2016 CALBO Education Week

2016 California Electrical Code: Significant Changes

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Building Official, City of Santa Monica
President/Executive Board of Directors, CALBO
Chair, CA Building Standards Commission PEME CAC

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SIGNIFICANT CHANGES TO THE 2016 CALIFORNIA ELECTRICAL CODE

RON TAKIGUCHI, P.E.

BUILDING OFFICIAL - CITY OF SANTA MONICA
PRESIDENT/EXECUTIVE BOARD OF DIRECTORS - CALBO
CHAIR – CA BUILDING STANDARDS COMMISSION PEME CAC

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AGENDA

Class	8:00 am - 11:15 am
Break	~ 9:30 am - 9:45 am
Certificates/ Evaluation	Conclusion of Class

2

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ICC INTERNATIONAL CODE COUNCIL® PREFERRED PROVIDER

3

American Institute of Architects
Continuing Education System
(AIA/CES)

- *This program is registered with the AIA/CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of distributing, or dealing in any material or product.*
- *Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.*

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SIGNIFICANT CHANGES TO THE 2016 CALIFORNIA ELECTRICAL CODE

- *Non-Gov't Jurisdiction*
- *Private Consulting*

- *Building Department*
- *Non-Building & Safety*

2016 California Building Codes
California Building Standards Commission
Code Advisory Committees

Purpose

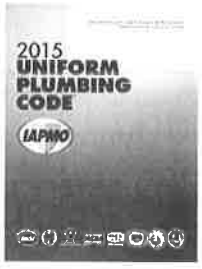
- *Review proposed building standards by State Agencies*
- *Advise and make recommendations to the CBSC*
- *Ensure public participation*
- *Ensure adequate technical review*

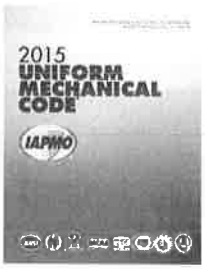
Code Advisory Committees

- *Accessibility*
- *Plumbing, Electrical, Mechanical, Energy*
- *Building, Fire, Other*
- *Structural Design / Lateral Forces*
- *Health Facilities*
- *Green Building*

California Building Officials

2016 California Building Codes (PEME)





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2016 California Building Codes (PEME)

CBSC

Division of the State Architect

oshpd Office of Statewide Health Planning & Development

California Department of PublicHealth CDPH

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2016 California Building Codes – State Agencies

CBSC

BSC: *State Buildings, UC, Cal-State, CC, URM*
BSC-CG (NEW): *All Occupancies Green Building Standards*

HCD1: *Dwellings, Apartments, Condominiums, Hotels, Motels*
HCD2: *Mobilehome Parks Permanent Buildings*
HCD1-AC: *Housing Accessibility Multi-Family Dwellings*

oshpd

OSHPD 1: *Hospitals, Psychiatric Hospitals*
OSHPD 2: *Skilled Nursing Facilities, Intermediate Care Facilities*
OSHPD 3: *Licensed Clinics, Outpatient Clinical Services*
OSHPD 4: *Correctional Treatment Centers*

Division of the State Architect

DSA-AC: *Commercial Facilities, Private Funded Public Accom*
DSA-SS: *Public Elementary, Secondary Schools, CC*
DSA-SS/CC: *Community Colleges*

CAL FIRE

SFM: *Residential, High-Rise Structures, Institutional, Educational, Places of Assembly, Fire Alarm Devices, Equipment, Systems*

California Department of PublicHealth CDPH

DPH: *Public Swimming Pools, Commissaries Serving Mobile Food*

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STATE AGENCY AMENDMENTS
2016 CA ELECTRICAL CODE – *BUILDING & SAFETY*

- BSC
- BSC-CG
- SFM
- HCD-1
- HCD-2
- DSA-AC
- OSHPD 3
- DPH

- DSA-SS
- DSA-SS/CC
- OSHPD 1
- OSHPD 2
- OSHPD 4

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STATE AGENCY AMENDMENTS
2016 CA ELECTRICAL CODE – *BUILDING & SAFETY*

• BSC	2 Amendments
• BSC-CG	1 Amendment
• SFM	11 Amendments
• HCD-1	6 Amendments
• HCD-2	4 Amendments
• DSA-AC	3 Amendments (notes only)
• OSHPD 3	34 Amendments
• DPH	4 Amendments
• DSA-SS	0 Amendments
• DSA-SS/CC	0 Amendments
• OSHPD 1	64 Amendments
• OSHPD 2	51 Amendments
• OSHPD 4	56 Amendments

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STATE AGENCY AMENDMENTS
2016 CA ELECTRICAL CODE – *BUILDING & SAFETY*

• BSC	2 Amendments
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• DSA-SS	0 Amendments
• DSA-SS/CC	0 Amendments
• OSHPD 1	64 Amendments
• OSHPD 2	51 Amendments
• OSHPD 4	56 Amendments
TOTAL	***88 Amendments*** ⇨ ***65 B&S***

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State Agency Amendments to the
2014 National Electrical Code

California Building Officials

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State Agency Amendments to the 2014 National Electrical Code

C A C A C A C A

Chapter 1

- Add definition Ballasted Solar Photovoltaic System
  [BSC, SFM, HCD 1, HCD 2]
  Ballasted Solar Photovoltaic System *A roof mounted system composed of solar photovoltaic panels and supporting members that are unattached or partially attached to the roof and must rely on their weight, aerodynamics and friction to counter the effect of wind and seismic forces.*

- Section 11013 Exception Mounting of Equipment Ballasted PV System

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State Agency Amendments to the 2014 National Electrical Code

C A C A C A

- *[BSC]* ***not*** Adopt Article 517 Health Care Facilities
- *[BSC]* ***not*** Adopt Article 550 Mobilehomes
- *[HCD]* ***not*** Adopt Several Chapter 5 Special Occupancies
- *[OSHPD]* ***Adopt*** Article 708 COPS
- *[SFM]* ***Adopt*** Annex A (Standards); Annex B (Ampacities)

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2016 California Electrical Code

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Administrative

2016 California Electrical Code

- *Article 89* *General Code Provisions (CA)*
- Article 90 Introduction
- Chapter 1 General
- Chapter 2 Wiring and Protection
- Chapter 3 Wiring Methods and Materials
- Chapter 4 Equipment for General Use
- Chapter 5 Special Occupancies
- Chapter 6 Special Equipment
- Chapter 7 Special Conditions
- Chapter 8 Communication Systems
- Chapter 9 Tables
- Annexes
- Index

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2016 California Electrical Code

Purpose

Safeguards – Use of Electricity
i.e. – Prevention of Shock, Fire, Electrocution

Safe Occupancy
i.e. – Egress Lighting, Power Continuity

Support of Other Codes
i.e. – Health & Sanitation, Accessibility, Energy Conservation

2014 National Electrical Code

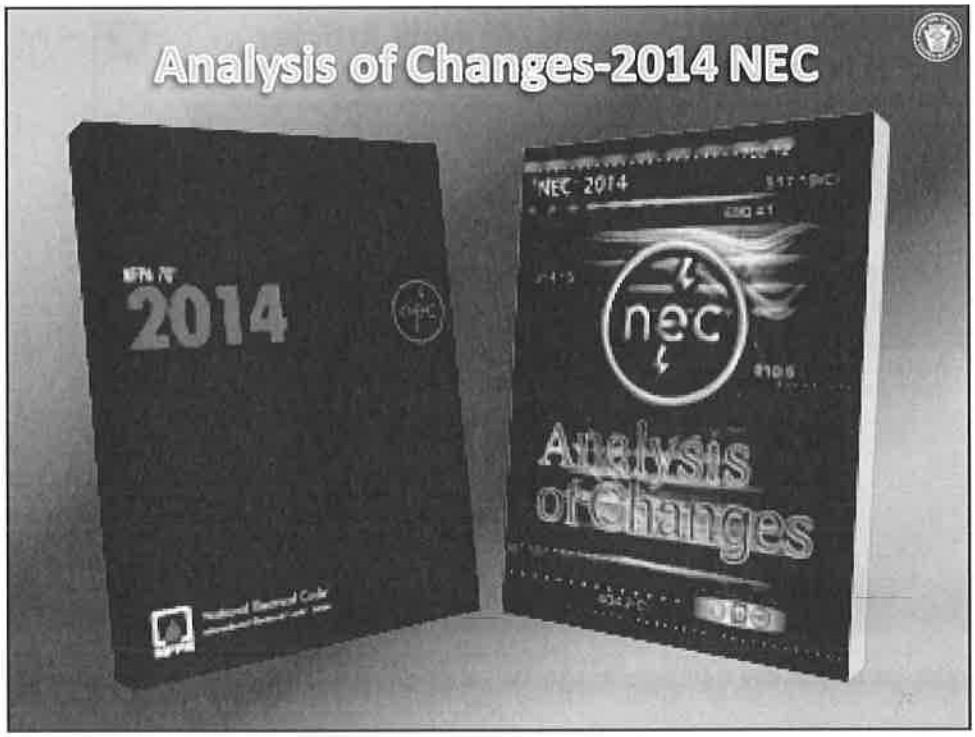
Model Code Change Highlights

California Building Officials

Analysis of Changes – 2014 *NEC*

Training Presentation by:

International Association of Electrical Inspectors

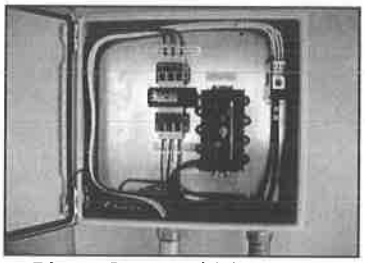


NEW

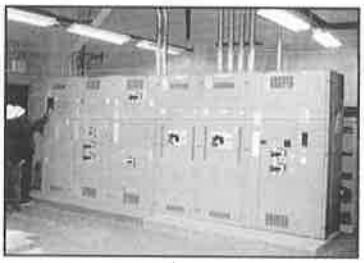
Code-Wide Changes

Field-Applied Hazard Markings

Lockable Disconnecting Means



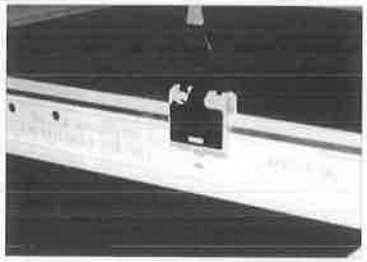
Direct Current (dc) Circuits



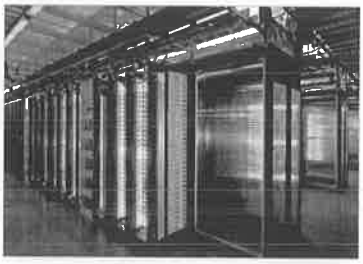
Switchgear

NEW

Code-Wide Changes: (4) New Articles



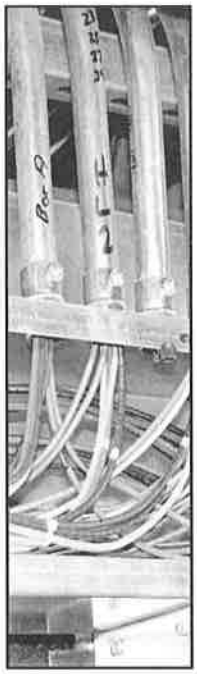
Article 393 Low Voltage Suspended Ceiling Power Distribution Systems



Article 646 Modular Data Centers

Article 728 Fire-Resistive Cable Systems

Article 750 Energy Management Systems



Article 90
Introduction

25

90.1(A) Purpose (of the *Code*)

- The purpose of this *Code* is the practical safeguarding of persons and property from hazards arising from the use of electricity
- This *Code* is not intended as a design specification or an instruction manual for untrained persons
- Previous "Intention" of the *Code* deleted and incorporated into "Purpose" of the *Code*

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Chapter One
General

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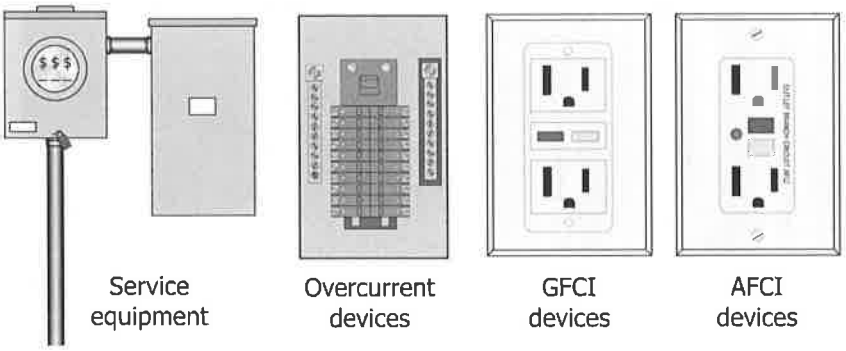
Chapter 1 – General

- Article 100 Definitions
- 110.2 Approval
- 110.3 Use of Equipment
- 110.9 Interrupting Rating
- 110.12 Mechanical Execution of Work
- 110.13 Mounting and Cooling of Equipment
- 110.14 Electrical Connections
- 110.16 Arc Flash Hazard Warning
- 110.22 Marking
- 110.24 Available Fault Current
- 110.26 Working Clearance
- 110.27 Guarding of Live Parts

28

Article 100 Definitions: Readily Accessible

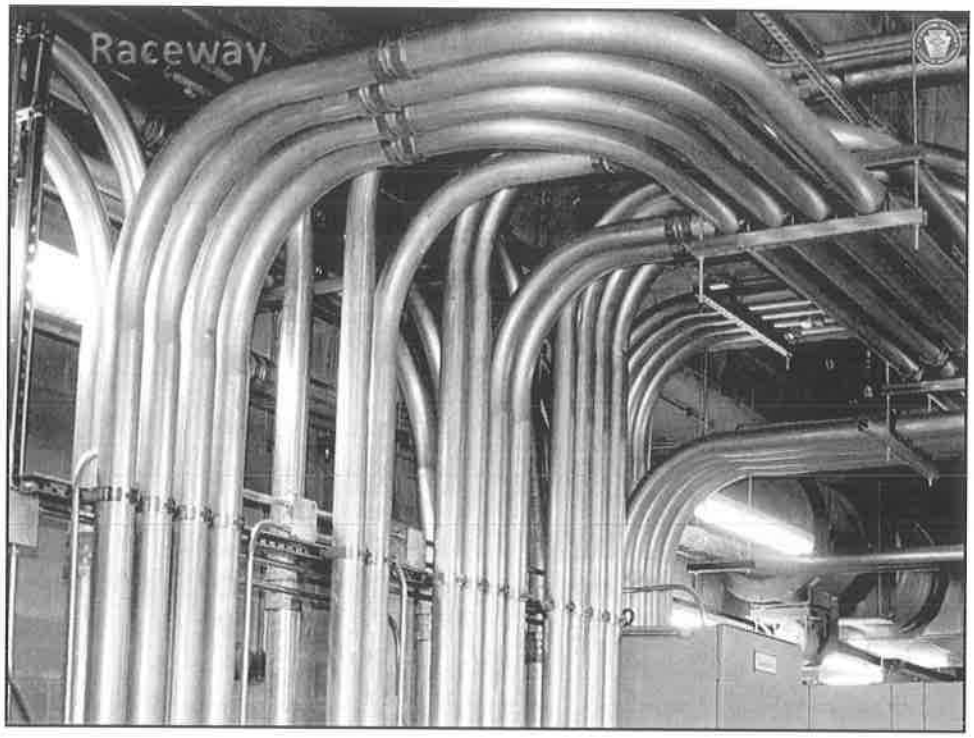
Accessible, Readily (Readily Accessible). Capable of being reached quickly for operation, renewal, or inspections without requiring those to whom ready access is requisite to actions such as to use tools, to climb over or remove obstacles, or to resort to portable ladders, and so forth.



Service equipment | Overcurrent devices | GFCI devices | AFCI devices

Article 100 Definitions: Raceway

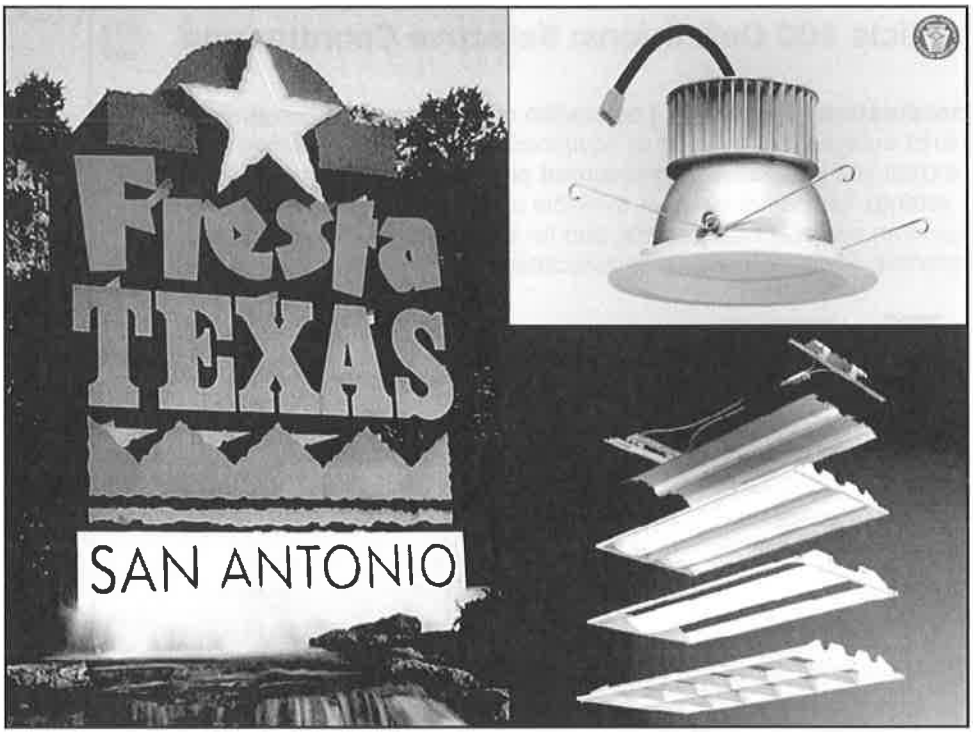
- **Raceway.** An enclosed channel of metallic or nonmetallic materials designed expressly for holding wires, cables, or busbars, with additional functions as permitted in this *Code*.
- **Informational Note:** A raceway is identified within specific article definitions.
- Definition of "Raceway" was revised by removing the "laundry list" of raceways listed in previous definition.



NEW

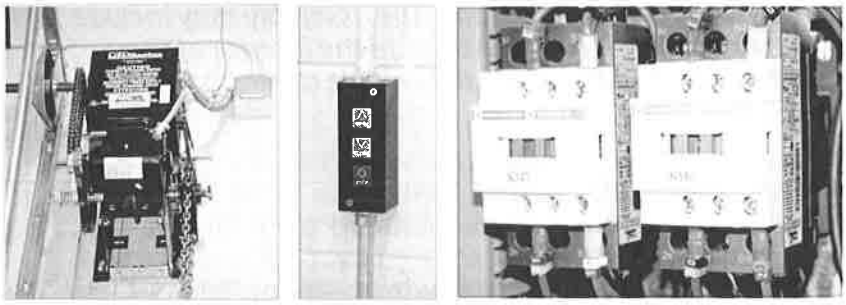
Article 100 Definitions: Retrofit Kit

- **Retrofit Kit.** A general term for a complete subassembly of parts and devices for field conversion of utilization equipment.
- New definition of the term "Retrofit Kit" was added to Article 100.
- New definition applies to LED listed retrofit kits used for luminaires and signs as referenced by new requirements in Articles 410 and 600.
- Extensive upgrades are underway in the sign and lighting industries to achieve greater energy efficiency in signs and luminaires by replacing in-place illumination systems with light emitting diodes (LED) technology.



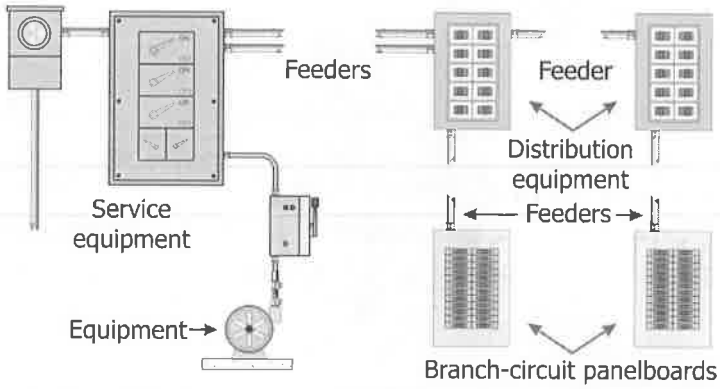
Article 100 Definitions: Control Circuit

~~**Motor**~~ **Control Circuit.** The circuit of a control apparatus or system that carries the electric signals directing the performance of the controller but does not carry the main power current.



Article 100 Definitions: Selective Coordination

Coordination (Selective). Localization of an overcurrent condition to restrict outages to the circuit or equipment affected, accomplished by the selection and installation of overcurrent protective devices and their ratings or settings for the full range of available overcurrents, from overload to the maximum available fault current, and for the full range of overcurrent protective device opening times associated with those overcurrents.



35

"NEW"

Article 100 Definitions: Switchgear

- ~~*Metal-Enclosed Power*~~ ***Switchgear.*** *An assembly completely enclosed on all sides and top with sheet metal (except for ventilating openings and inspection windows) and containing primary power circuit switching, interrupting devices, or both, with buses and connections. The assembly may include control and auxiliary devices. Access to the interior of the enclosure is provided by doors, removable covers, or both.*

- **Informational Note:** All switchgear subject to *NEC* requirements is metal enclosed. Switchgear rated 1000 volts or less may be identified as "Low-Voltage Power Circuit Breaker Switchgear". Switchgear rated over 1000 volts may be identified as "Metal-Enclosed Switchgear" or "Metal-Clad Switchgear". Switchgear is available in non-arc-resistant or arc-resistant constructions.

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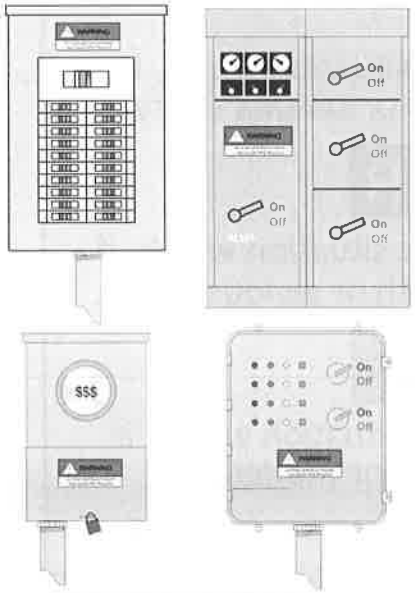
110.16 Arc-Flash Hazard Warning



*Not all required warning labels shown

WARNING

Arc Flash and Shock Hazard
Appropriate PPE Required

- Arc-flash warning label required to be applied in the field or factory
- Applies to equipment such as: switchboards, switchgear, panelboards, motor control centers, industrial control panels, meter socket enclosures, and enclosed circuit breakers
- Applies to equipment in other than dwelling occupancies

NEW

110.21(B) Field-Applied Hazard Markings

- New subsection for "Field-Applied Hazard Markings" was added for specific requirements for warning labels and similar markings required elsewhere in the *Code*.
- Specific "one-stop" requirements for warning labels and similar markings.

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NEW

110.21(B) Field-Applied Hazard Markings

- *DANGER* indicates a hazardous situation which, if not avoided, will result in death or serious injury.

- *WARNING* indicates a hazardous situation which, if not avoided, could result in death or serious injury.

- *CAUTION* indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

40

NEW

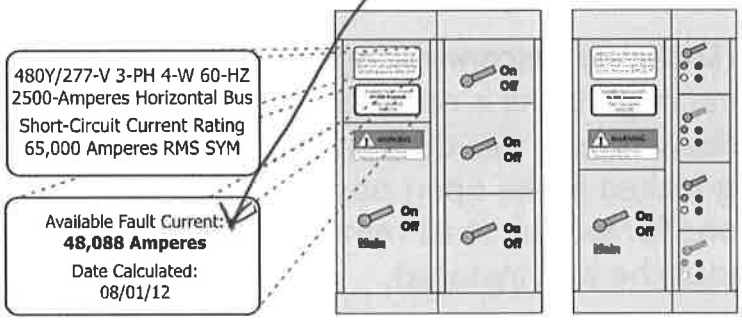
110.21(B) Field-Applied Hazard Markings

Hazard markings, signs or labels should meet the requirements in ANSI Z535.4 for suitable font sizes, words, colors, symbols and location requirements for labels

Make sure this is on the new service

110.24(A) Available Fault Current

Non-dwelling unit service equipment required to be field-marked with the amount of available fault current when installed or modified



Service equipment in other than dwelling units shall be legibly marked in the field with the maximum available fault current

The field marking(s) shall include the date the fault current calculation was performed and be of sufficient durability to withstand the environment involved

Informational Note: The available fault current marking(s) are related to required short-circuit current ratings of equipment *(not NFPA 70E)*

NEW

NEW 110.25 Lockable Disconnecting Means

- New 110.25 added to provide consistent requirements at one location for "Lockable Disconnecting Means" rules.
- Requirements for a disconnecting means to be "lockable in the open position" existed in a number of locations in the 2011 *NEC*.
- Forty-six (46) companion proposals to move lockable disconnect requirements to new 110.25.
- New provision intended to facilitate a lockout/tagout situation.
- New exception added where the attachment plug serves as the disconnecting means.

