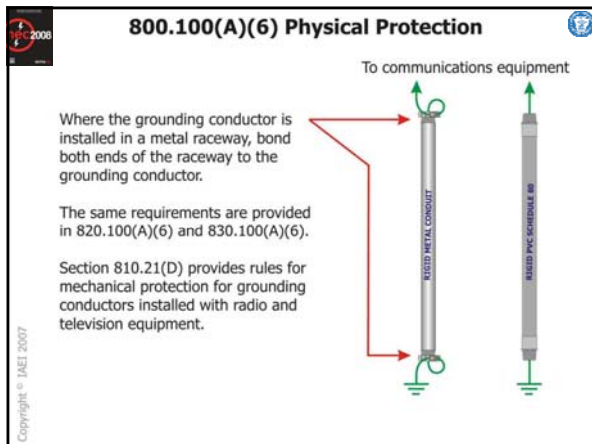
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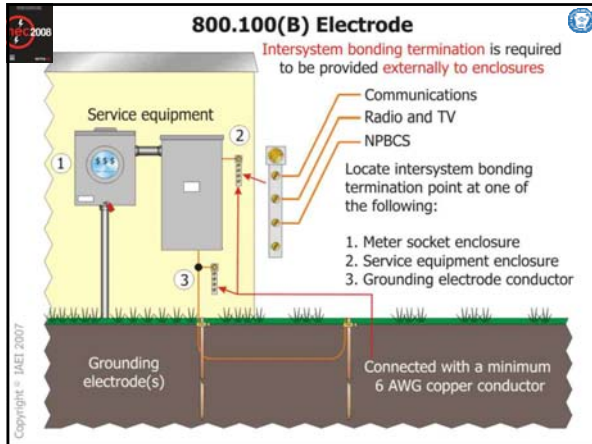
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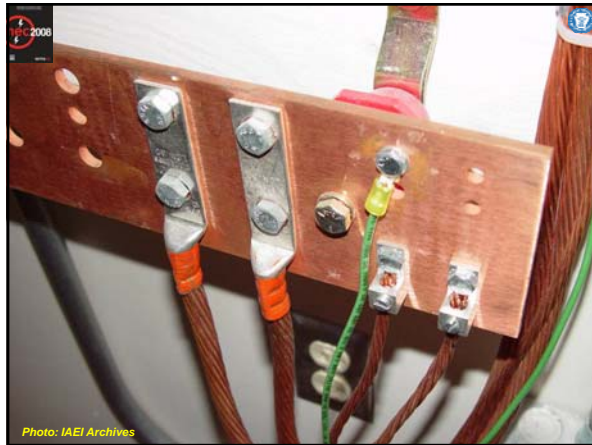
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**800.156 Dwelling Unit Communications Outlet**

- At least one communications outlet is required to be installed within a dwelling unit.
- The wiring for this communication outlet shall be routed to the service provider demarcation point of the dwelling unit.

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**810.21(F)(2)(6) Bonding Device**

The bonding device shall not interfere with the opening of an enclosure.

It shall be mounted on non-removable parts.

It shall not be mounted on a door or cover.

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**Article 810 - Part III Amateur and Citizen Band Transmitting and Receiving Stations**

Provisions for antenna systems for citizen band transmitting and receiving stations were added to Part III of Article 810

Previous language only covered requirements of antenna systems for amateur transmitting and receiving stations

Citizen band antennas are of like construction and require similar lead-in cable as amateur antennas

Water pipe grounding electrode

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**Article 810 – Part III Amateur and Citizen Band Transmitting and Receiving Stations - Antenna Systems (Radio and Television Equipment)**

810.51 Other Sections

810.52 Size of Antenna  
Table 810.52 Size of **Amateur-Station** Outdoor Antenna Conductors

810.53 Size of Lead-in Conductors

810.54 Clearance on Building

810.55 Entrance to Building

810.56 Protection Against Accidental Contact

810.57 Antenna Discharge Units - Transmitting Stations

810.58 **Bonding Conductor and Grounding Electrode** Conductors - Amateur and Citizen Band Transmitting and Receiving Stations

(A) Other Sections

(B) Size of Protective **Bonding Conductor** or Grounding **Electrode** Conductor

(C) Size of Operating **Bonding Conductor** or Grounding **Electrode** Conductor

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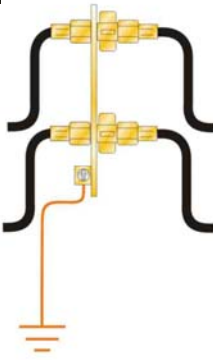
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### 820.93(C) and (D) Locations



A listed primary protector is required on each community antenna and radio distribution CATV cable external to the premises.

The listed protector shall be located as close as practicable to the entrance point of the cable to the building.

The listed protector shall be located on either side of the grounding block, or integral to the grounding block.

The primary protector shall not be located in a hazardous location or in the vicinity of easily ignitable material.