43

NEW 110.25 Lockable Disconnecting Means *(cont.)*

- **110.25 Lockable Disconnecting Means.** Where a disconnecting means is required to be lockable open, elsewhere in this Code, it shall be capable of being locked in the open position. The provisions for locking shall remain in place with or without the lock installed.

- ***Exception:*** *Cord-and-plug connection locking provision shall not be required to remain in place without the lock installed.*

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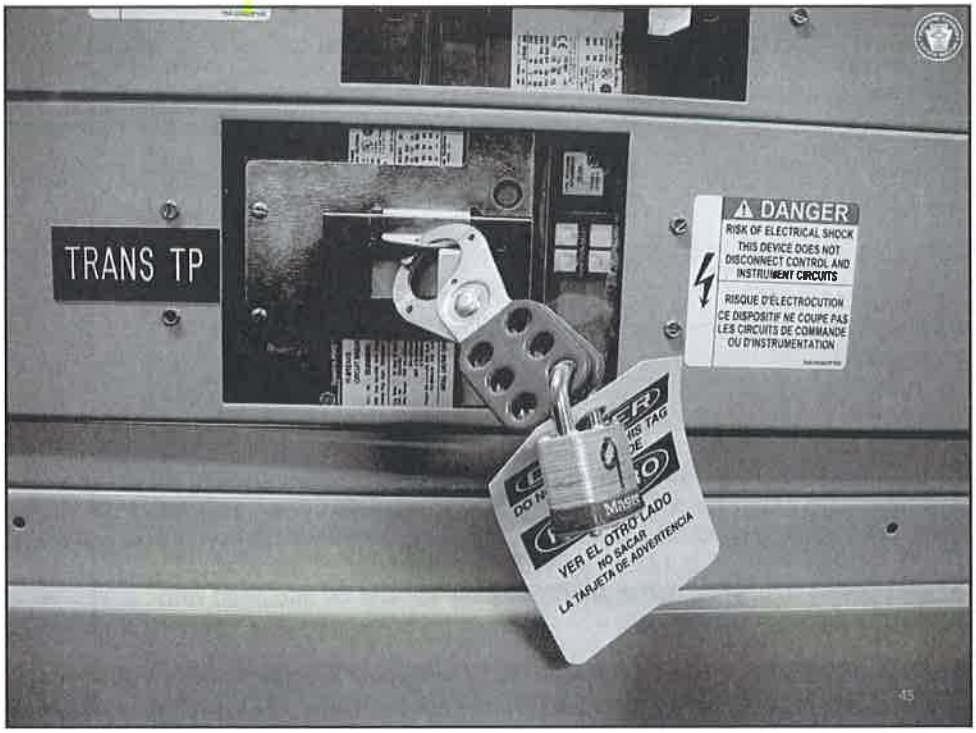
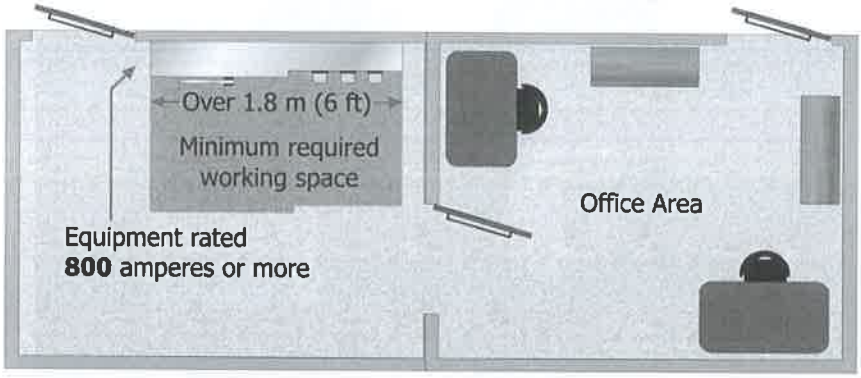


110.26(C)(3) Personnel Doors

- The ampere value related to provisions for "Personnel Doors" for "Entrance to and Egress from Working Space" was lowered to **800 amperes** from 1200 amperes.

- The term "listed panic hardware" replaces the previous list of specific hardware provided at this requirement.
- Serious injury and fatalities have occurred involving electrical equipment rated at below 1200 amperes.
- This same panic hardware change occurred at 110.33(A)(3) for equipment with a voltage rating over 600 volts.

110.26(C)(3) Personnel Doors



110.26(C)(3) Personnel Doors. Where equipment rated 800 A or more that contains overcurrent devices, switching devices, or control devices is installed and there is a personnel door(s) intended for entrance to and egress from the working space less than 7.6 m (25 ft) from the nearest edge of the working space, the door(s) shall open in the direction of egress and be equipped with listed panic hardware.

Note: Requirements for "Large Equipment" at 110.26(C)(2) still applies to equipment rated at 1200 A or more and over 1.8 m (6 ft) wide.

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NEW

110.26(E)(2) Dedicated Equipment Space

- "Dedicated Equipment Space" added for equipment located outdoors.
- Dedicated equipment space now required for outdoor installations as well as indoor installations.
- Dedicated equipment space equal to the width and depth of the equipment and extending from grade to a height of 1.8 m (6 ft) above the equipment.
- Same "equipment foreign to the electrical installation" is often present such as gas piping, water piping, mechanical refrigeration lines, irrigation equipment, phone and internet equipment, compressed air lines, and other non-electrical equipment.

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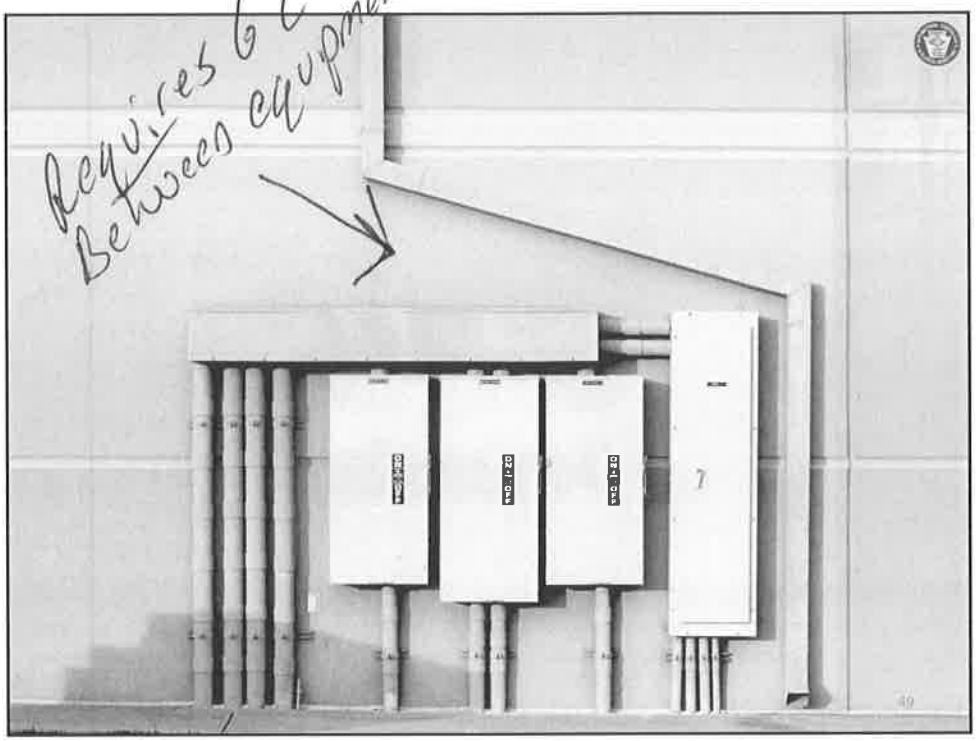

110.27(A) Live Parts Guarded Against Accidental Contact

- Revision for "Guarding of Live Parts" increases the elevation of live parts against accidental contact to 2.6 m (8½ ft) when voltages range from 301 to 600 volts.
- Live parts of electrical equipment with a voltage range from 50 to 300 volts can still comply with this requirement with a minimum of 2.5 m (8 ft) above the floor or other working surface.
- 2.6 m (8½ ft) clearance corresponds with the *National Electrical Safety Code* (NESC) clearances for live exposed parts.

Chapter Two
Wiring and Protection

51

Chapter 2 – Wiring & Protection

- 200 Grounded Conductor
- 210 Branch Circuits
- 215 Feeders
- 220 Load Calculations
- 230 Services
- 240 Overcurrent Protection
- 250 Grounding and Bonding

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NEW

200.4(B) Neutral Conductors for Multiple Circuits

- New provisions added requiring grouping the common neutral conductor for multiple circuits with its associated ungrounded conductors when contained in the same enclosure.
- Neutral conductors are typically terminated on a common neutral terminal bar making tracing these neutral conductors more difficult than tracing the ungrounded conductors.

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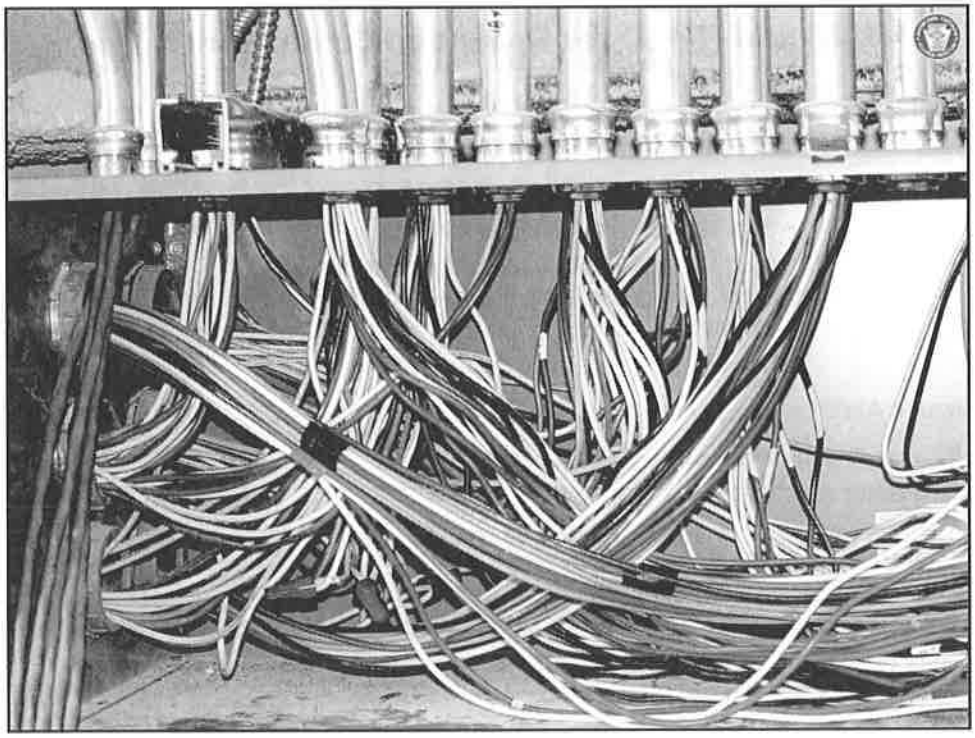


200.6(A)(3) Identifying Grounded Conductors

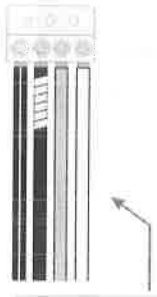
- Revision permits three continuous white "or gray" stripes along the grounded conductor's entire length *(on other than green insulation)* for identification of sizes 6 AWG or smaller.

- Same change occurred at the following locations:

200.6(B)(3)	200.7(A)(2)	200.7(C)(2)
200.6(E)	200.7(C)	
200.7	200.7(C)(1)	

55

200.6(A) and (B) ID for Grounded Conductors



200.6(A)

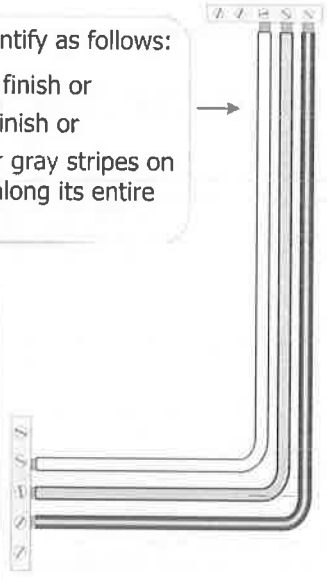
Sizes 6 AWG or smaller identify as follows:

- By a continuous white outer finish or
- By a continuous gray outer finish or
- By three continuous white or gray stripes on other than green insulation along its entire length

200.6(B)

Sizes 4 AWG or larger identify as follows:

- By a continuous white outer finish or
- By a continuous gray outer finish or
- By three continuous white or gray stripes on other than green insulation along its entire length
- At the time of installation, by a distinctive white or gray marking at the terminations that encircles the conductor



56

NEW

210.5(C)(2) Direct Current Branch Circuits

- New branch circuit identification requirements added for DC systems.
- For sizes 6 AWG and smaller, **red** for positive DC conductors and **black** for negative dc conductors.
- For branch circuits supplied from a dc system operating at more than 50 volts, each ungrounded conductor of 4 AWG or larger is to be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means.

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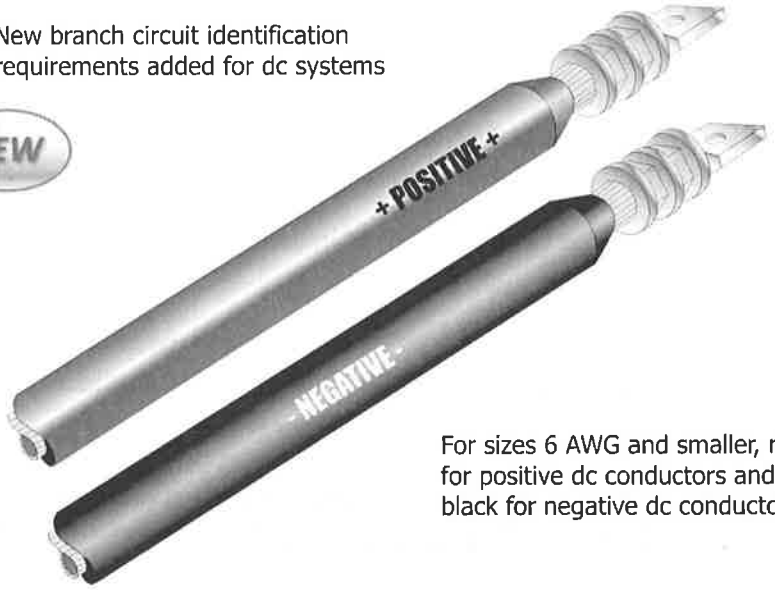
210.5(C)(2) ID of Branch Circuits From DC Systems

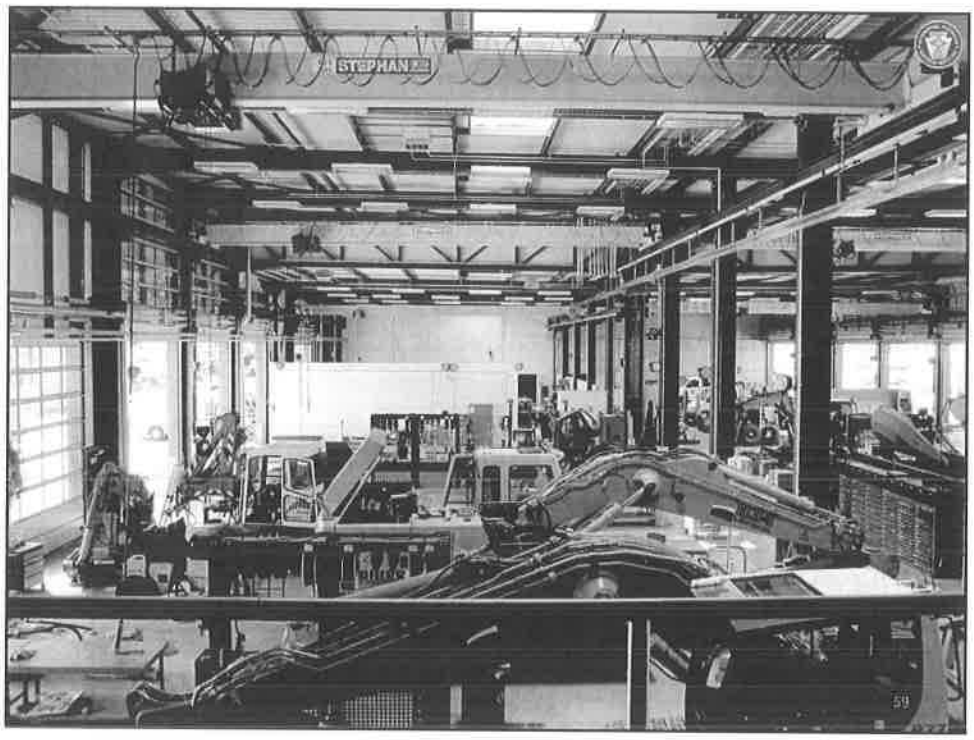
New branch circuit identification requirements added for dc systems

NEW



For sizes 6 AWG and smaller, red for positive dc conductors and black for negative dc conductors

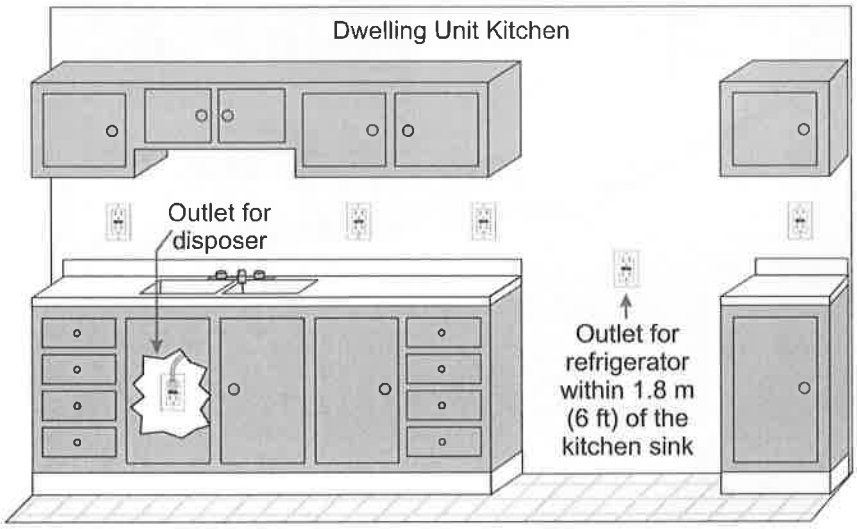
56



210.8(A)(7) GFCI: Dwelling Unit Sinks

- GFCI protection required for all 125-volt, single-phase, 15- and 20-ampere receptacles installed within 1.8 m (6 ft) of all dwelling unit sinks *(including kitchen sinks).*
- Revision removes the term "located in areas other than kitchens."
- Rule will now include the garbage disposal receptacle located in the cabinet under a kitchen sink, receptacle located behind a refrigerator, or a general lighting branch circuit living room receptacle located on the back side of a kitchen sink bar area if they are located within 1.8 m (6 ft) of the kitchen sink.

210.8(A)(7) GFCI - Dwelling Unit Sinks



All 125-volt, single-phase, 15- and 20-ampere receptacles installed within 1.8 m (6 ft) of the outside edge of any dwelling unit sink now require GFCI protection

61

62

63

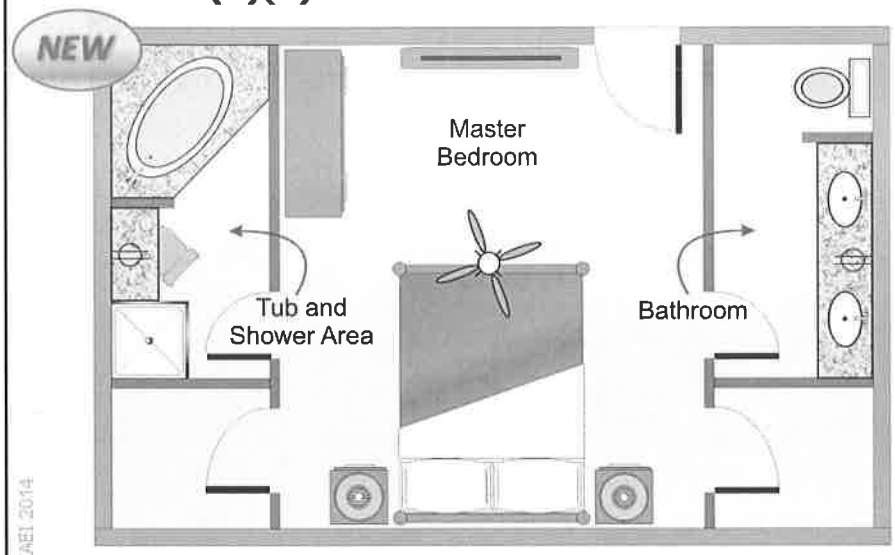
NEW

210.8(A)(9) Dwelling Unit Bathtubs or Shower Stalls

- GFCI protection now required where receptacles are installed within 1.8 m (6 ft) of the outside edge of dwelling unit "Bathtubs or Shower Stalls."
- Bathtubs or shower stalls are not always located in an area that meets the Article 100 definition of a "bathroom."
- Bathroom is "an area including a basin with one or more of the following: a toilet, a urinal, a tub, a shower, a bidet, or similar plumbing fixtures."
- Example: a room or area connected to a dwelling unit bedroom with a bathtub or shower stall as the only plumbing fixture in that particular room or area with a basin sink and toilet provided in another common area of the dwelling.

64

210.8(A)(9) GFCI: Bathtubs or Shower Stalls



All 125-volt, single-phase, 15- and 20-ampere receptacles installed within 1.8 m (6 ft) of the outside edge of a dwelling unit bathtub or shower stall requires GFCI protection

65

210.8(A)(10) GFCI: Laundry Areas

- All dwelling unit "Laundry Areas" now require GFCI protection for 125-volt, single phase, 15-and 20-ampere receptacles *(regardless of presence of a sink or distance from same).*
- A laundry room sink is no longer the driving factor whether GFCI protection is required or not.
- GFCI protection in laundry areas addresses increased shock hazard risk and is consistent with other *NEC* requirements for GFCI protection of receptacles in areas in close proximity of water.
- Increased usage of GFCI protection for personnel at receptacles of residential homes is a highly effective means of further reducing the potential for electrical shock hazards.

66

NEW 210.8(D) Dwelling Unit Kitchen Dishwasher Branch Circuit

- GFCI protection now required for all outlets that supply dishwashers installed in dwelling units.
  - Includes both receptacle and hard-wired outlet for dishwasher.
- Modern-day electronically controlled dishwashers can experience "end of life" failures that can result in increased risk of electrical shock.
- GFCI protection for outlets supplying dishwashers can mitigate these increased risk of electrical shock.

69

70

NEW

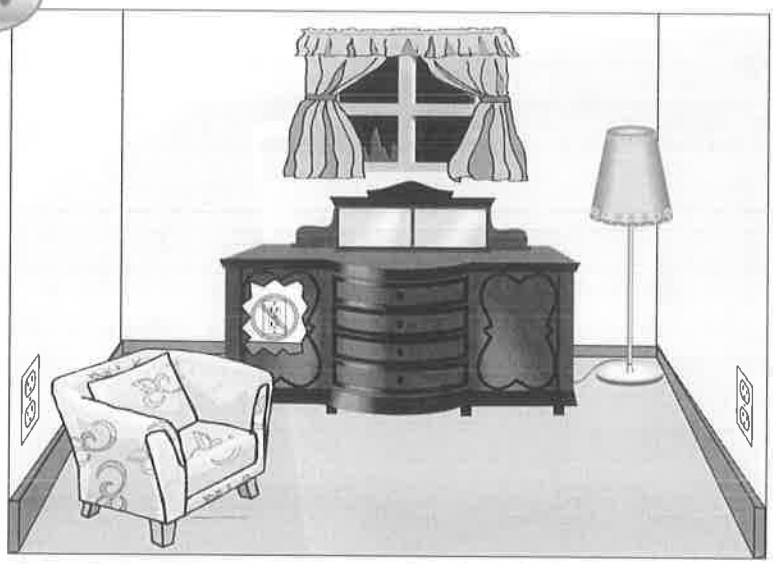
210.12 AFCI Protection

- New provision added to require all AFCI devices required by 210.12 to be installed in a readily accessible location.
- Aligns with the "readily accessible" requirements for GFCI devices covered at 210.8.
- Primarily related to occupant or user accessibility to the monthly testing and reset features of AFCI devices.
- Will aid and facilitate the ability to reset the AFCI device in the event the AFCI detects an arcing event.

71

NEW

210.12 Arc-Fault Circuit-Interrupters



AFCI devices required to be installed in a readily accessible location

72

210.12 Arc-Fault Circuit-Interrupter Protection

Listed Outlet Branch-Circuit Type AFCI Devices

Courtesy of Pass & Seymour/Legrand

Listed Combination Overcurrent Protection Type AFCI Device

Courtesy of Eaton Corporation

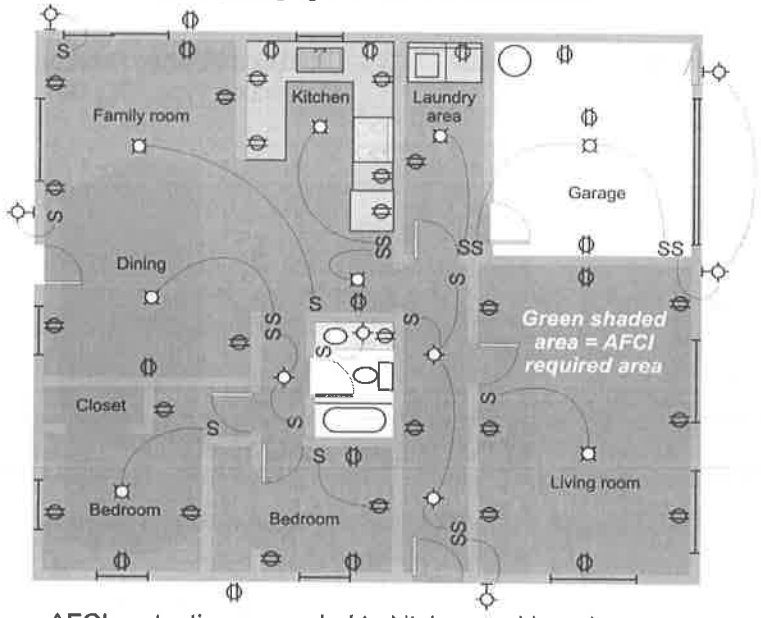
73

210.12(A) AFCI Protection

- "Kitchens" and "laundry areas" were added to list of areas requiring AFCI protection.
- This expansion into the kitchens and laundry areas is another step in the incremental approach for AFCI protection at dwelling units.
- AFCI protection was also expanded to include 15 or 20 ampere branch circuits supplying outlets or "devices" which would now include switches, etc.
- AFCI protection is now required to be installed in dwelling unit kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, laundry areas, or similar rooms or areas.

74

210.12(A) AFCI Protection



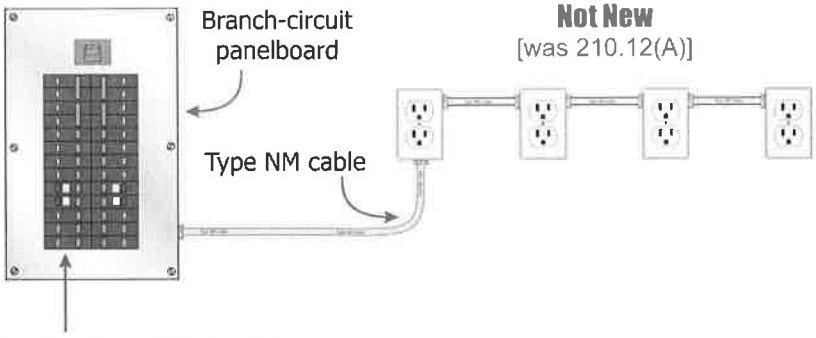
AFCI protection expanded to kitchen and laundry areas

210.12(A)(1) – (6) AFCI Protection

- AFCI protection methods were expanded and language put into a list format.
- Provisions for outlet branch circuit (OBC) AFCI devices were expanded.
- The first two previous exceptions were revised to positive language and put into a list format of six provisions for providing AFCI protection.
- AFCI protection for dwelling units has taken another step forward with the continued incrementally approach to the expansion of this safety enhancing protection.

210.12(A) AFCI Protection

All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in specified areas of dwelling unit shall be protected by any of the means described in (1) through (6):



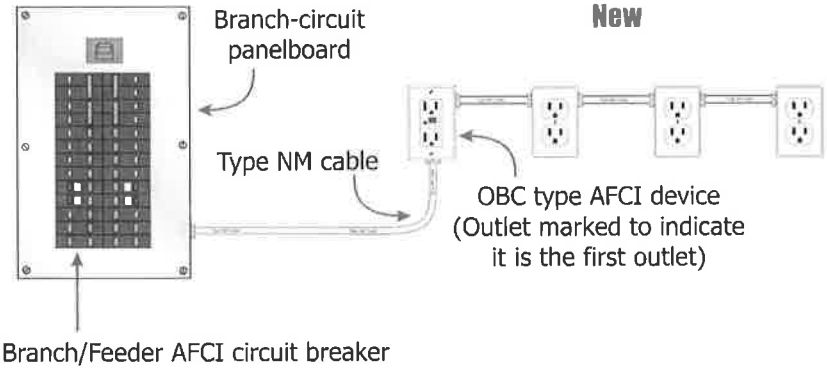
(1) A listed combination type arc-fault circuit interrupter, installed to provide protection of the entire branch circuit

77

210.12(A) AFCI Protection

All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in specified areas of dwelling unit shall be protected by any of the means described in (1) through (6):

OBC = Outlet Branch Circuit

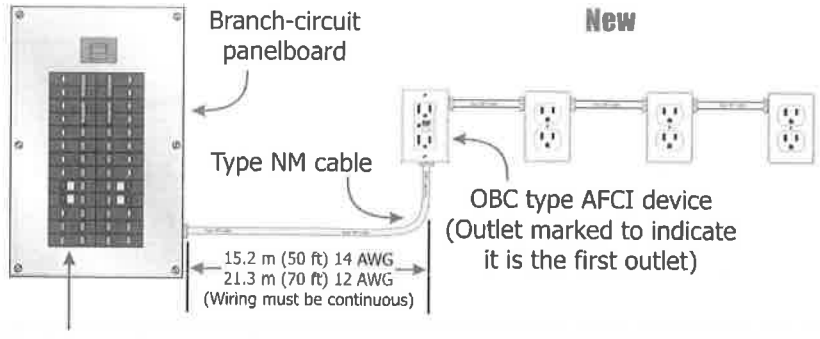


(2) A listed branch/feeder type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch circuit type AFCI installed at the first outlet box on the branch circuit (first outlet marked to indicate that it is the first outlet)

78

210.12(A) AFCI Protection

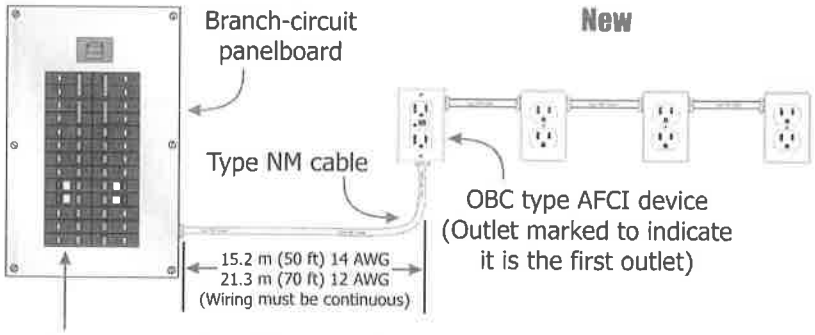
All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in specified areas of dwelling unit shall be protected by any of the means described in (1) through (6):



(3) A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch circuit type AFCI installed at the first outlet box on the branch circuit (with three limiting conditions)

210.12(A) AFCI Protection

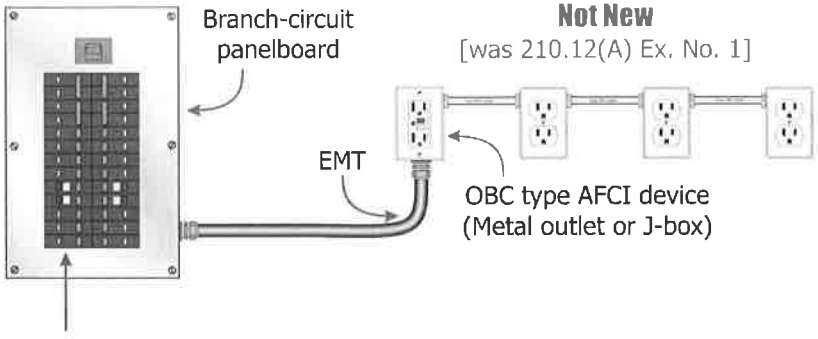
All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in specified areas of dwelling unit shall be protected by any of the means described in (1) through (6):



(4) System Combination Type AFCI. A listed outlet branch circuit type AFCI installed at the first outlet in combination with a listed branch circuit over-current protective device (with four limiting conditions) (OCPD & OBC AFCI device must be identified and listed as "System Combination" type AFCI)

210.12(A) AFCI Protection

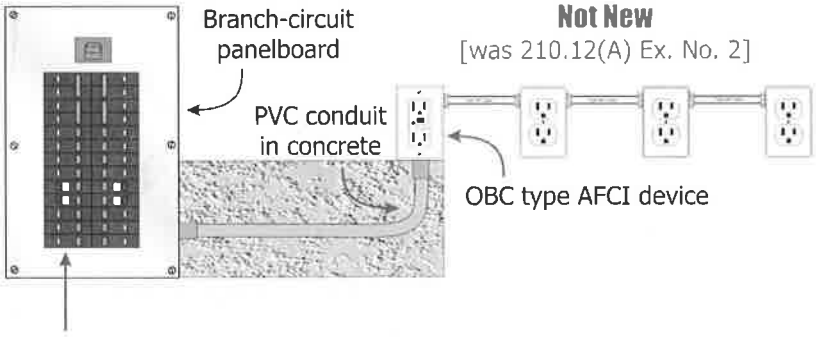
All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in specified areas of dwelling unit shall be protected by any of the means described in (1) through (6):



(5) A listed outlet branch-circuit type AFCI device (first outlet) is permitted with RMC, IMC, EMT, Type MC, steel armored Type AC cables, metal wireways, or metal auxiliary gutters and metal outlet and junction boxes installed for the portion of the branch circuit between the OCPD and the first outlet S1

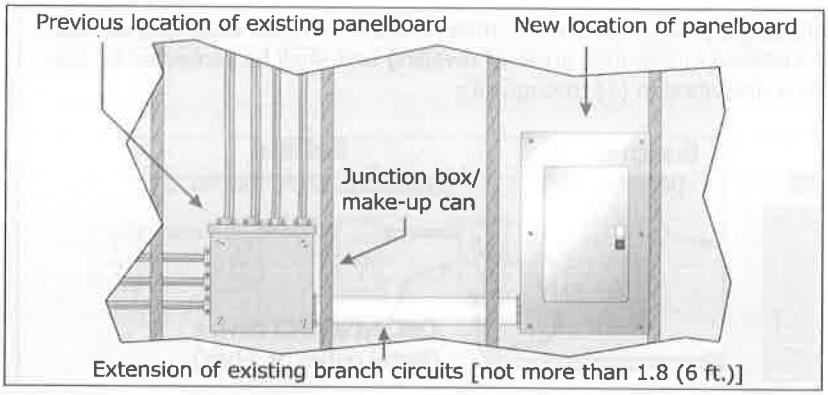
210.12(A) AFCI Protection

All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in specified areas of dwelling unit shall be protected by any of the means described in (1) through (6):



(6) Where a listed metal or nonmetallic conduit or tubing or Type MC cable is encased in not less than 50mm (2 in.) of concrete for the portion of the branch circuit between the OCPD and the first outlet, it shall be permitted to install an a listed outlet branch circuit type AFCI at the first outlet S2

210.12(B) AFCI - Extensions or Modifications



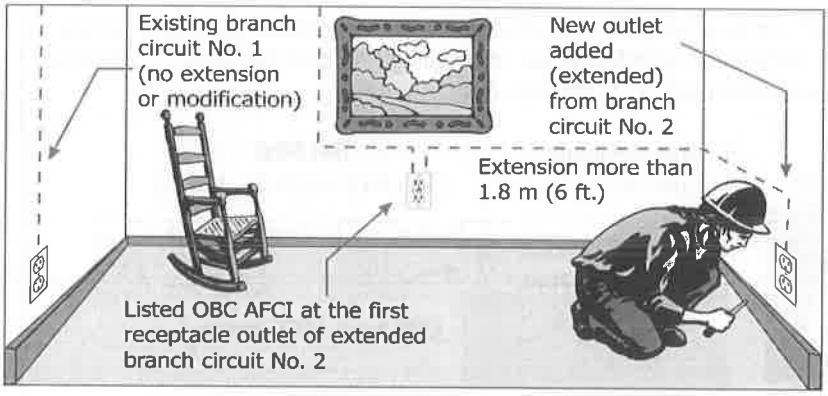
In any of the areas specified in 210.12(A), where branch-circuit wiring is modified, replaced or extended, the branch circuit shall be protected by:

(1) A listed combination AFCI located at the origin of the branch circuit, or

(2) A listed outlet branch-circuit AFCI located at the first receptacle outlet of the existing branch circuit

Exception: *AFCI protection is not required where the extension is not more than 1.8 m (6 ft.) and does not include any additional outlets or devices*

210.12(B) AFCI - Extensions or Modifications



In any of the areas specified in 210.12(A), where branch-circuit wiring is modified, replaced or extended, the branch circuit shall be protected by:

(1) A listed combination AFCI located at the origin of the branch circuit, or

(2) A listed outlet branch-circuit AFCI located at the first receptacle outlet of the existing branch circuit

Exception: *AFCI protection is not required where the extension is not more than 1.8 m (6 ft.) and does not include any additional outlets or devices*

NEW

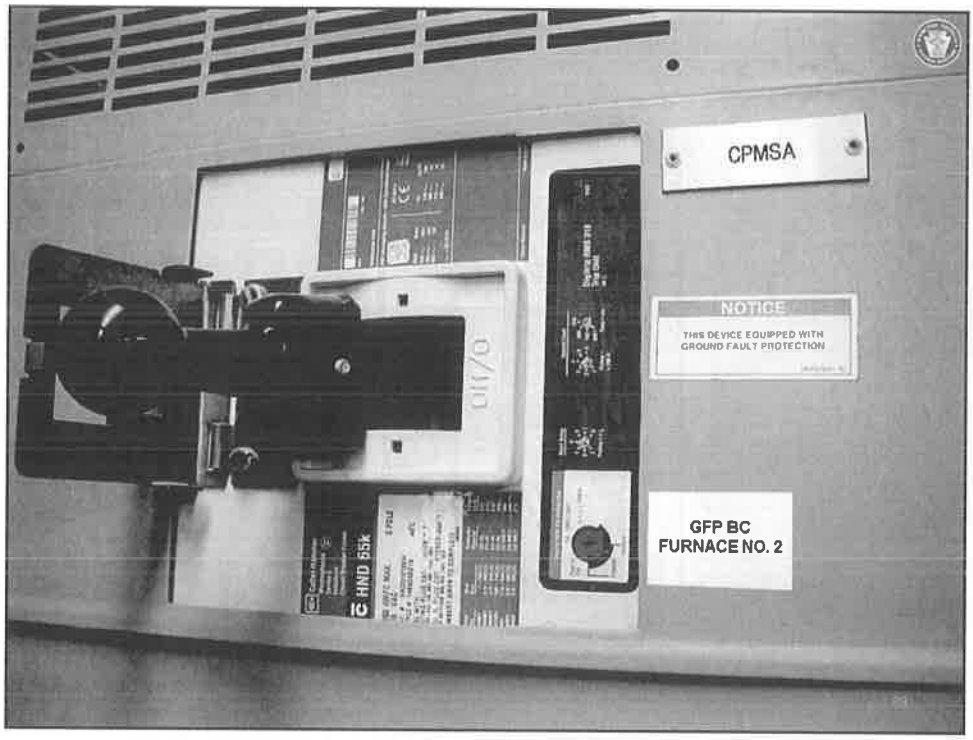
210.12(C) AFCI: Dormitory Units

- All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dormitory unit bedrooms, living rooms, hallways, closets, and similar rooms are now required to be provided with AFCI protection.
- These confined living quarter conditions can lead to damage or misuse of the extension cords which in many cases are undersized for the applied load such as a microwave oven.
- Dorm occupants should be afforded the same level of AFCI protection provided to those who reside in a dwelling unit.

NEW

210.13 GFPE: Branch Circuits

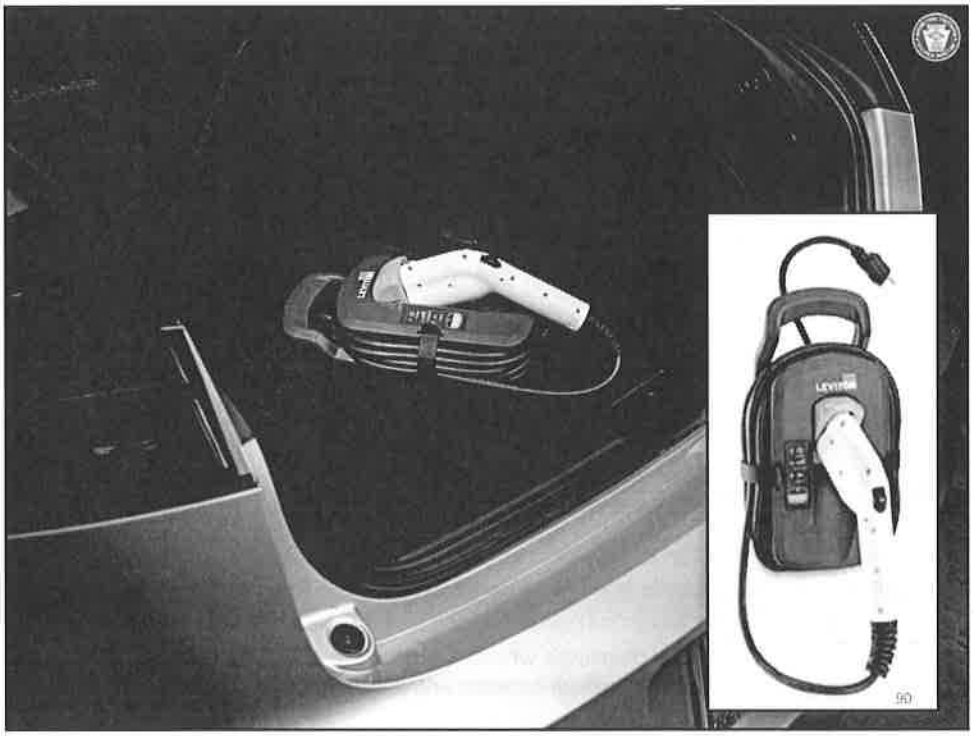
- GFP of equipment now required for branch circuit disconnects meeting provisions described at 230.95.
- New section requires each branch circuit disconnect rated 1000 amperes or more and installed on solidly grounded wye electrical systems of more than 150 volts to ground (but not exceeding 600 volts) to be provided with GFPE.



NEW

210.17 Electric Vehicle Branch Circuit

- Outlet(s) installed for the purpose of charging electric vehicles required to be supplied by a separate branch circuit with no other outlets.

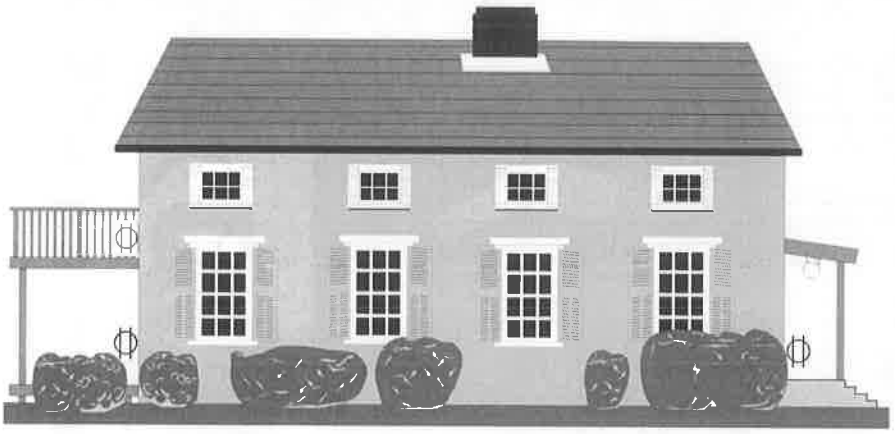


210.52(E)(1) and (E)(2) Outdoor Outlets

- The requirements for outdoor receptacles at dwellings have been revised to permit the required receptacle outlets to be "readily accessible from grade."
- This provision was revised by removing the "while standing at grade level" requirement.
- This change will allow the deck or porch receptacle outlet to serve as one of the required outdoor receptacle outlets if it is "readily accessible from grade" with the deck or porch permitted to serve as "grade."
- Same revision to individual units of multifamily dwellings *(with individual exterior entrance/egress).*

91

210.52(E)(1) and (E)(2) Outdoor Outlets



At least one receptacle outlet readily accessible from grade and not more than 2.0 m (6½ ft) above grade level shall be installed at the front and back of dwelling units

Same provision for multifamily dwellings where the dwelling unit is located at grade level and provided with individual exterior entrance/egress

92

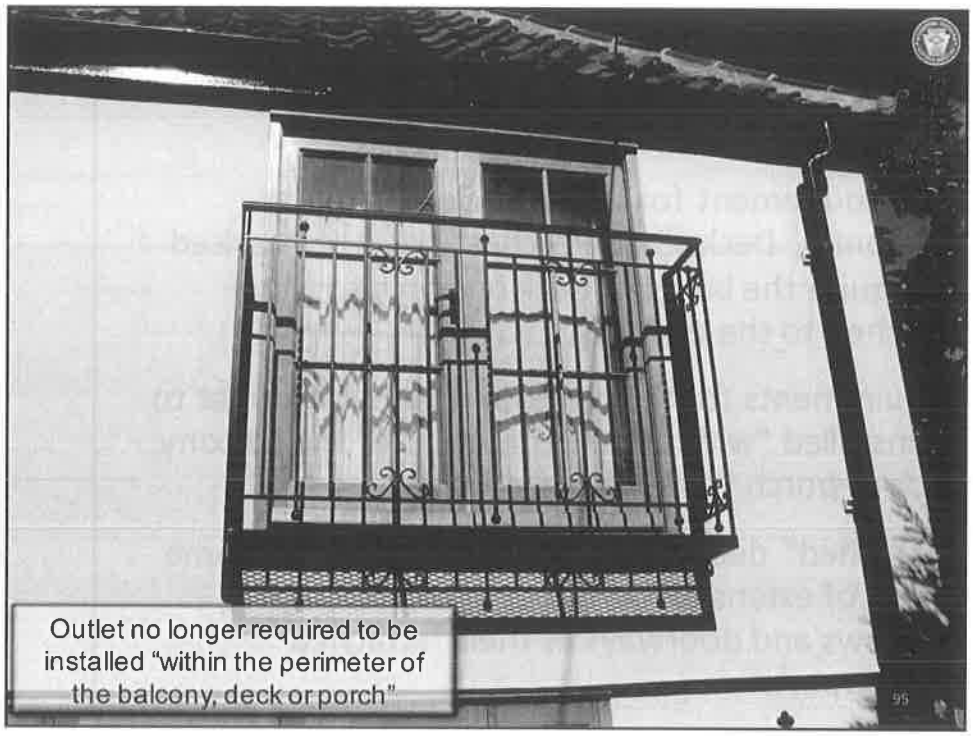
210.52(E)(3) Balconies, Decks and Porches

- The requirement for a receptacle located at "Balconies, Decks, and Porches" has been revised to require the balcony, deck or porch to be attached to the dwelling.
- Requirements for the outdoor receptacle outlet to be installed "within the perimeter" of the balcony, deck or porch have been eliminated.
- "Detached" decks and such do not pose the same threat of extension cords being ran through windows and doorways as their "attached" counterparts.