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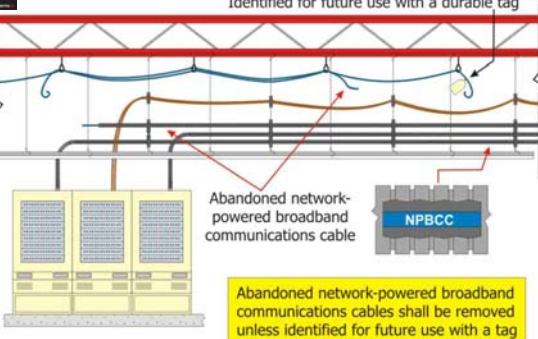
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### 830.25 Abandoned Cables

Identified for future use with a durable tag



Abandoned network-powered broadband communications cable

NPBCC

Abandoned network-powered broadband communications cables shall be removed unless identified for future use with a tag durable for the environment involved.

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### 830.26 Spread of Fire and Products of Combustion

← Network-powered broadband communications cable

← Firestopped by approved methods to maintain the fire rating

Openings around penetrations through fire-resistant-rated walls, partitions, floors, or ceilings shall be firestopped with approved methods to maintain the fire-resistance rating. **New FPN** refers to building codes, fire-resistance directories, and product listings.

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### 830.44 Overhead (Aerial) Cables (Network-Powered Broadband Communications Systems)

Network-powered broadband communications cables

Aerial cable and the supports or attachment fixtures are required to be "identified as suitable for outdoor aerial applications"

Overhead aerial spans between buildings or "structures" for network-powered broadband communications cables are required to have sufficient strength to withstand the loads to which they may be subjected

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### Article 840 Premises-Powered Broadband Communications Systems

Optical network terminal external box

Optical fiber cable

Fiber-to-the-premises (FTTP)

Router

Computer

Optical network terminal (ONT)

Television

Phone

A new Article 840 was added to Chapter 8 to address premises-powered broadband communication systems

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**Article 840 - Premises-Powered Broadband Communication Systems**

I. General

- 840.1 Scope
- 840.2 Definitions
- 840.3 Other Articles
- 840.21 Access to Electrical Equipment Behind Panels Designed to Allow Access
- 840.24 Mechanical Execution of Work
- 840.25 Abandoned Cables
- 840.26 Spread of Fire or Products of Combustion


II. Cables Outside and Entering Building

- 840.44 Overhead Optical Fiber Cables
- 830.47 Underground Optical Fiber Cables Entering Buildings
- 840.48 Unlisted Cables and Raceways Entering Buildings

III. Protection

- 840.90 Protective Devices
- 840.93 Grounding or Interruption

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**Article 840 - Premises-Powered Broadband Communication Systems (cont.)**

IV. Grounding Methods

- 840.100 ONT and Optical Fiber Cable Grounding
- 840.101 Premises Circuits Not Leaving the Building
- 840.103 Equipment Grounding
- 840.106 Grounding and Bonding at Mobile Homes


V. Installation Methods Within Buildings

- 840.110 Raceways for Premises-Powered Broadband Communications Optical Fiber Cables
- 840.113 Installation Past the ONT
- 840.133 Installation of Optical Fibers and Electrical Conductors Associated with Premises-Powered Broadband Communications Systems
- 840.154 Applications of Listed Optical Fiber Cables and Raceways

VI. Listing Requirements

- 840.170 Equipment and Cables

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Chapter Nine



Tables

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**Chapter 9, Table 1, Note (9)**

Multiconductor cables and flexible cords are to be treated as single conductors when calculating the percentage of raceway area.

Applies to all raceways, not just conduits.

Equipment

Bushings

Flexible cords

Cords are permitted in raceways per 400.14, as an example.

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**Chapter 9, Table 4 (in part)**

Article 352 - Rigid PVC Conduit (PVC) Schedule 80
Articles 352 and 353 - Rigid PVC Conduit (PVC) Schedule 40, and HDPE Conduit (HDPE)
Article 352 - Type A, Rigid PVC Conduit (PVC)
Article 352 - Type EB, Rigid PVC Conduit (PVC)

The term rigid nonmetallic conduit changed to rigid PVC conduit Code-wide.

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**Chapter 9 - Notes to Tables, Note 5**

Optical fiber cables were added to Note (5) of Chapter 9, Notes to Tables for conductor fill requirements

Optical fiber cables

For conductors not included in Chapter 9, such as multi-conductor cables and optical fiber cables, the actual dimensions shall be used

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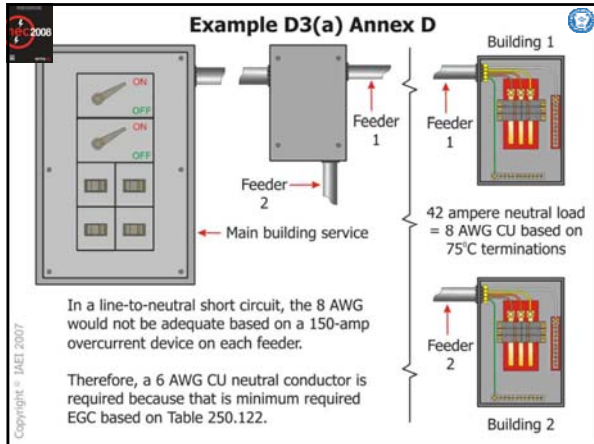
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