210.52(E)(3) Balconies, Decks and Porches

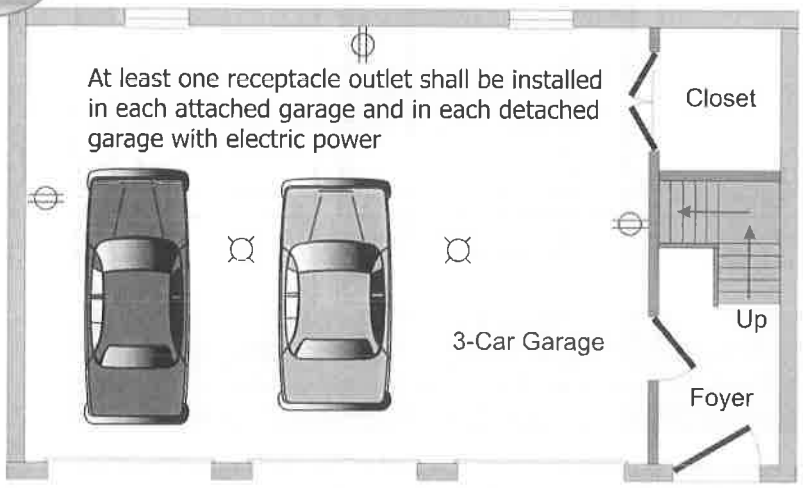
Balconies, decks and porches that are attached to the dwelling unit and are accessible from inside the dwelling unit shall have at least one receptacle outlet accessible from the balcony, deck or porch

The receptacle outlet shall not be located more than 2.0 m (6½ ft) above the balcony, deck, or porch walking surface



210.52(G)(1) Dwelling Unit Garages

NEW



The branch circuit supplying this receptacle(s) shall not supply outlets outside of the garage

At least one receptacle outlet shall be installed for each car space

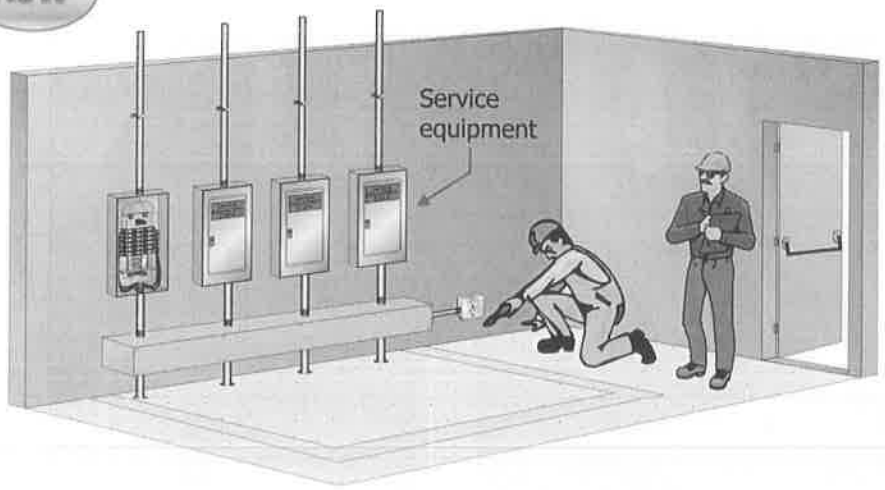
NEW

210.64 Electrical Service Areas

- New provision requiring 125 volt, single-phase, 15-or 20-ampere receptacle outlet to be installed at *"Electrical Service Areas."*
- At least one 125 volt, single-phase, 15-or 20-ampere receptacle outlet is now required to be installed within 15 m (50 ft) of all electrical service areas.
- Exception was added for one- and two-family dwelling services.

210.64 Electrical Service Areas

NEW



At least one 125-volt, single phase, 15 or 20 ampere rated receptacle outlet shall be installed within 15 m (50 ft) of the electrical service equipment

Exception for one and two family dwellings

99

Table 220.3 Additional Load Calculation References

- New line item added to Table 220.3 for "Electric Vehicle Charging Equipment" and a reference to 625.14 *(should be 625.41)*.
- This will help clarify the load calculation requirements for electric vehicle (EV) charging loads *(considered as continuous)*.

100

Table 220.3 Additional Load Calculation References (in Part)

Calculation	Article	Section (or Part)
Air-conditioning and refrigerating equipment, branch-circuit conductor sizing	440	Part IV
Cranes and hoists, rating and size of conductors	610	610.14
Electric vehicle charging system branch circuit and feeder calculations	625	625.14 *
Electric welders, ampacity calculations	630	630.11, 630.31
Electrically driven or controlled irrigation machines	675	675.7(A), 675.22(A)

(Remainder of table unchanged, see NEC for complete table)

**(Article 625 Code reference should be 625.41)*

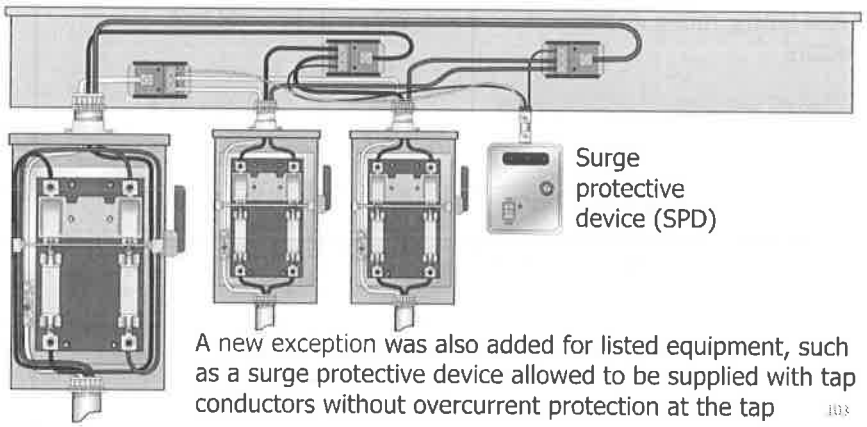
240.21(B)(1) Feeder Taps Not Over 10 ft Long

- Tap conductor ampacity for feeder taps [not over 3 m (10 ft) long] required to be not less than the rating of the equipment containing an overcurrent device(s).
- "Equipment containing an overcurrent device(s)" replaces "device."
- This same change also occurred at 240.21(C)(2) for transformer secondary conductors not over 3.0 m (10 ft) long.

240.21(B)(1) Feeder Taps Not Over 3 m (10 ft)

Conductors are permitted to be tapped, without overcurrent protection at the tap, if the length of the tap conductors does not exceed 3 m (10 ft) and the tap conductors:

- Ampacity is not less than the combined calculated loads on the circuits supplied by the tap conductors
- Ampacity is not less than the rating of the equipment containing an overcurrent device(s) supplied by the tap conductors



A new exception was also added for listed equipment, such as a surge protective device allowed to be supplied with tap conductors without overcurrent protection at the tap

240.21(B)(1) Feeder Taps Not Over 3 m (10 ft) Long

- Conductors are permitted to be tapped, without overcurrent protection at the tap, if the length of the tap conductors does not exceed 3 m (10 ft) and the tap conductors comply with all the following:
  - Ampacity cannot be less than the combined calculated loads on the circuits supplied by the tap conductors.
  - Ampacity cannot be less than the rating of the equipment containing an overcurrent device(s) supplied by the tap conductors.
  - Do not extend beyond the panelboard, etc. they supply.
  - Generally, required to be enclosed in a raceway.
  - If the tap conductors leave the enclosure in which the tap is made, the ampacity of the tap conductors cannot be less than one-tenth of the rating of the overcurrent device protecting the feeder conductors.

2014 National Electrical Code
Model Code Change Highlights

Chapter 2
Article 250 Grounding and Bonding

Over 16 Significant Changes

California Building Officials

105

250.66(A) and (B) Grounding Electrode Conductor "Sole Connections"

- Explanatory-type language and plural text was added to 250.66(A) and (B) to clarify that the "sole connection" provisions of these subsections pertains to the types of electrodes involved.
- The plural language and revised text at both 250.66(A) and (B) should make it clear that the *Code* considers two ground rods one electrode as far as the "sole connection" sizing provisions are concerned.

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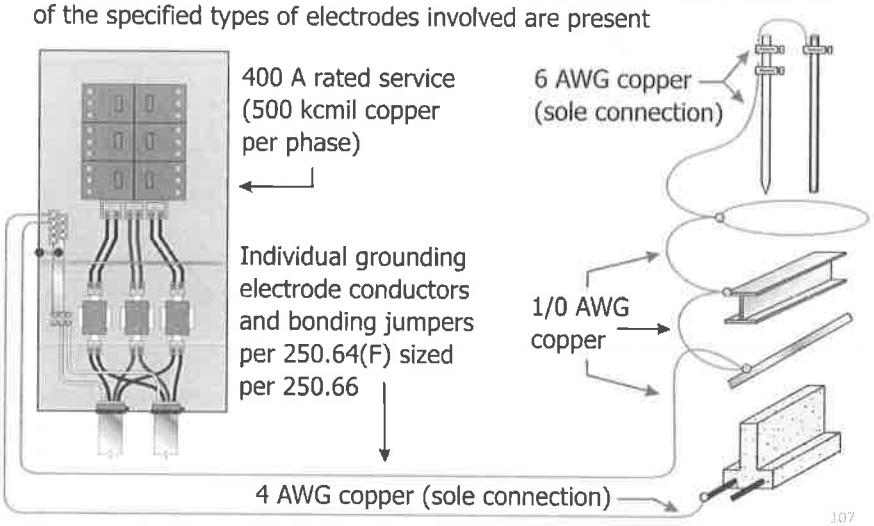
250.66(A) and (B) GEC "Sole Connections"

Explanatory language and plural text was added to clarify that the "sole connection" provisions pertains to the types of electrodes involved

The "sole connection" sizing provisions are not forfeited if more than one of the specified types of electrodes involved are present

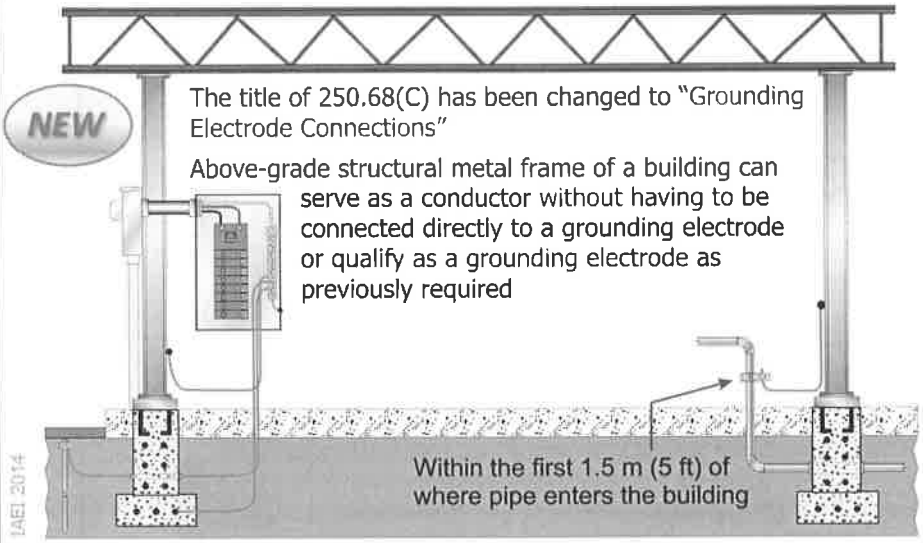


NEW

250.68(C) Grounding Electrode Connections

- The title of 250.68(C) has been changed to "Grounding Electrode Connections."
- Provisions for metal structure steel used to as a conductor to interconnect electrodes have been revised *(prescriptive language has been removed).*
- Structural metal frame of a building should be treated the same as metallic water piping without having to meet qualifying conditions of a grounding electrode.

250.68(C) Grounding Electrode Connections

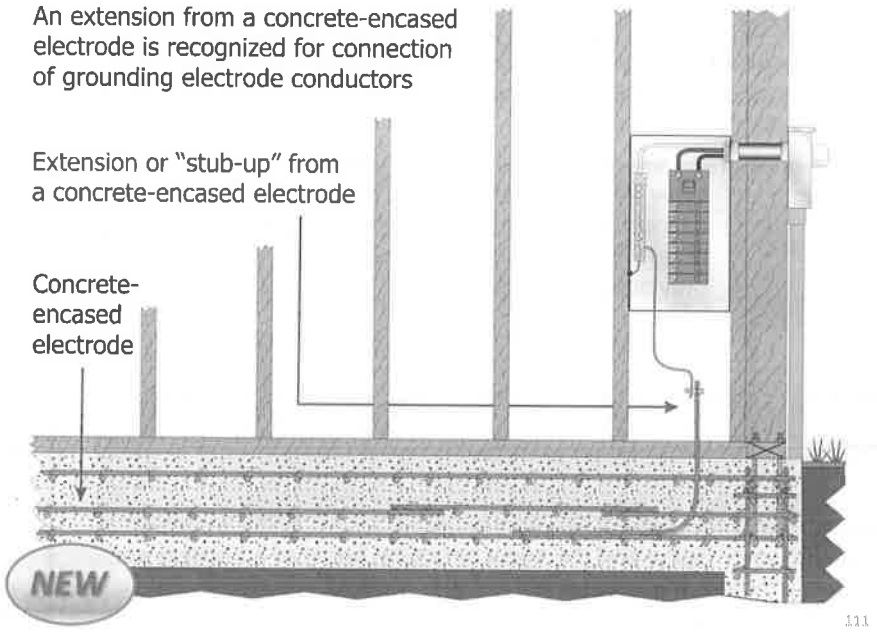


Interior metal water piping and the metal structural frame of a building are permitted as a means of interconnecting electrodes that are part of the grounding electrode system

250.68(C)(3) Concrete-Encased Electrode Extension

- New text added to recognize an extension from a concrete-encased electrode as being suitable for the connection of grounding electrode conductor(s).
- This rebar "stub-up" is already a commonly accepted practice, but no *Code* language addressed this issue.
- It be noted that the extension or "stub-up" is not part of the concrete-encased electrode *(just an extension).*

250.68(C)(3) Concrete-Encased Electrode Extension



111

NEW Table 250.102(C)(1) Sizing Grounded Conductors, Main Bonding Jumpers, Etc.

- New Table 250.102(C)(1) added for sizing grounded conductors, main bonding jumpers, system-bonding jumpers, and supply-side bonding jumpers *(rather than Table 250.66).*

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Table 250.102(C)(1) Grounded Conductor, Main Bonding Jumper, System Bonding Jumper, and Supply-Side Bonding Jumper for Alternating-Current Systems

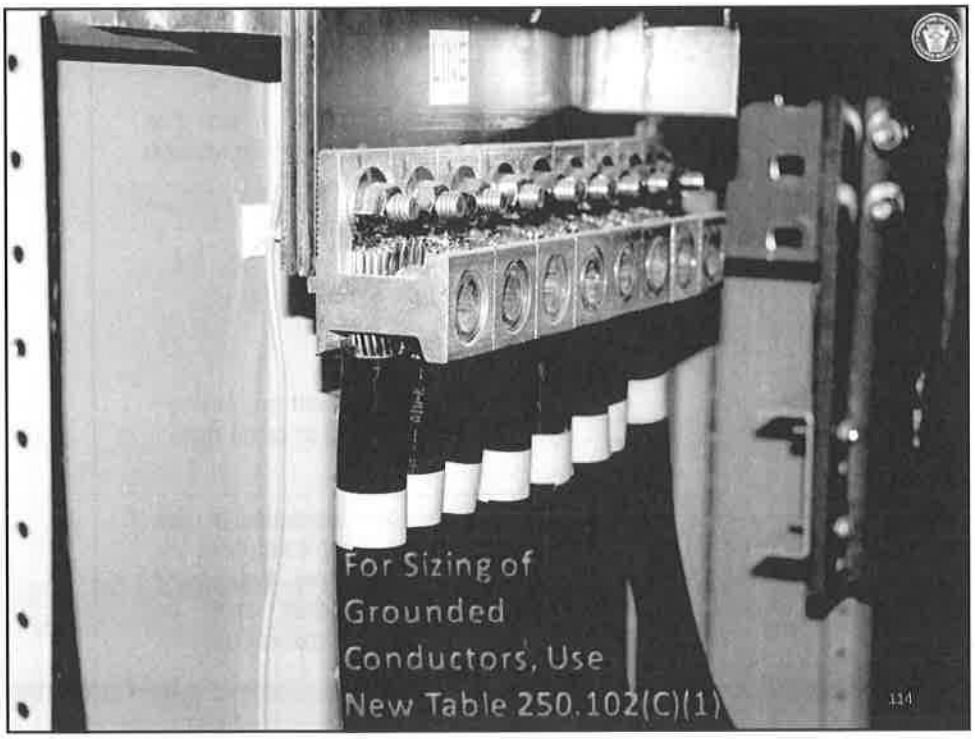
NEW

Size of Largest Ungrounded Conductor or Equivalent Area for Parallel Conductors (AWG/kcmil)		Size of Grounded Conductor or Bonding Jumper* (AWG/kcmil)	
Copper	Aluminum or Copper-Clad Aluminum	Copper	Aluminum or Copper-Clad Aluminum
2 or smaller	1/0 or smaller	8	6
1 or 1/0	2/0 or 3/0	6	4
2/0 or 3/0	4/0 or 250	4	2
Over 3/0 through 350	Over 250 through 500	2	1/0
Over 350 through 600	Over 500 through 900	1/0	3/0
Over 600 through 1100	Over 900 through 1750	2/0	4/0
Over 1100	Over 1750	See Notes	

*For the purposes of this table, the term bonding jumper refers to main bonding jumpers, system bonding jumpers, and supply-side bonding jumpers.

Notes:
[See NEC for complete text of notes to Table 250.102(C)(1)]

113

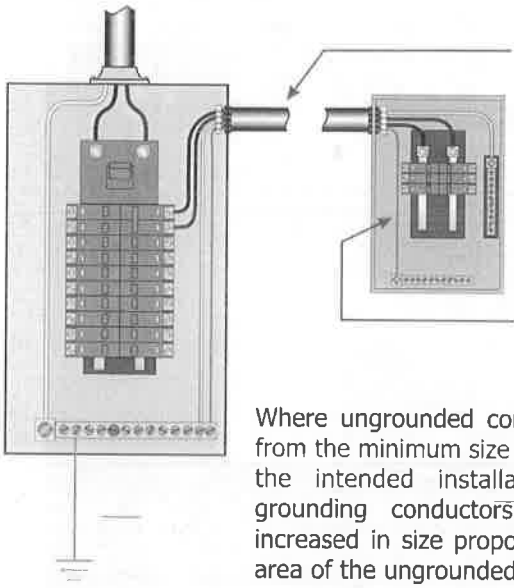


114

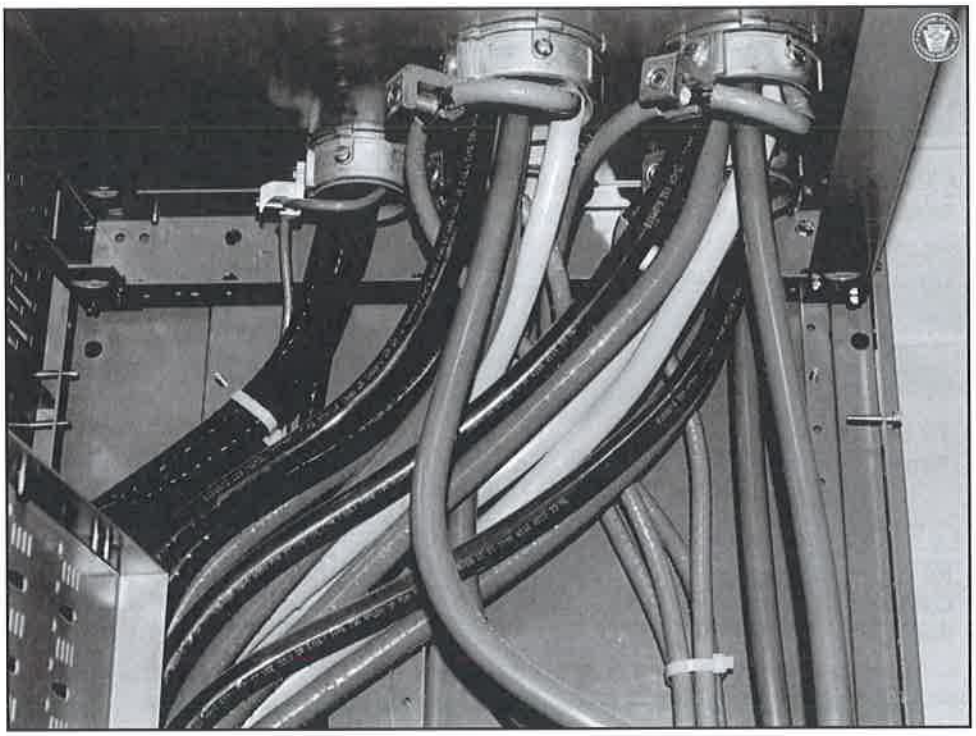
250.122(B) EGC Increased in Size

- Wire-type equipment grounding conductors (EGC) required to be increased in size when the minimum sized ungrounded conductors are increased in size.
- Previous language would have literally required an "increase in size" of the metal raceway or conduit when used as the sole EGC.
- EGC's are not required to be increased in size when the ungrounded conductors are installed oversized or above the minimum sizes required for sufficient ampacity for the intended load.

250.122(B) EGC Increased in Size



Where ungrounded conductors are increased in size from the minimum size that has sufficient ampacity for the intended installation, **wire-type** equipment grounding conductors, where installed, shall be increased in size proportionately with the circular mil area of the ungrounded conductors



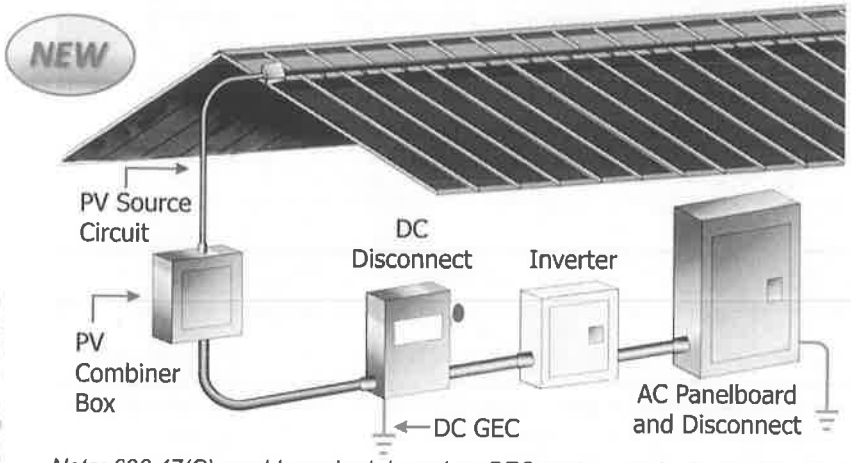
NEW

250.166 Size of Direct-Current Grounding Electrode Conductor

- A maximum size requirement of 3/0 copper or 250 kcmil aluminum for grounding electrode conductor of dc systems was added at 250.166.
- This correlates with the maximum size requirements for ac system grounding electrode conductor as specified at 250.66 and Table 250.66.

250.166 Size of DC Grounding Electrode Conductor

- A maximum size requirement for grounding electrode conductors of dc systems has added at 250.166
- The GEC for dc systems shall be sized per 250.166 but shall not be required to be larger than 3/0 copper or 250 kcmil aluminum

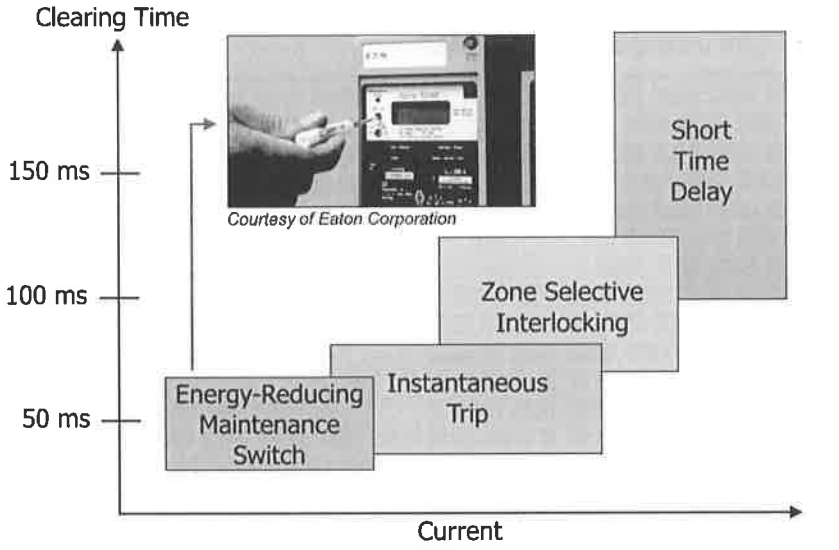


Note: 690.47(C) would required dc and ac GEC systems to be bonded together

240.87 Arc Energy Reduction

- Title was changed from "**Noninstantaneous Trip**" to "**Arc Energy Reduction**" and section was revised for usability and formatted into subdivisions.
- Revision expands these requirement to more than just power circuit breakers without an instantaneous trip function.
- A limitation to the size of breaker (1200 ampere or greater) required to comply with this section was added.
- An additional method to reduce clearing time was added to the list of methods dealing with energy-reducing active arc-flash mitigation system.

240.87 Arc Energy Reduction



Relative clearing times for electronic circuit breaker trip functions

121

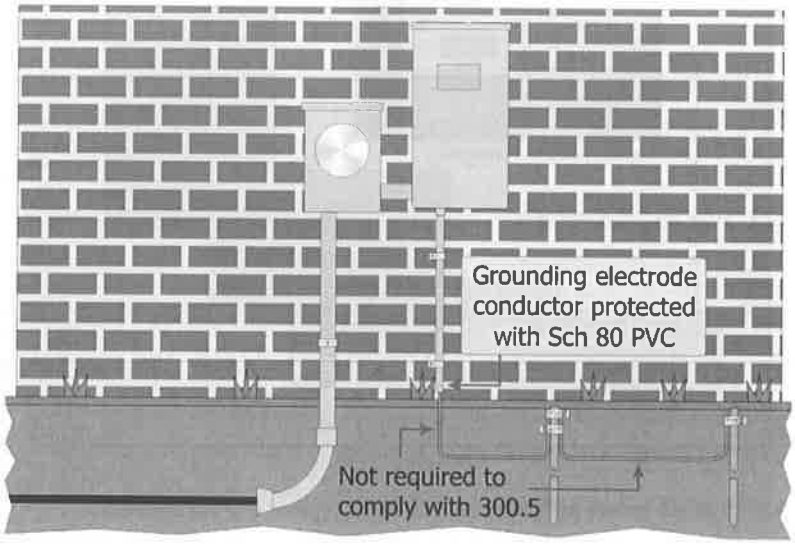
250.64(B) Grounding Electrode Conductor Installation

- New provisions added to clarify that grounding electrode conductors and grounding electrode bonding jumpers are not required to comply with 300.5 for underground installations.
- Prior to this clarification concerning grounding electrode conductors and burial depth requirements of Table 300.5, the *Code* was unclear on this subject.
- Inconsistent interpretation was the result.
- This added sentence at 250.64(B) will clarify that grounding electrode conductors or grounding electrode bonding jumpers are not subject to the burial depth requirements of 300.5 or Table 300.5.

122

250.64(B) GEC Installation

New provisions added to clarify that grounding electrode conductors and grounding electrode bonding jumpers are not required to comply with 300.5 for underground installations



123

Chapter Three
Wiring Methods And Materials

124

Chapter 3 – Wiring Methods

- Chapter 3 — 42 Wiring Methods
- 310 — Conductor Ampacity
- *393 NEW* — *Low-Voltage Suspended Ceiling Power Distribution Systems*

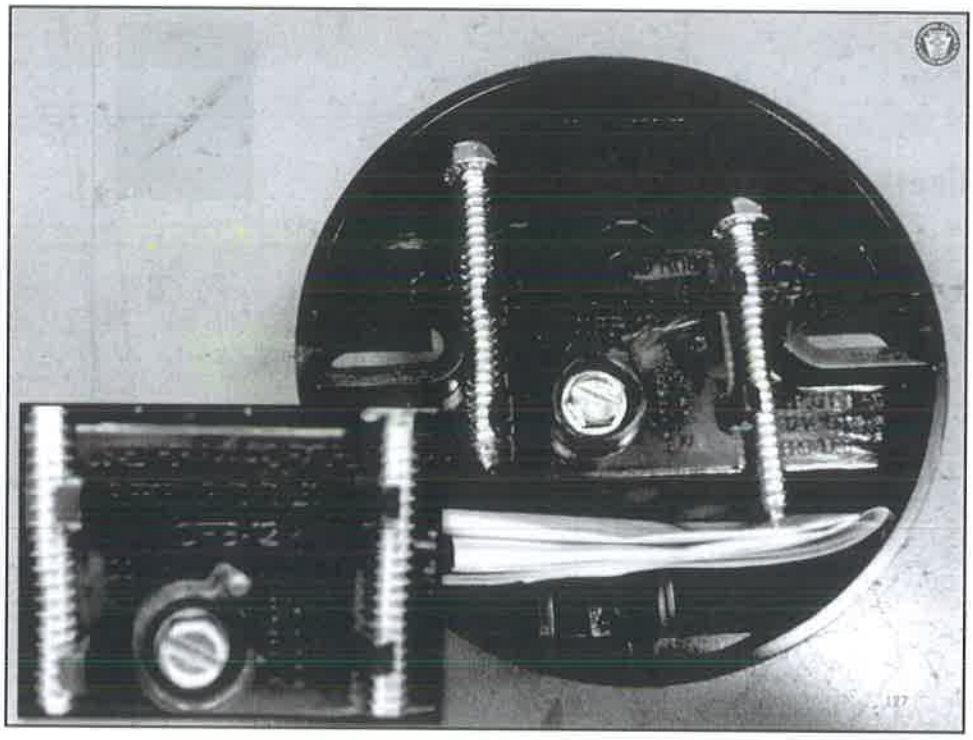
California Building Officials

2014 National Electrical Code
Model Code Change Highlights

Chapter 3 – Wiring Methods

Over 15 Significant Changes

California Building Officials



NEW 300.6(A) Protection Against Corrosion Informational Note

- A new Informational Note was added indicating what constitutes "Field-Cut Threads."
- Field-cut threads are those threads that are "field-applied" or cut in conduit, elbows, or nipples anywhere other than at the factory where the product is produced and listed.
- All field-cut threads, internal and external, are required to be corrosion protected, after cutting, as part of the product listing.

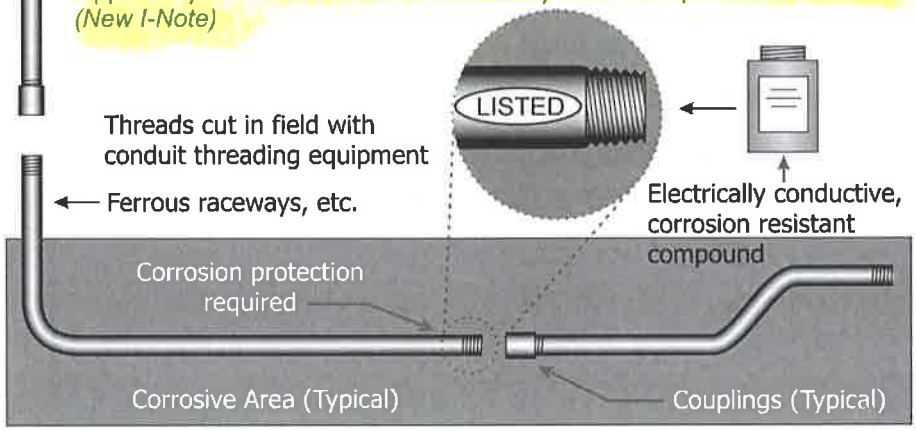
NEW

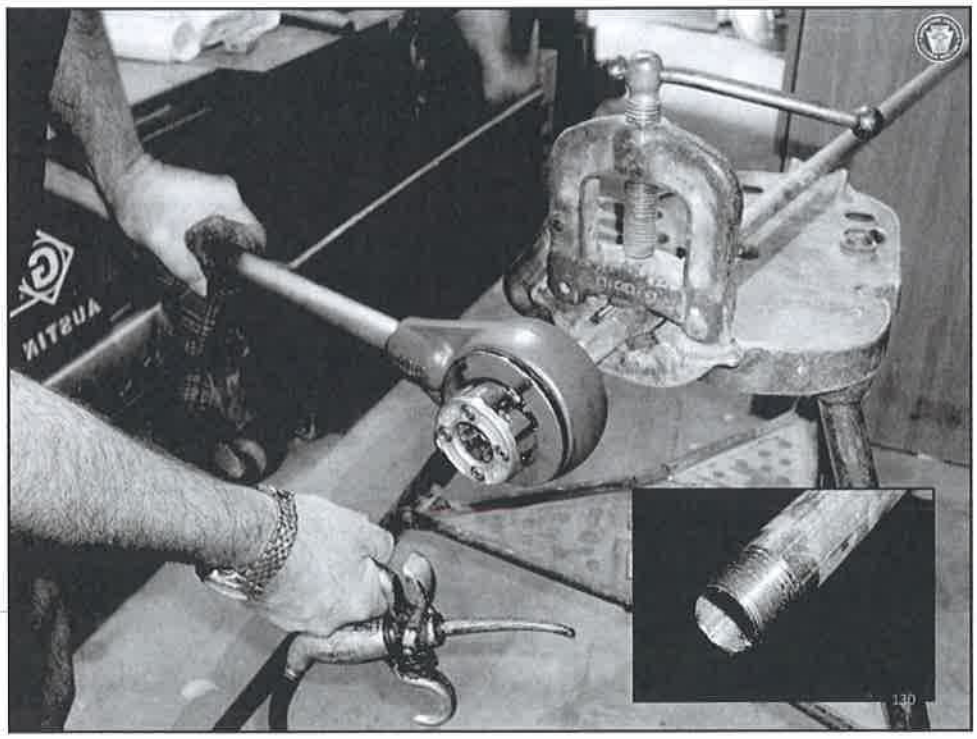
300.6(A) Protection Against Corrosion

Ferrous metal raceways, etc. are typically required to be suitably protected against corrosion inside and outside

Field threads shall be coated with an approved electrically conductive, corrosion-resistant compound

Field-cut threads are those threads that are cut in conduit, elbows, or nipples anywhere other than at the factory where the product is listed *(New I-Note)*

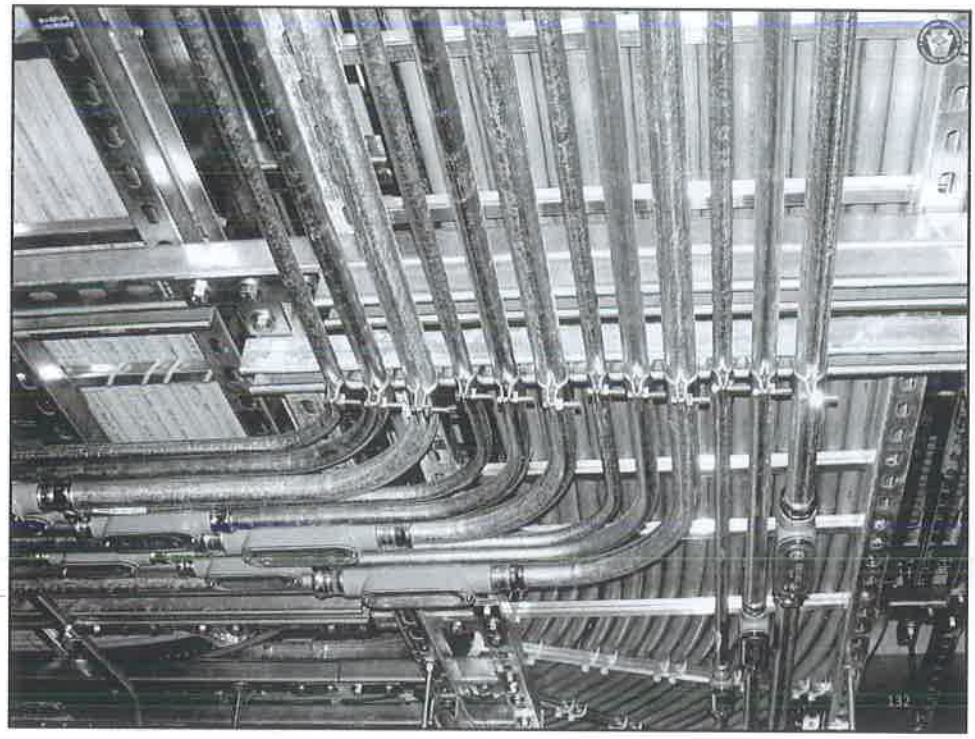




300.11(B)(1) Raceways Used as a Means of Support

- Raceways are permitted to be used as a means of support for other raceways, cables, or nonelectrical equipment, but the raceway or means of support must now be "identified as a means of support," not just "identified for the purpose."
- Revised text will ensure that the raceway or means of support is identified as a "means of support."

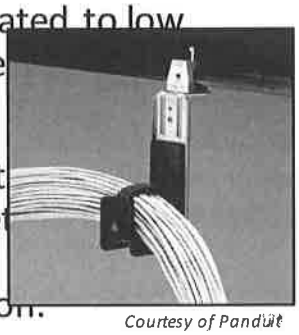
131



132

300.22(C)(1) Wiring Methods for Environmental Air Spaces (Plenums)

- Cable ties used to secure cables in plenums must be listed as having fire resistant and low smoke producing characteristics.
- A new informational note was also added that will provide pertinent information related to low smoke and heat release properties of nonmetallic cable ties.
- Plenum grade nonmetallic cable ties are readily available in the marketplace today that can achieve compliance with this new provision.



Courtesy of Panduit

300.22(C)(1) Wiring Methods (Plenums)

The wiring methods for environmental air-handling spaces shall be limited to Type AC cable, flexible metal conduit, EMT, etc.

Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables shall be listed as having low smoke and heat release properties

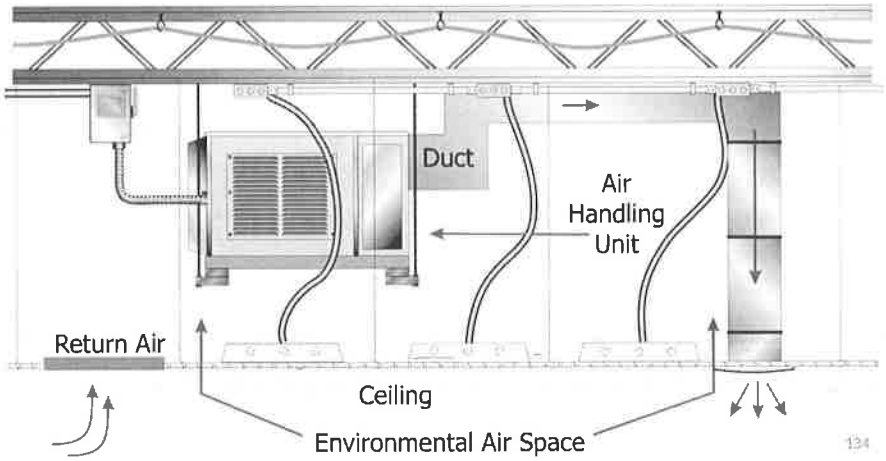


Table 310.15(B)(3)(a) More Than Three Current-Carrying Conductors

- Title of 310.15(B)(3)(a) and corresponding table was changed to "More Than Three Current-Carrying Conductors ~~in a Raceway or Cable~~."
- Note to Table 310.15(B)(3)(a) was revised to make it clear that table applies to spare conductors but does not apply to conductors that cannot be simultaneously energized.
- Ampacity adjustment correction factor is required for three or more current carrying conductors that are installed or bundled together without maintaining spacing as well as those in a raceway or cable.

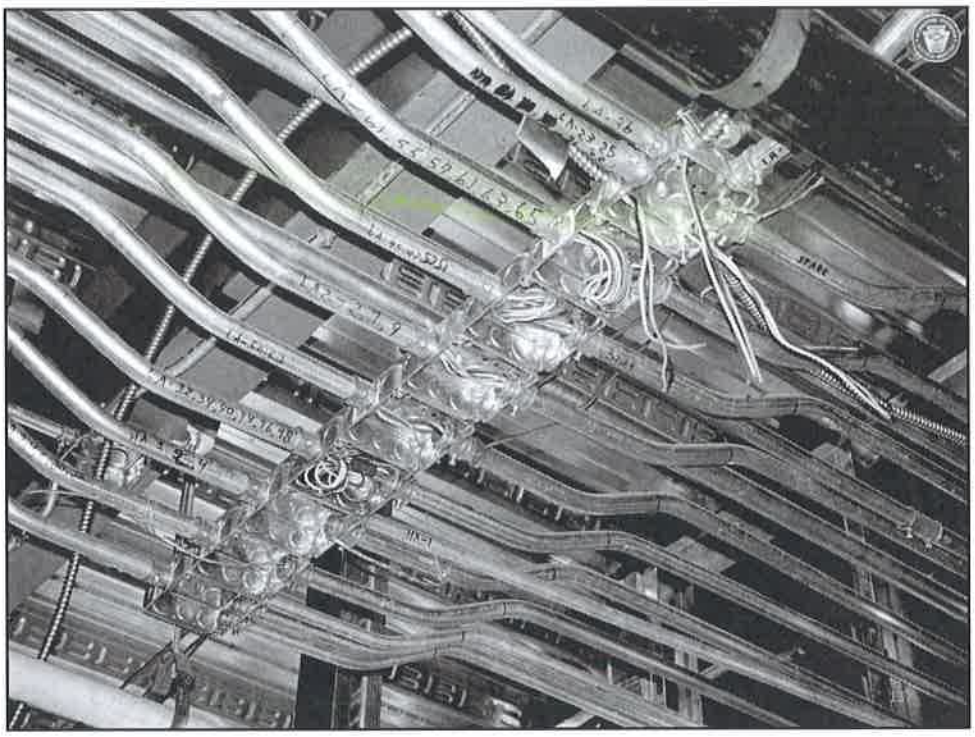
135

Table 310.15(B)(3)(a) Adjustment Factors for More Than Three Current-Carrying Conductors ~~in a Raceway or Cable~~

Number of Conductors[1]	Percent of Values in Tables 310.15(B)(16) through 310.15(B)(19) as Adjusted for Ambient Temperature if Necessary
4-6	80
7-9	70
10-20	50
21-30	45
31-40	40
41 and above	35

[1]Number of conductors is the total number of conductors in the raceway or cable, including spare conductors. The count shall be adjusted in accordance with 310.15(B)(5) and (6), and shall not include conductors that are connected to electrical components but that cannot be simultaneously energized.

136



310.15(B)(3)(c) Raceways and Cables Exposed to Sunlight on Rooftops

- The title and parent text at 310.15(B)(3)(c) has been revised for clarity from "Circular Raceways Exposed to Sunlight on Rooftops" to "Raceways and Cables Exposed to Sunlight on Rooftops."

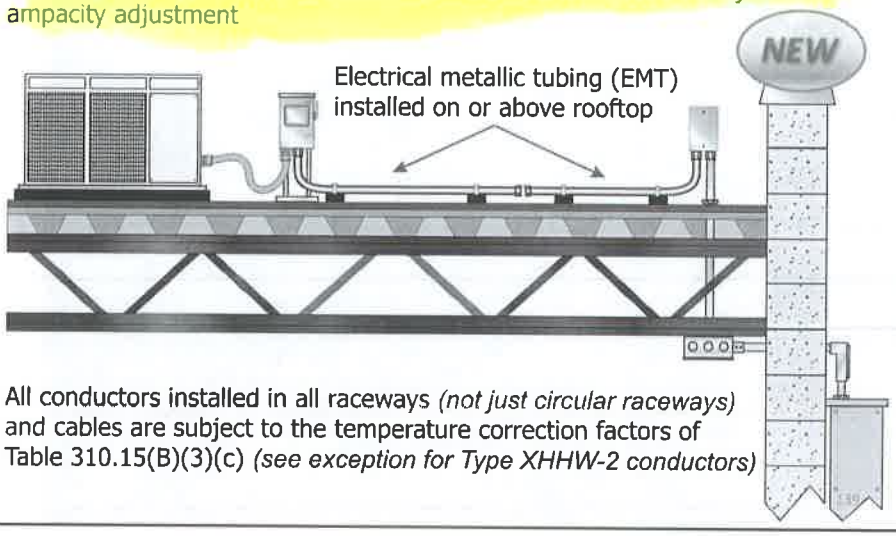
- A new exception was also added allowing Type XHHW-2 conductors *(thermoset insulated conductor)* to be installed in raceways or cables on rooftops without having to apply an ambient temperature adjustment correction factor for these conductors.

NEW

310.15(B)(3)(c) Raceways and Cables on Rooftops

Where raceways or cables are exposed to direct sunlight on or above rooftops, the adjustments shown in Table 310.15(B)(3)(c) shall apply

By exception, Type XHHW-2 insulated conductors shall not be subject to this ampacity adjustment



All conductors installed in all raceways *(not just circular raceways)* and cables are subject to the temperature correction factors of Table 310.15(B)(3)(c) *(see exception for Type XHHW-2 conductors)*

NEW 310.15(B)(3)(c) Rooftop Adjustment Factors

310.15(B)(3)(c) ~~Circular~~ Raceways and Cables Exposed to Sunlight on Rooftops. Where ~~conductors or cables are installed in circular~~ raceways or cables are exposed to direct sunlight on or above rooftops, the adjustments shown in Table 310.15(B)(3)(c) shall apply.

Exception: Type XHHW-2 insulated conductors shall not be subject to this ampacity adjustment.

Table 310.15(B)(2)(c) Ambient Temperature Adjustment for Raceways or Cables Exposed to Sunlight On or Above Rooftops

Distance Above Roof to Bottom of Raceway or Cables	Temperature Added	
	°C	°F
On roof 0 - 13 mm (0 - ½ in.)	33	60
Above 13 mm (½ in.) - 90 mm (3½ in.)	22	40
Above 90 mm (3½ in.) - 300 mm (12 in.)	17	30
Above 300 mm (12 in.) - 900 mm (36 in.)	14	25

Informational Note to Table 310.15(B)(3)(c): The temperature adders in Table 310.15(B)(3)(c) are based on the measured temperature rise above the local climatic ambient temperatures due to sunlight heating.

310.15(B)(7) 120/240 Volt, Single-Phase Dwelling Services and Feeders

- Previous Table 310.15(B)(7) has been deleted entirely.
- The parent text at 310.15(B)(7) has been revised and broken up into four level 1 list items.
- Revision allows the ampacity values found at Table 310.15(B)(16) to be reduced by 17 percent *(not less than 83 percent of the service or feeder rating).*

141

The Table will still apply except for parallel runs so copy & insert into new code

NEW

314.15 Damp or Wet Locations

- All "outlet box hood" covers are required to be listed for use in a wet location, not just "extra duty" outlet box hood covers installed in a wet locations.
- 314.15 only required boxes, conduit bodies, and fittings installed in wet locations to be listed for use in wet locations.

142

314.15 Damp or Wet Locations

NEW

Outlet box hood cover

"Extra-Duty" outlet box hood cover

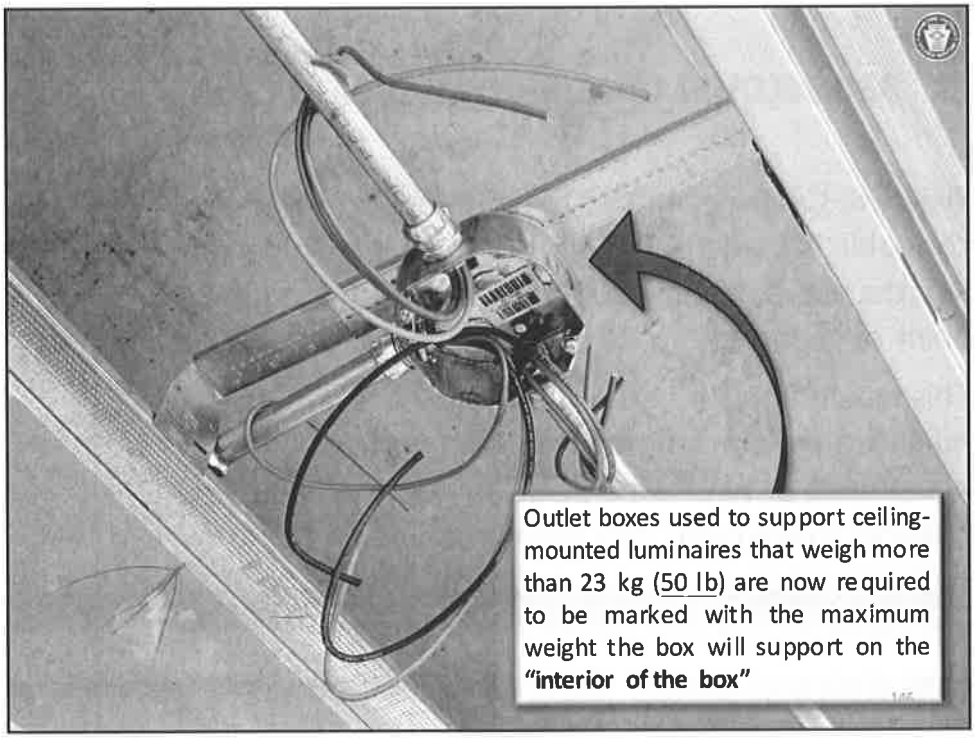
Courtesy of Thomas & Betts

Boxes, conduit bodies, outlet box hoods, and fittings installed in wet locations shall be listed for use in wet locations

All "outlet box hood" covers required to be listed for use in a wet location, not just "extra duty" outlet box hoods installed in a wet locations

314.27(A)(2) Boxes at Ceiling-Mounted Luminaire Outlets

- Outlet boxes used to support ceiling-mounted luminaires that weigh more than 23 kg (50 lb) are now required to be marked with the maximum weight the box will support on the "interior of the box."
- Allows the installer and the electrical inspector an opportunity to review this information at the time of installation without having to climb into the attic to retrieve this information.
- In some cases, the exterior of the outlet box is not accessible after a certain point in the building construction process.
- Ceiling-mounted outlet box supporting a luminaire weighing more than 23 kg (50 lb) is required to be listed and marked for the maximum weight that particular outlet box is designed to support.


Outlet boxes used to support ceiling-mounted luminaires that weigh more than 23 kg (50 lb) are now required to be marked with the maximum weight the box will support on the **"interior of the box"**

NEW

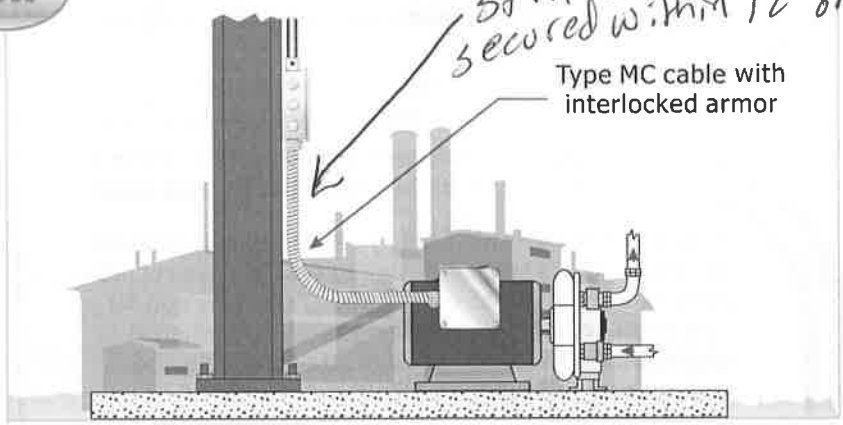
330.30(D)(3) Unsupported Type MC Cable

- Type MC Cable permitted to be unsupported where the cable is made of the interlocked armor type in lengths not exceeding 900 mm (3 ft) from the last point of support.
- This would apply where flexibility is necessary to minimize the transmission of vibration from equipment or to provide flexibility for equipment that requires movement after installation.

330.30(D)(3) Unsupported Type MC Cables

NEW

Still needs to be secured within 12" of Box



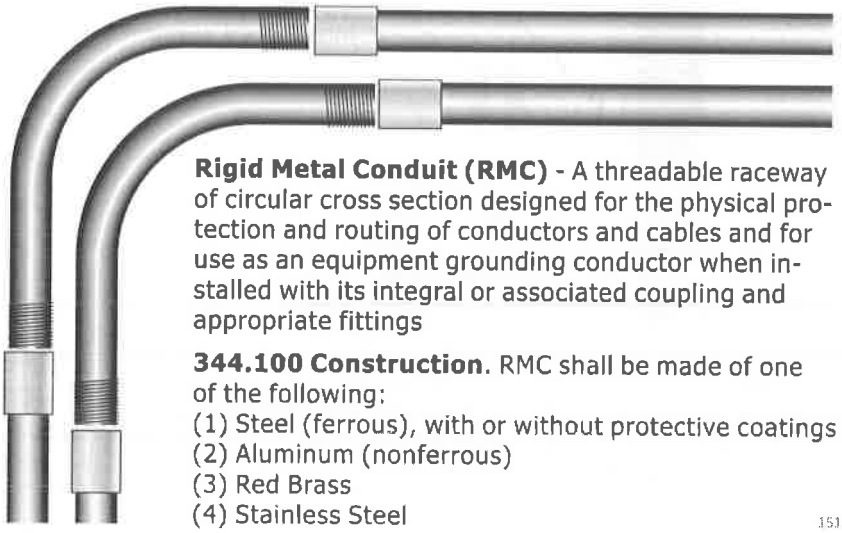
Interlocked armor Type MC cable is permitted to be unsupported in lengths not exceeding 900 mm (3 ft) from the last point where it is securely fastened and is used to connect equipment where flexibility is necessary to minimize transmission of vibration or to provide flexibility after installation

344.2 Definition: Rigid Metal Conduit and 344.100 Construction

- Definition of "Rigid Metal Conduit" was revised by removing last two previous sentences and relocating permitted construction material text to new 344.100 titled "Construction".
- Relocated language was repetitive by describing types of RMC that is already covered in Article 344 at 344.10 (Uses Permitted).

344.2 Definition: Rigid Metal Conduit (RMC)

Definition of "Rigid Metal Conduit" was revised by removing last two previous sentences and relocating this permitted construction material text to a new 344.100 titled "Construction"



Rigid Metal Conduit (RMC) - A threadable raceway of circular cross section designed for the physical protection and routing of conductors and cables and for use as an equipment grounding conductor when installed with its integral or associated coupling and appropriate fittings

344.100 Construction. RMC shall be made of one of the following:
(1) Steel (ferrous), with or without protective coatings
(2) Aluminum (nonferrous)
(3) Red Brass
(4) Stainless Steel

151

376.22 Number of Conductors and Ampacity (Metal Wireways)

- Ampacity adjustment factors for more than three current-carrying conductors in a raceway shall only apply to metal wireways where the number of current-carrying conductors exceeds 30 at any cross section of the wireway.
- Does not apply to simply 30 or more current-carrying conductors total in the wireway.
- It was never intended for the adjustment factors of 310.15(B)(3)(a) to apply once there were more than 30 conductors total in the wireway as opposed to at a cross sectional area.

153

NEW

Article 393 Low Voltage Suspended Ceiling Power Distribution Systems

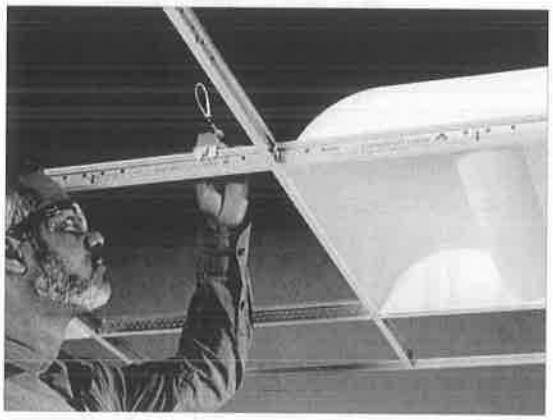
- A new article was added to address low-voltage Class 2 ac and dc volt supplied equipment *(lighting and power)* connected to ceiling grids, floors and walls built for this purpose.
- New article addresses equipment with similar features to track lighting but includes the wiring and power supply requirements.
- New article provides specific requirements for safe installations of low-voltage, power-limited power distribution, for power to lighting and non-lighting loads.
- The growing interest in alternative energy sources (e.g. PV, wind turbines, batteries, fuel cells, etc.) and the increase of low voltage, low power devices (sensors, LV lighting, IT equipment, AV equipment, etc.), has created a significant need for this new article.

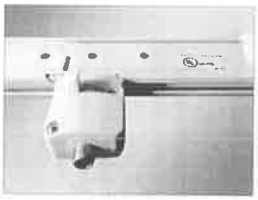
155

NEW

Article 393 Low Voltage Suspended Ceiling Power Distribution Systems

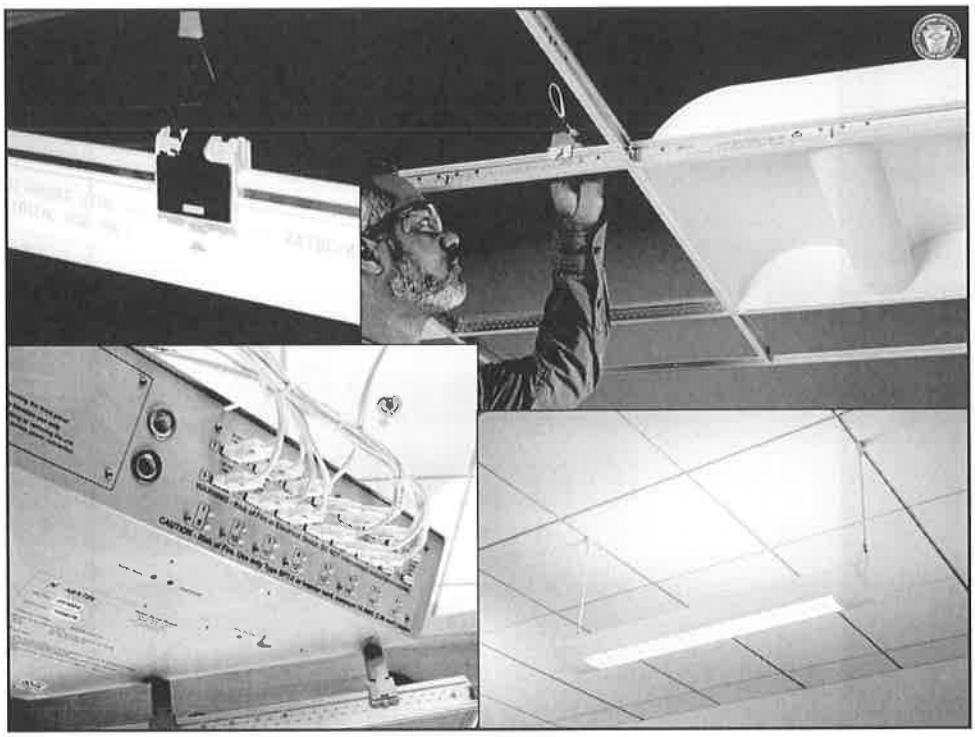
A new article added to address low-voltage Class 2 ac and dc volt supplied equipment *(lighting and power)* connected to ceiling grids, floors and walls built for this purpose

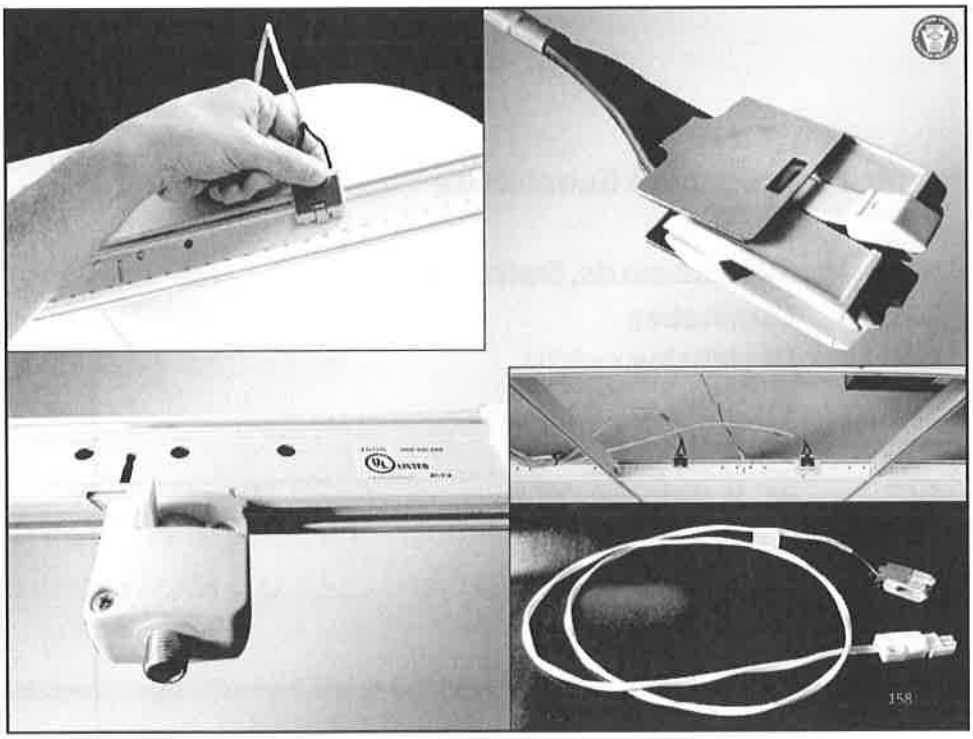




A system that serves as a support for a finished ceiling surface and consists of a busbar and busbar support system to distribute power to utilization equipment supplied by a Class 2 power supply

156




158

Chapter Four Equipment for General Use

Chapter 4 – Equipment General Use

- 408 Switchboards, Switchgear, Panelboards
- 410 Luminaires
- 411 LV Lighting <=30V
- 422 Appliances
- 430 Motors
- 440 AC & Refrigeration
- 450 Transformers
- 490 HV Equipment

California Building Officials

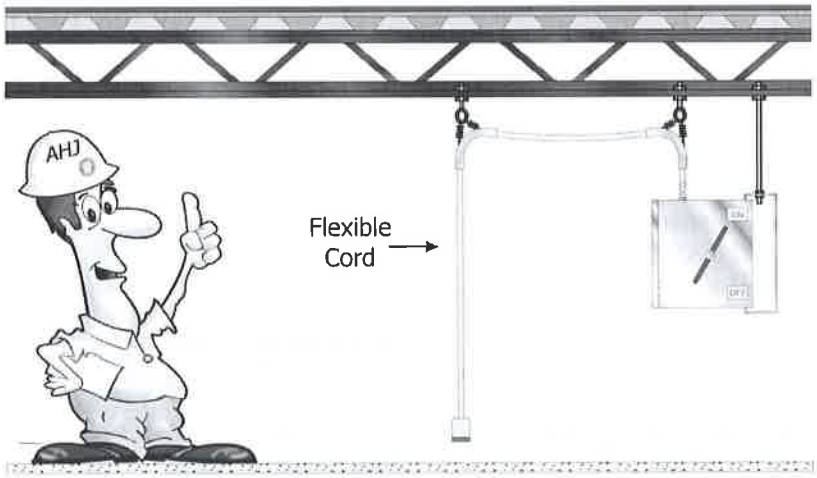
400.4 Types (Flexible Cords and Cables)

- Use of flexible cords and flexible cables not described in Table 400.4 requires the "permission of the AHJ."
- Revision requires "permission by the authority having jurisdiction" rather than requiring these flexible cords and cables to be the "subject of special investigation."
- What is a "special investigation" and who was to conduct this special investigation?
- The AHJ is the person or organization that is responsible for enforcing the requirements of the *Code*, or for "approving" equipment, materials, an installation, or a procedure.

161

400.4 Types (Flexible Cords and Cables)

The use of flexible cords and flexible cables not described in Table 400.4 requires the permission of the AHJ



Requires "permission by the authority having jurisdiction" rather than requiring flexible cords and cables to be "subject of special investigation"

162

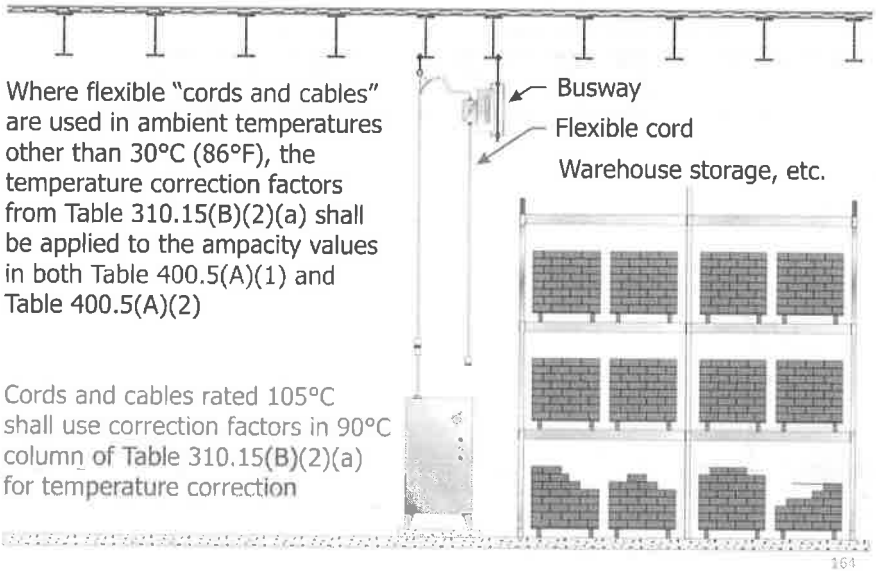
400.5(A) Ampacity Tables for Flexible Cords and Cables

- Temperature correction factors apply to ampacity values for flexible cords and cables in both Table 400.5(A)(1) and Table 400.5(A)(2).
- The previous language literally only applied to flexible "cords" and Table 400.5(A)(2).
- Cords and cables rated 105°C required to use the 90°C column from Table 310.15(B)(2)(a) as this table does not include 105°C correction factors.

163

400.5(A) Ampacity Tables for Cords and Cables

Temperature correction factors apply to ampacity values for flexible cords and cables in both Table 400.5(A)(1) and Table 400.5(A)(2)



Where flexible "cords and cables" are used in ambient temperatures other than 30°C (86°F), the temperature correction factors from Table 310.15(B)(2)(a) shall be applied to the ampacity values in both Table 400.5(A)(1) and Table 400.5(A)(2)

Cords and cables rated 105°C shall use correction factors in 90°C column of Table 310.15(B)(2)(a) for temperature correction

164

NEW

400.6 Markings (Flexible Cords and Cables)

- Standard marking requirements for flexible cords and cables now required to include the maximum operating temperature of the flexible cord or cable.
- A listed cords or cables may include a temperature marking, but not all flexible cords are required to be listed.
- Maximum operating temperature marked on the flexible cord or cable makes it possible to calculate the ampacity of a cord or cable in an ambient temperature *[if other than 30°C (86° F)].*

165

166

NEW

400.7(A)(11) Uses Permitted (Flexible Cords and Cables)

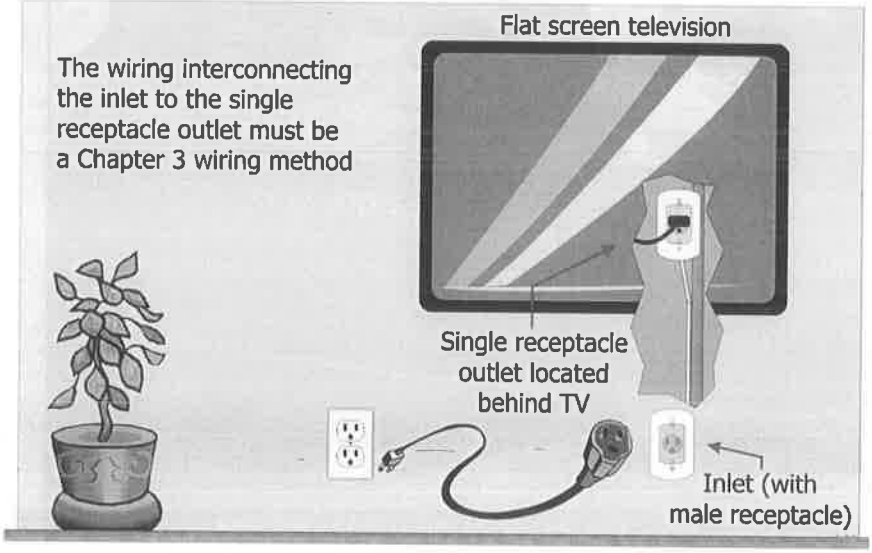
- A flexible cord between an existing receptacle outlet and an inlet, where the inlet provides power to an additional single receptacle outlet as a listed assembly is now permitted.
- Wiring interconnecting the inlet to the single receptacle outlet to be a Chapter 3 wiring method.
- The inlet, receptacle outlet, and Chapter 3 wiring method, including the flexible cord and fittings, must be a "listed assembly" specific for this application.
- Primarily used for flat-screen televisions mounted on a wall.

167

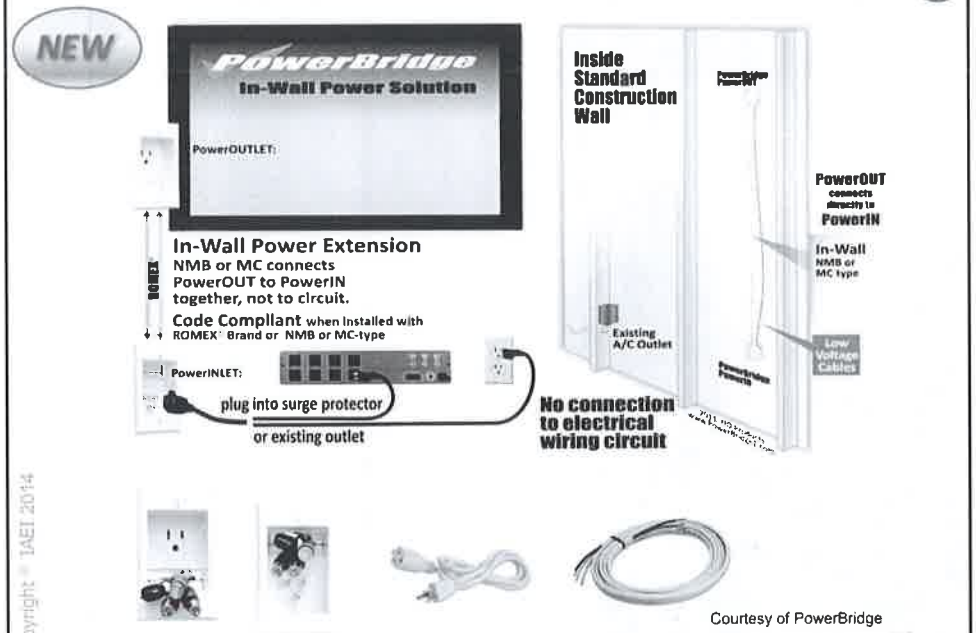
NEW

400.7(A)(11) Uses Permitted (Flexible Cords)

A flexible cord between an existing receptacle outlet and an inlet, where the inlet provides power to an additional single receptacle outlet as a listed assembly is now permitted



400.7(A)(11) Uses Permitted (Flexible Cords)



Courtesy of PowerBridge

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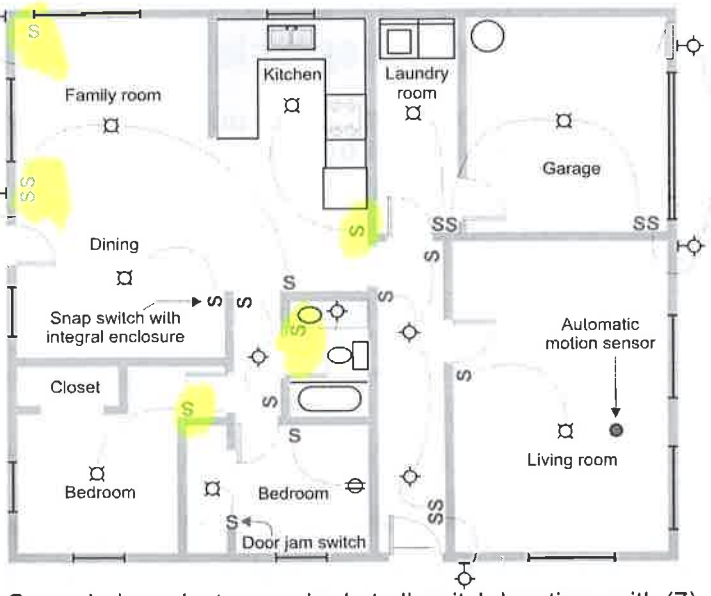
169

404.2(C) Grounded Conductor at Switch Locations

S = Grounded (neutral) conductor required

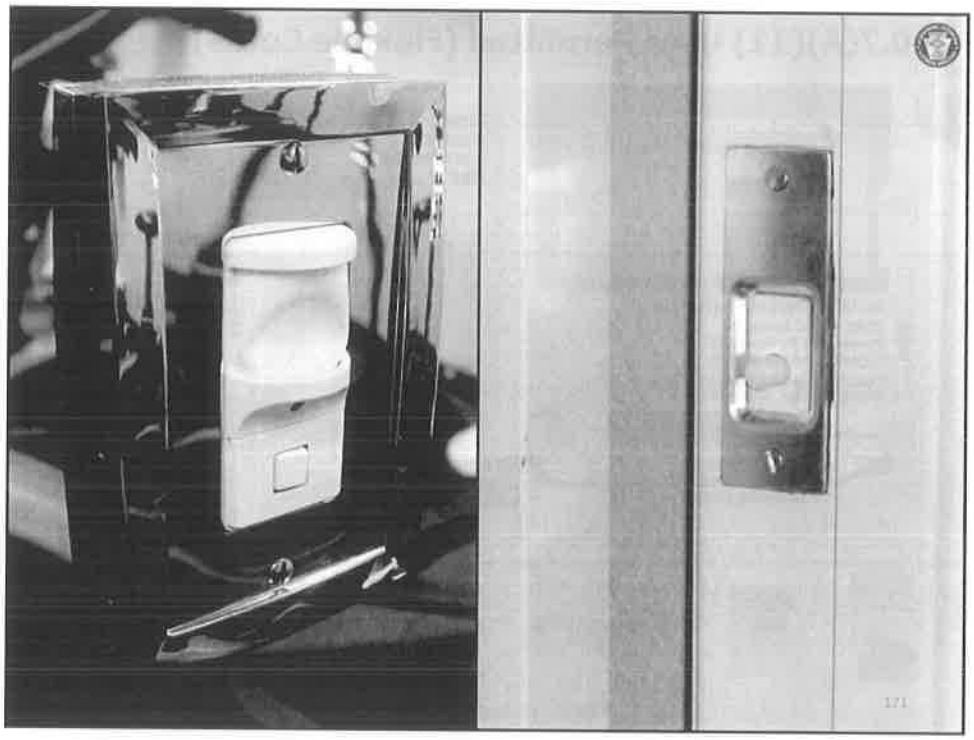
S = Grounded (neutral) conductor not required

** Note: A switch accessible for additional or re-placement cables without removing finish materials does not require a grounded conductor*



Grounded conductor required at all switch locations with (7) concessions to this main rule

170



NEW

406.3(E) and Figure 406.3(E) Controlled Receptacle Marking

New

- New marking symbol for receptacle outlets controlled by an automatic control device or by an automatic energy management system was added at 406.3(E).
- New Figure 406.3(E) was also added displaying "Controlled Receptacle Marking" symbol.
- New exception added to indicate that this marking is not required for receptacle outlets controlled by a wall switch to provide the required room lighting outlet(s) as permitted by 210.70(A)(1) Ex. No. 1.
- The occupant or end user needs to know which receptacle outlets will be automatically controlled and which receptacles will be energized continually.
- It is important to be able to readily identify receptacle outlets that will be automatically powered on and off.

172

NEW

406.3(E) Controlled Receptacle Marking

All nonlocking-type, 125-volt, 15- and 20-ampere receptacles controlled by an automatic control device, energy management, or building automation shall be marked with the "Controlled Receptacle Marking Symbol" from Figure 406.3(E) placed on the controlled receptacle outlet where visible after installation

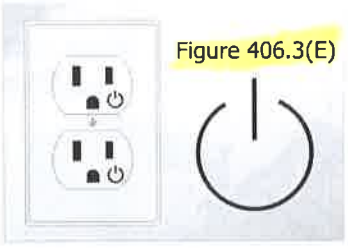


Figure 406.3(E)

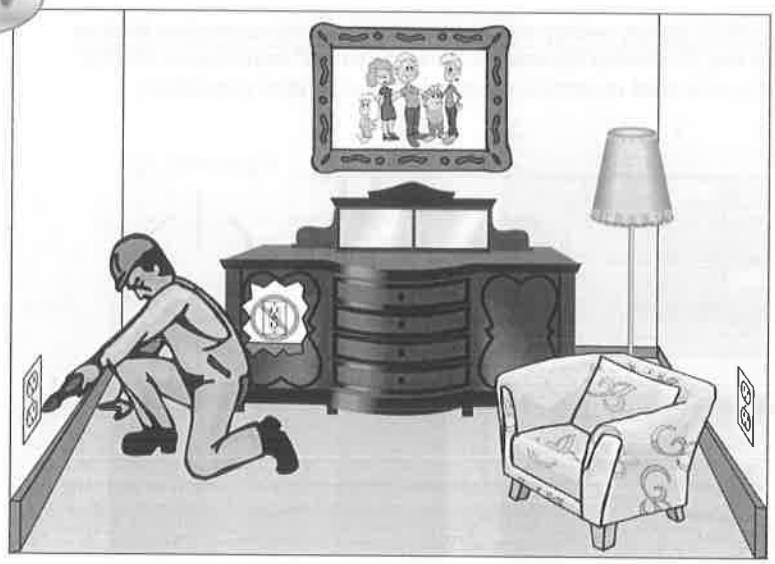
NEW

406.4(D) Replacement Receptacles

- Arc-fault circuit-interrupter (AFCI) and ground-fault circuit-interrupter (GFCI) type receptacles installed for replacement receptacles required to be installed in a readily accessible location.
- Primarily related to occupant or user accessibility to the monthly testing and access to the reset features of the device.
- It should be noted that this "readily accessible" requirement only pertains to AFCI and GFCI outlet devices used for replacement of existing receptacles due to its placement at 406.4(D).

406.4(D) Replacement Receptacles

NEW



AFCI and GFCI-type receptacles installed for replacement receptacles required to be installed in a readily accessible location

175

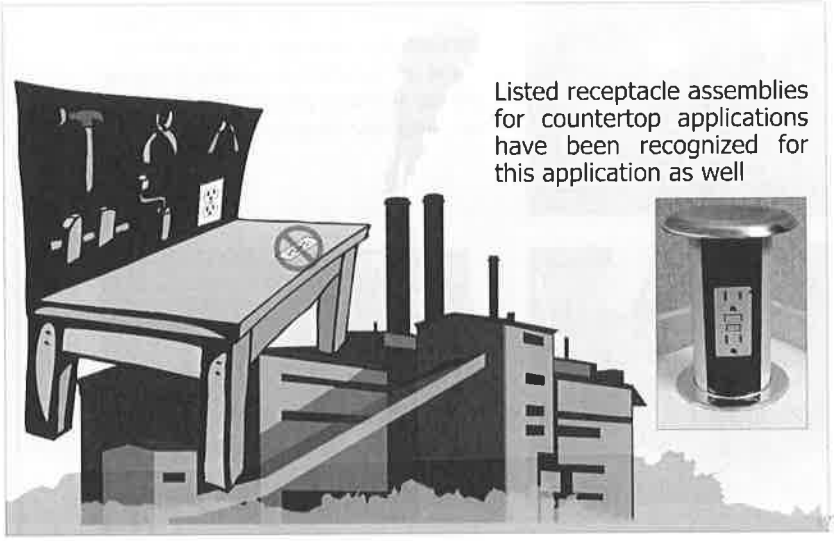
406.5(E) Receptacles in Countertops and Similar Work Surfaces

- The term "in Dwelling Units" was removed from the title to make it clear that receptacles cannot be installed in a face-up position of any type occupancy *(not just dwelling units).*
- Concern about receptacles installed in the "face-up" position for such things as liquid spillage exist at countertops or similar work surfaces of non-dwelling units as well dwelling units.
- Listed receptacle assemblies for countertop applications have been recognized for this application as well.

176

406.5(E) Receptacles in Countertops and Similar Work Surfaces ~~in Dwelling Units~~

Restriction to prohibit receptacles from being installed in the face-up position expanded to all occupancies *(not just dwelling units)*



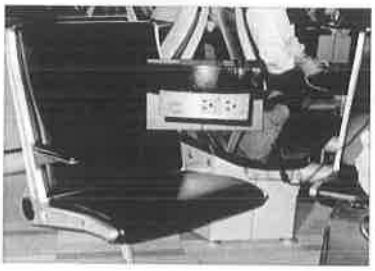
NEW 406.5(F) Receptacles in Seating Areas and Other Similar Surfaces

- New provisions added which prohibits receptacles from being installed in a "face-up" position in seating areas or similar surfaces unless they are part of an assembly listed for the application.
- Benches and seating areas in public locations such as airports are being installed with receptacles installed in and on the seating areas *(some in the face-up position).*
- Where there is a need to install such receptacles in benches or other similar surfaces, it should be done with an assembly listed for the application to prevent damage and potential exposure to energized conductors or circuit parts.

NEW

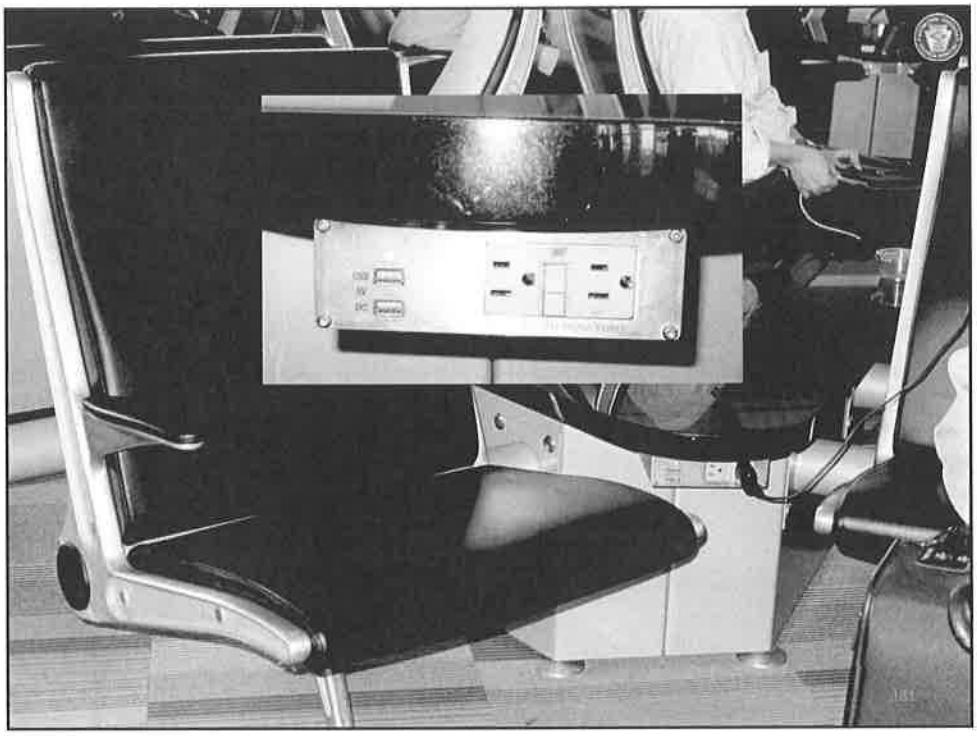
406.5(F) Receptacles in Seating Areas and Other Similar Surfaces

New provisions added which prohibits receptacles from being installed in a "face-up" position in seating areas or similar surfaces unless they are part of an assembly listed for the application



179

180



NEW

406.9(B)(1) 15- and 20-Ampere Receptacles in a Wet Location

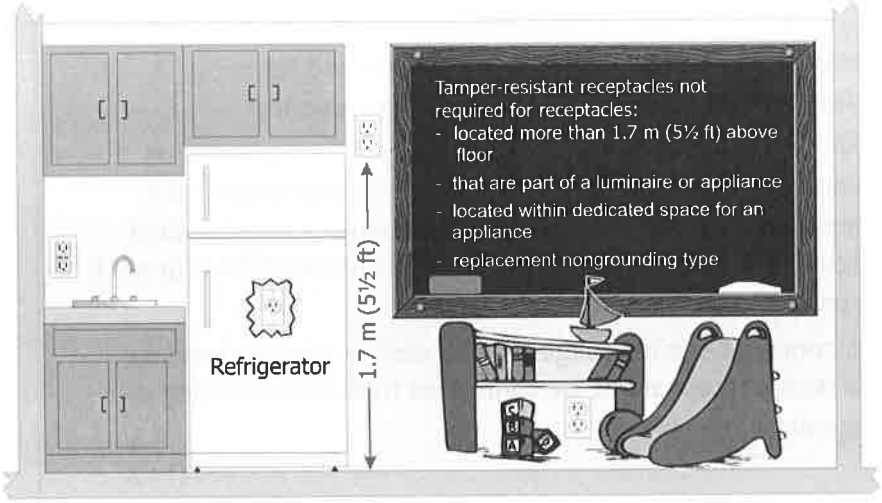
- "Extra duty" covers are now required for all 15- and 20-ampere, 125- and 250-volt receptacles installed in a wet location *(not just those supported from grade).*

406.12 Tamper-Resistant Receptacles

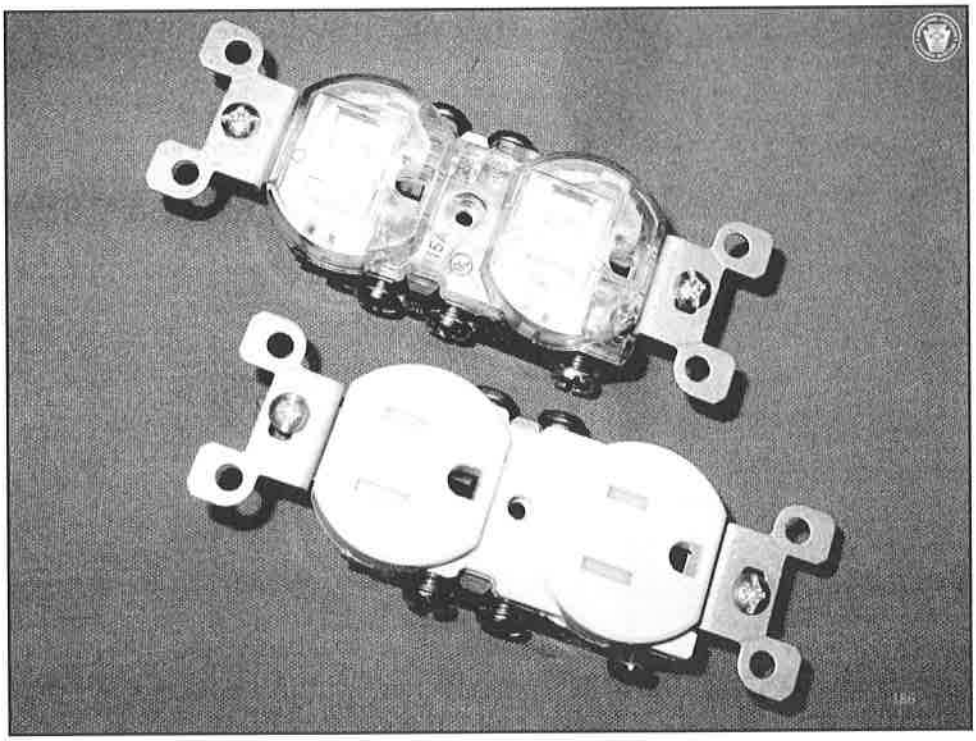
- Main Rule: All nonlocking type 125-volt, 15- and 20-ampere receptacles in guest rooms and guest suites of hotels and motels and child care facilities required to be listed tamper-resistant receptacles.
- These (4) exempted locations, whether in a dwelling, hotel room, or a child care facility are out of reach of small children and should be exempted for tamper-resistant receptacle provisions.

406.12 Tamper-Resistant Receptacles

Exception for tamper-resistant receptacles at dwelling units has been expanded to guest rooms and guest suites of hotels and motels and child care facilities



All nonlocking type 125-volt, 15- and 20-ampere receptacles in hotel/motel guest rooms/suites and child care facilities required to be listed tamper-resistant receptacles



NEW

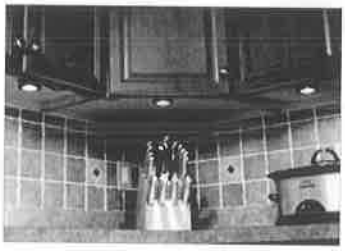
406.15 Dimmer Controlled Receptacles

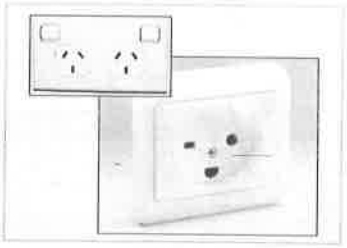
- Dimmer-controlled receptacles now permitted for a plug/receptacle combination in listed nonstandard configuration types.
- A receptacle supplying lighting loads can be connected to a dimmer if the plug/receptacle combination is a nonstandard configuration type and specifically listed and identified for each such unique combination.
- Clear, concise *Code* language was needed to ensure standard grade receptacles cannot be controlled from any dimming or voltage dropping device.

NEW

406.15 Dimmer Controlled Receptacles

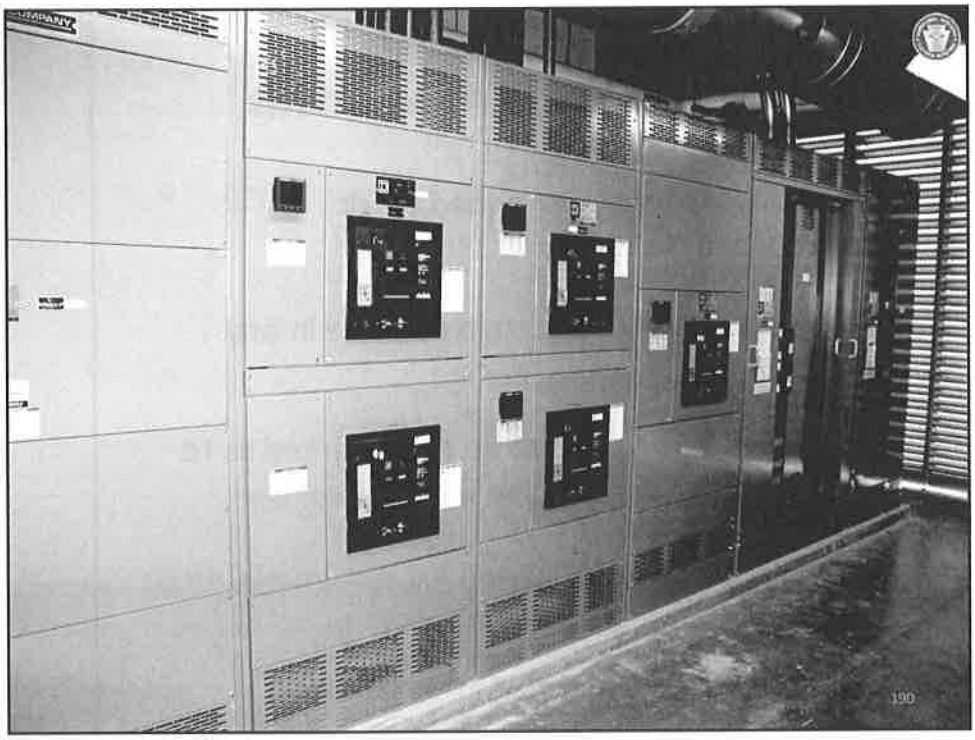
A receptacle supplying lighting loads shall not be connected to a dimmer unless the plug/receptacle combination is a nonstandard configuration type that is specifically listed and identified for each such unique combination

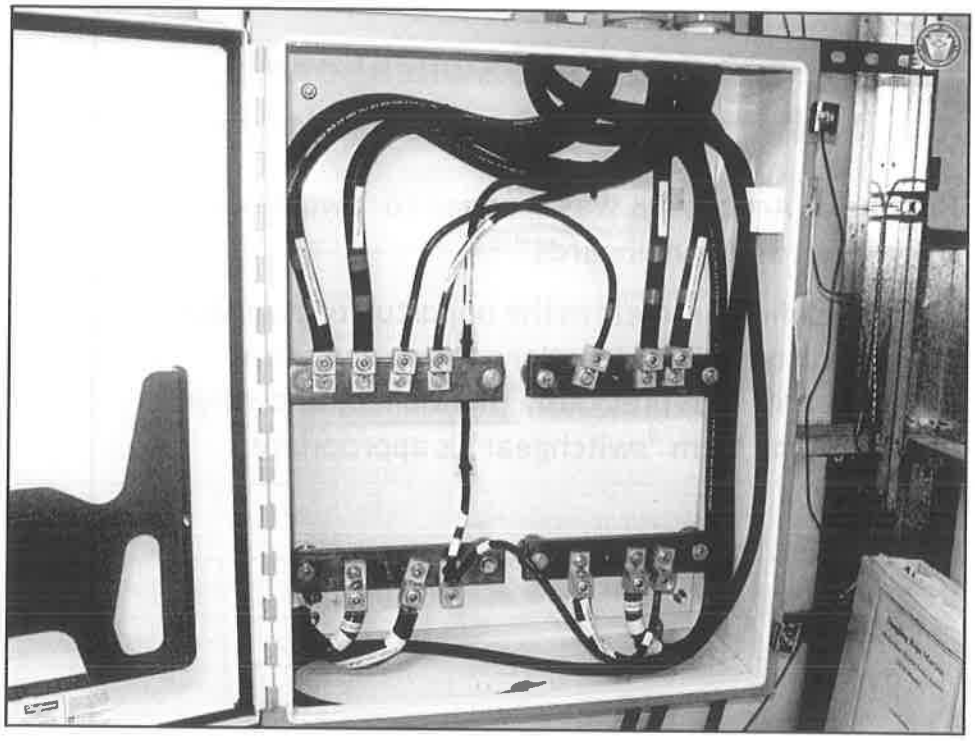




"NEW" Article 408 and 408.1 Switchboards, Switchgear, and Panelboards

- The title of Article 408 was changed to "Switchboards, Switchgear, and Panelboards."
- The new definition creates the opportunity to utilize the generic term in all locations where the term "switchboard" was previously mentioned, and where the use of the term "switchgear" is appropriate.

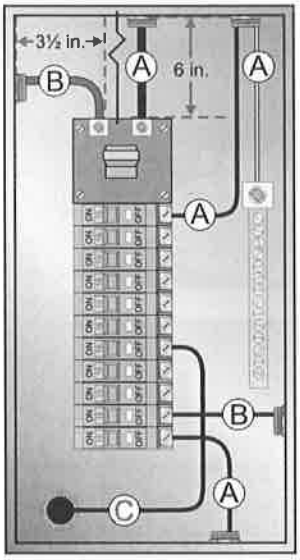




408.3(E)(2) DC Bus Arrangement

- New "DC Bus Arrangement" added for dc ungrounded buses.
- Ungrounded dc buses are permitted to be in any order.
- Arrangement of dc buses is to be field marked as to polarity, grounding system, and nominal voltage.

408.55 Wire-Bending Space Within an Enclosure Containing a Panelboard



(A) Top and Bottom Wire-Bending Space
Minimum wire bending space per Table 312.6(B) for the largest conductor entering or leaving the enclosure
(4 exceptions to top and bottom space)

(B) Side Wire-Bending Space
Minimum wire bending space per Table 312.6(A) for the largest conductor entering or leaving the enclosure

(C) Back Wire-Bending Space
Minimum wire bending space per Table 312.6(A) based on the "one wire per terminal" column

The distance between the center of the rear entry and the nearest termination for the entering conductors shall not be less than the distance given in Table 312.6(B)

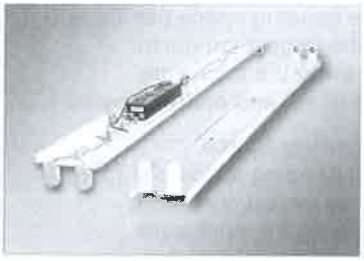
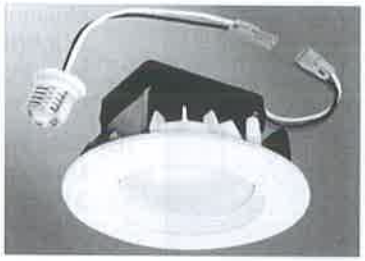
* *Not all conductors shown*
* *Distances shown are based on 2/0 AWG as largest conductors entering or leaving the enclosure*

410.6 Listing Required (Luminaires)

- Listing requirements for luminaires and lampholders expanded to "Retrofit Kits."
- Extensive upgrades are underway in the lighting as well as the sign industries to achieve greater energy efficiency in luminaires and signs by replacing in-place illumination systems with light emitting diodes (LED) technology.
- The changing of illumination systems in luminaires presents a hazard for electricians doing maintenance after the conversion if not installed using these listed subassembly retrofit kits and installed properly per the manufactures instructions.

410.6 Listing Required

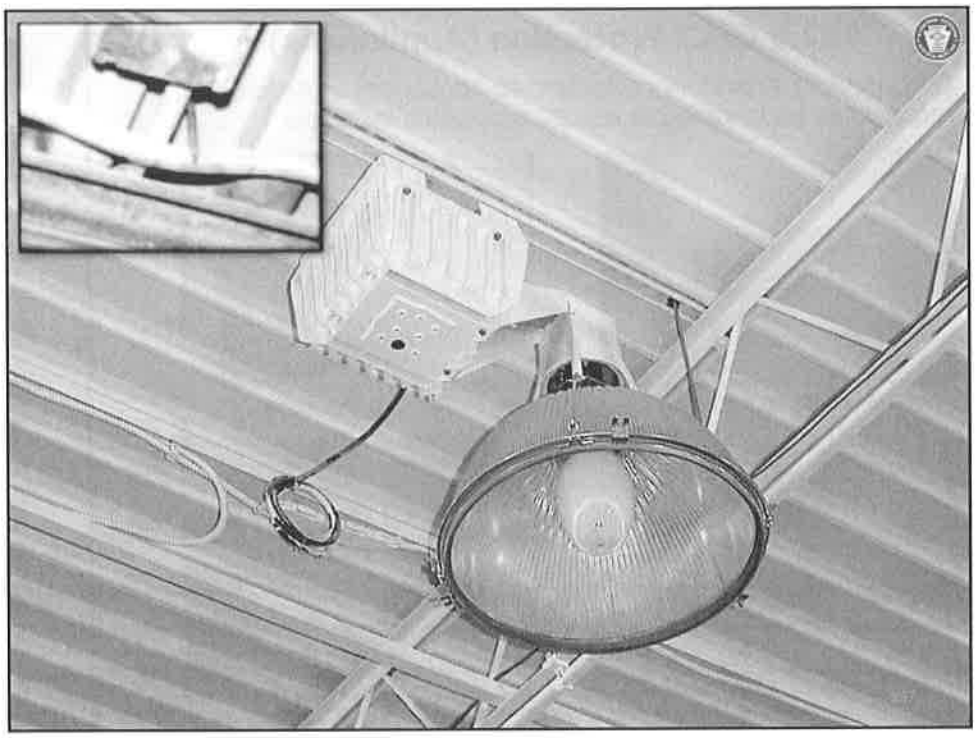
Listing requirements for luminaires and lampholders have been expanded to "Retrofit Kits"

NEW

410.10(F) Luminaires Installed in or Under Roof Decking

- Luminaires no longer permitted to be installed within 38 mm (1½ in.) of the lowest metal deck surface.
- This will bring luminaires in line with cables, raceways, and boxes as for as their location in proximity to metal-corrugated sheet roof decking.
- Fastening devices *[typically 32 mm (1¼ in.) in length]* used to hold down roofing materials are typically driven through the metal decking as a normal part of their installation.
- Luminaires, conductors and its associated equipment such as the ballast(s) and transformer within the luminaire are also subject to the same physical damage as cables, raceways, and boxes.



NEW

422.5 GFCI Protection (Appliances)

- GFCI devices providing protection to appliances in Article 422 now required to be installed in readily accessible locations.
- Manufacturers of GFCI protective devices routinely require that their GFCI device be tested on a monthly basis to ensure it is providing the life-safety protection intended.

NEW

422.5 GFCI Protection (Appliances)

GFCI devices providing protection to appliances in Article 422 required to be installed in readily accessible locations

Drinking fountains

Vending machines

High-pressure spray washers

Tire inflation/auto vac machines

430.22(G) Conductors for Small Motors

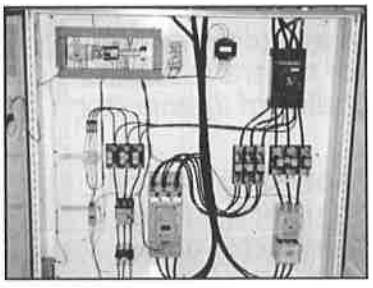
- Current referred to within 430.22(G) is the current of the motor and not the conductors.
- The word "ampacity" was removed as motors do not have "ampacities" *(they have current values).*
- Further clarification was added to indicate that the 125 percent multiplier for continuous duty required by the parent text at 430.22 is not required to be calculated in determining the conductor sizing for these small motors due to the fact the motor full load current rating cannot exceed the values given in these subsections for 16 and 18 AWG conductors.
- Revisions for the 2014 *NEC* will now recognize Class 10A overload relays as well as most of the thermally adjustable, bi-metallic overload relays used in the industry today could be classified as Class 10A overload relays per the relevant UL product standards.

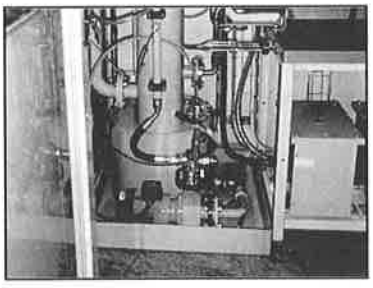
201

430.22(G) Conductors for Small Motors

Conductors for small motors shall not be smaller than 14 AWG unless otherwise permitted in 430.22(G)(1) or 430.22(G)(2)

Where installed in a cabinet or enclosure, 18 or 16 AWG individual copper conductors, or copper conductors of either a jacketed multiconductor cable assembly or a flexible cord shall be permitted, under specific conditions





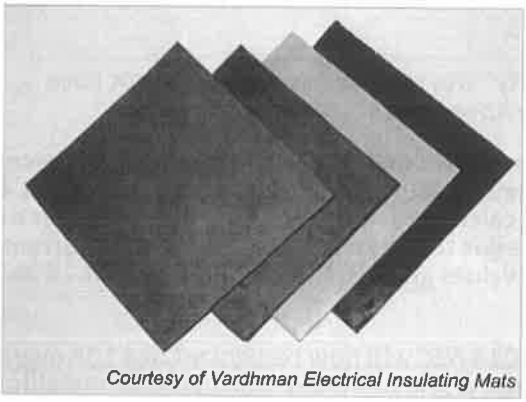
Current referred to within 430.22(G) is the current of the motor and not the conductors

The word "ampacity" was removed as motors do not have "ampacities" *(they have current values)*

202

430.233 Guards for Attendants

The minimum voltage levels for live parts of motors or controllers requiring guarding against accidental contact by insulating mats or platforms were lowered from 150 volts to ground to 50 volts to ground



Courtesy of Vardhman Electrical Insulating Mats

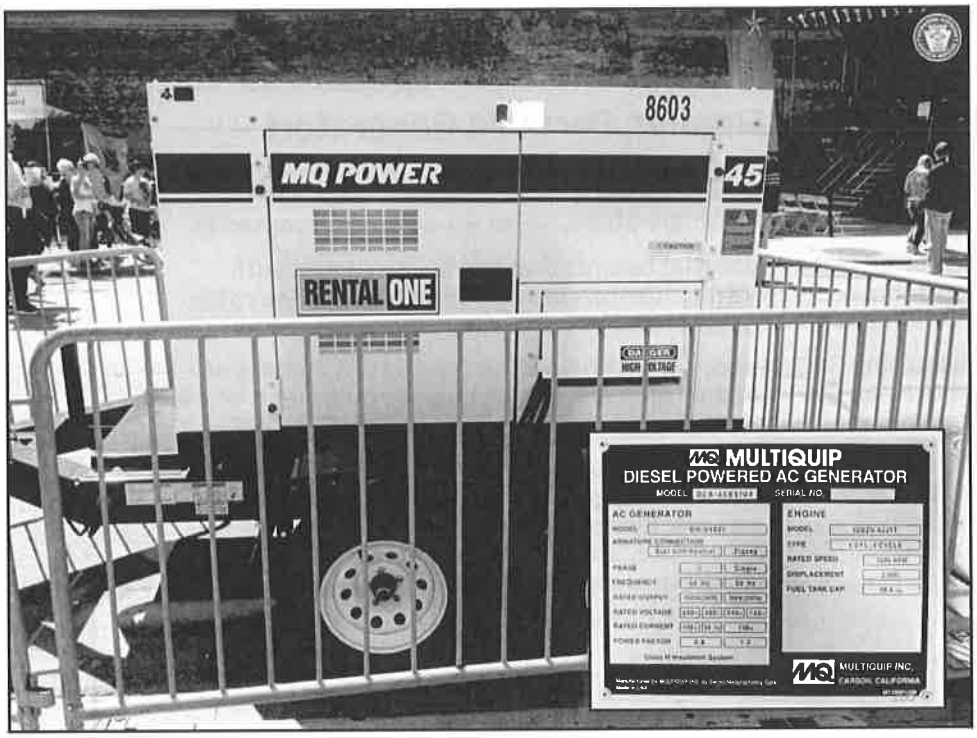
Any voltage above 50 volts is considered an electrical shock hazard according to NFPA 70E (Standard for Electrical Safety in the Workplace), the *NEC*, and the U.S. Occupational Safety and Health Administration (OSHA)

203

445.11 Marking (Generator)

- A new manufacturer's marking provision was added requiring indication whether or not the generator neutral is bonded to the generator frame.
- This new neutral bonding provision requires additional marking to indicate whether the generator neutral is bonded to the generator frame whenever the bonding of a generator is modified in the field.
- In order to determine if a generator is a separately derived system or not, installers, enforcers, and users of the *Code* must be able to determine if the neutral conductor of the generator is bonded to the generator frame.
- Power factor, subtransient and transient impedances, insulation system class, and time rating markings are now only required for stationary and portable generators rated more than 15 kW.

204


8603
MQ POWER
45
RENTAL ONE
DANGER
HIGH VOLTAGE
MQ MULTIQUIP
DIESEL POWERED AC GENERATOR
MODEL
SERIAL NO.
AC GENERATOR
ENGINE
MULTIQUIP INC.
CARSON, CALIFORNIA


CENTURION
by Generac Power Systems, Inc.
5000
RUNNING WATTS
6250
120VAC
NEUTRAL BONDED TO FRAME

445.20 GFCI Protection for Receptacles on 15-kW or Smaller, Portable Generators

NEW

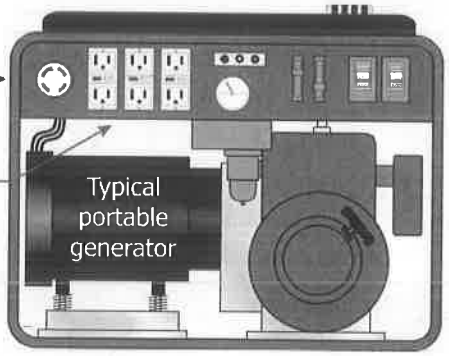
- New GFCI requirements added for portable generators and associated 125-volt, single-phase, 15- or 20-amperes receptacles.
- There are many potential hazards that can be associated with portable generators *(accidental cuts and abraded wire and cable, standing water and wet locations, etc.).*
- Requiring GFCI protection will help eliminate the possibilities of shock hazards from damaged circuits, damaged equipment, or use of equipment in wet locations.
- By limiting GFCI protection to only 15- and 20-ampere, single phase, 120 volt circuits, small mobile generators can still be used for supplying standby power for non-GFCI protected 30-ampere, and larger 120/240 single phase, 3-wire with ground as well as 3-phase circuits of all sizes for houses and small commercial buildings.

207

445.20 GFCI Protection for Receptacles on 15-kW or Smaller, Portable Generators

All 125-volt, single-phase, 15-and 20 ampere receptacle outlets, on 15 kW or smaller, portable generators shall have GFCI protection for personnel:
- integral to the generator or receptacle, or...
- receptacle outlets shall not be available for use when the 125/250 volt locking-type receptacle is in use

NEW



If the generator does not have a 125/250 volt locking-type receptacle, GFCI requirements not required

208

NEW

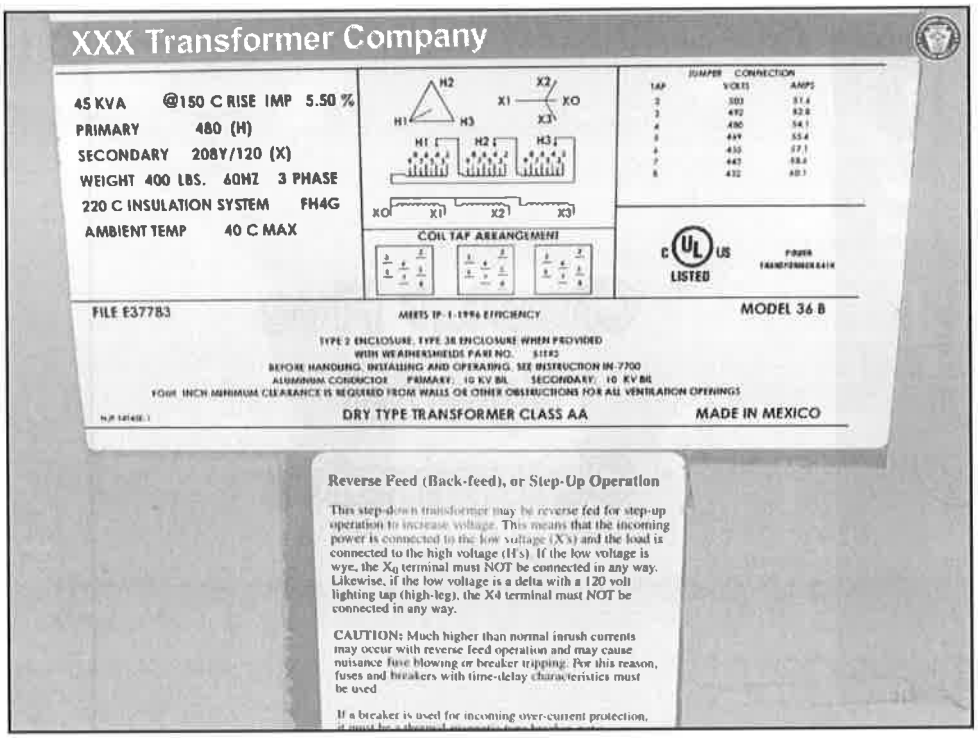
450.10 Grounding (Transformers)

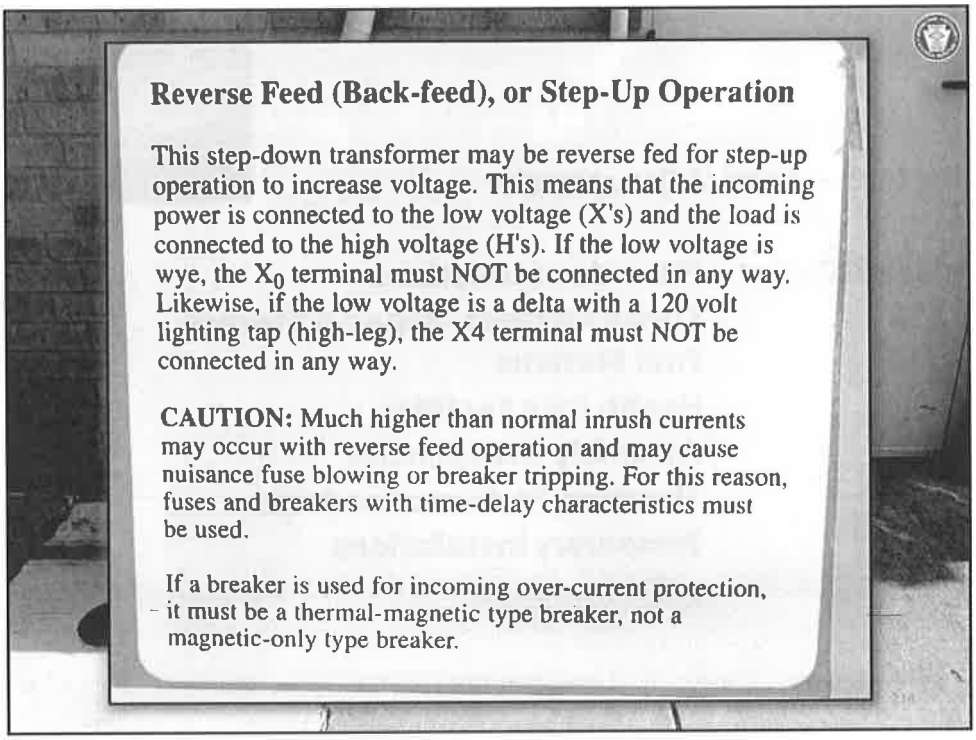
- A grounding and bonding terminal bar for the purpose of landing grounding and bonding conductors must be bonded to the transformer enclosure, but cannot be mounted on or over any vented screens or openings.
- This can result in a less than effective connection using a method that has not been evaluated as grounding and bonding equipment and should not be depended upon to serve as effective ground fault current return path.

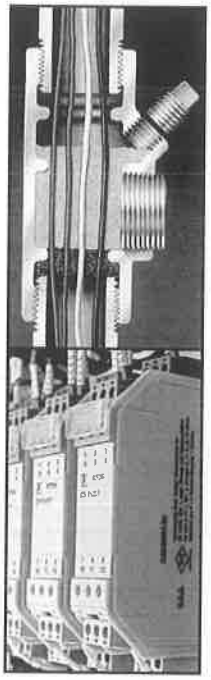
will need to Bond to side panel

450.11 Marking (Transformers)

- The required nameplate information for transformers was formatted into a more user-friendly list format.
- New subsection (B) was added to require transformers that are supplied at the secondary voltage *(reversed wired)* to be so installed in accordance with manufacturer's instructions *(only permitted if identified as such by the manufacture).*
- Dry-type transformers permitted to be supplied from either direction *(primary or secondary)* are typically marked by the manufacture as "Bi-Directional."
- "Bi-Directional" transformers will be provided with installation instructions detailing specific information as to how the transformer should be connected when the primary and secondary are reversed.
- Unless identified for "reverse wiring," UL 1561 requires the supply to a transformer to be connected to the primary and the load to be connected to the secondary side of the transformer.


XXX Transformer Company
45 KVA @150 C RISE IMP 5.50 %
PRIMARY 480 (H)
SECONDARY 208Y/120 (X)
WEIGHT 400 LBS. 60HZ 3 PHASE
220 C INSULATION SYSTEM FH4G
AMBIENT TEMP 40 C MAX
H2
X2
X1
XO
H1
H3
X3
COIL TAP ARRANGEMENT
LISTED
FILE E37783
MODEL 36 B
DRY TYPE TRANSFORMER CLASS AA
MADE IN MEXICO
Reverse Feed (Back-feed), or Step-Up Operation
This step-down transformer may be reverse fed for step-up operation to increase voltage. This means that the incoming power is connected to the low voltage (X's) and the load is connected to the high voltage (H's). If the low voltage is wye, the X_0 terminal must NOT be connected in any way. Likewise, if the low voltage is a delta with a 120 volt lighting tap (high-leg), the X4 terminal must NOT be connected in any way.
CAUTION: Much higher than normal inrush currents may occur with reverse feed operation and may cause nuisance fuse blowing or breaker tripping. For this reason, fuses and breakers with time-delay characteristics must be used


Reverse Feed (Back-feed), or Step-Up Operation
This step-down transformer may be reverse fed for step-up operation to increase voltage. This means that the incoming power is connected to the low voltage (X's) and the load is connected to the high voltage (H's). If the low voltage is wye, the X_0 terminal must NOT be connected in any way. Likewise, if the low voltage is a delta with a 120 volt lighting tap (high-leg), the X4 terminal must NOT be connected in any way.
CAUTION: Much higher than normal inrush currents may occur with reverse feed operation and may cause nuisance fuse blowing or breaker tripping. For this reason, fuses and breakers with time-delay characteristics must be used.
If a breaker is used for incoming over-current protection, it must be a thermal-magnetic type breaker, not a magnetic-only type breaker.



Chapter Five Special Occupancies

Chapter 5 – Special Occupancies

- 500-510 Hazardous Locations
- 511 Comm Garages, Repair & Storage
- 514 Fuel Stations
- 517 Health Care Facilities
- 518 Assembly Occupancies
- 520 Theaters, Performance Areas
- 590 Temporary Installations

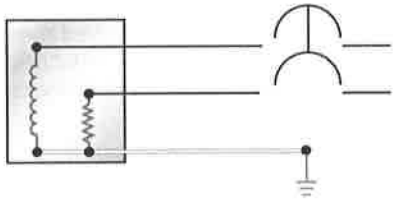
California Building Officials

501.40 Multiwire Branch Circuits

501.40 and the exception were deleted entirely as the requirements for simultaneous disconnection of all ungrounded conductors of multiwire branch circuits are already provided at 210.4(B)

~~In a Class I, Division 1 location, a multiwire branch circuit shall not be permitted.~~

~~Exception: Where the disconnect device(s) for the circuit opens all ungrounded conductors of the multiwire circuit simultaneously.~~



Note: Same deletion at 502.40, 505.21, and 506.21

517.2 Definitions (Health Care Facilities)

Several definitions in Article 517 were revised, deleted or added as a result of the re-organization of the make-up of the "Essential Electrical System" of a hospital

New Definitions:
- Support Space
- Wet Procedure Location

Revised Definitions:
- Critical Branch
- Equipment ~~System~~ Branch
- Life Safety Branch
- Patient Care ~~Area~~ Space
- General Care ~~Area~~ Space
- Patient Care Vicinity

Deleted Definitions:
- ~~Emergency System~~
- ~~Wet Procedure Locations~~ *(from definition of Patient Care Space)*

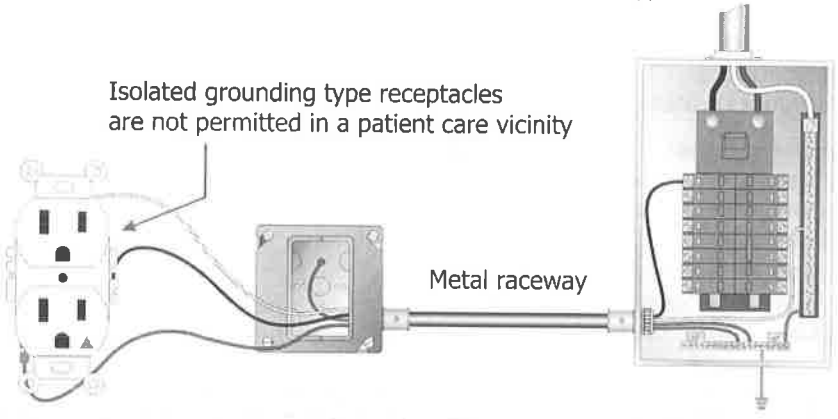
517.16 Use of Isolated Ground Receptacles

- Revision will now prohibit isolated grounding type receptacles within a patient care vicinity only *(rather than the entire health care facility).*
- Previous language at 517.16 prohibited isolated ground receptacles in the entire health care facility.
- NFPA 99 *(Health Care Facilities Code)* affirms the use of isolated ground receptacles in health care facilities while continuing to forbid their use only within patient care vicinities.
- Listed cord-and-plug-connected medical equipment used in health care facilities outside of patient care vicinities *(typically at nurses' monitoring stations)* often require connection to isolated ground receptacles.
- The concern with isolated ground receptacles within a patient care vicinity is the assurance of the equipment grounding conductor redundancy requirement of 517.13(A) and (B) for wiring methods at a patient care vicinity.

219

517.16 Use of Isolated Ground Receptacles

Isolated grounding type receptacles are now not permitted within a patient care vicinity only *(rather than the entire health care facility)*



517.16 Use of Isolated Ground Receptacles. An isolated ground receptacle shall not be installed within a patient care vicinity.

220

517.18(A) Patient Bed Location (General Care Areas)

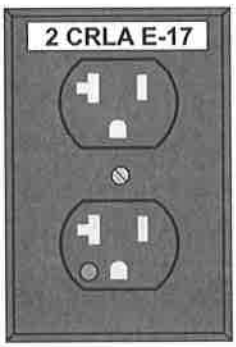
- All receptacles or the cover plate supplied from the critical branch required to have a distinctive color or marking so as to be readily identifiable.
- Marking is also to indicate the panelboard and branch circuit number supplying them.
- This change is a continuation to align Article 517 with NFPA 99 *(Health Care Facilities Code).*
- The term "emergency system" was removed from Article 517 to once again be consistent with NFPA 99.
- Removes confusion with these circuits in health care facilities with those circuits described in Article 700 for "Emergency Systems."

221

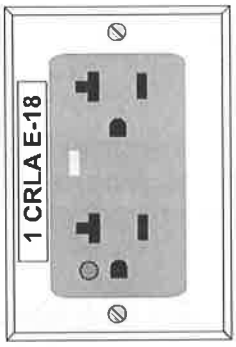
517.18(A) Patient Bed Location (General Care)

Cover plates for the receptacles or the electrical receptacles themselves are required to have a distinctive color or marking so as to be readily identifiable as being supplied from the critical branch

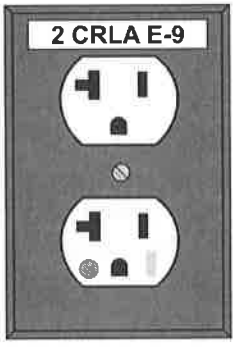
Covers or receptacles must also indicate the panelboard and branch circuit number supplying them



Receptacle and cover plate



Receptacle only



Cover plate only

222

223

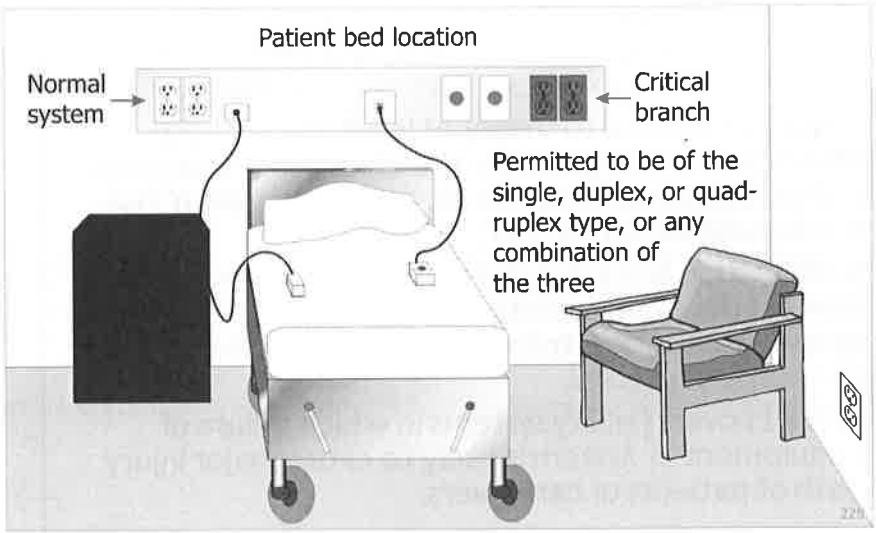
517.18(B) Patient Bed Location Receptacles (General Care Areas)

- The minimum number of receptacles required for general care area patient bed locations of health care facilities was increased from four to eight receptacles.
- Aligns the *NEC* with NFPA 99 *(Health Care Facilities Code).*
- NFPA 99 Section 6.3.2.2.6.2 requires each patient bed location in general care areas, where considered a Category 2 application, to be provided with a minimum of eight receptacles.
- Category 2 is facility systems in which failure of such equipment is likely to cause minor injury to patients or caregivers.

224

517.18(B) Patient Bed Location Receptacles

The minimum number of receptacles required for general care area patient bed locations of health care facilities was increased from four to eight receptacles



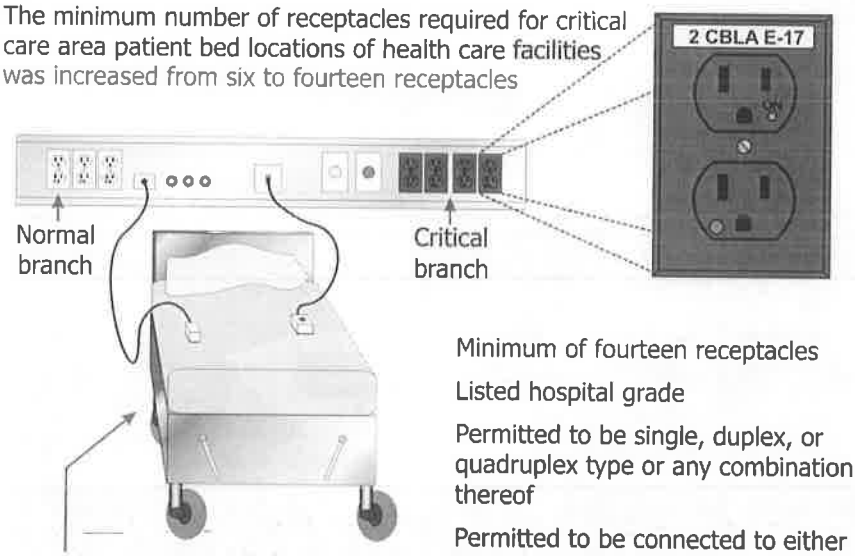
517.19(B) Patient Bed Location Receptacles (Critical Care Areas)

- The minimum number of receptacles required for critical care area patient bed locations of health care facilities was increased from six to fourteen receptacles.
- The systems required to supply at least one of these receptacles was changed from the emergency system to the critical branch as the term "emergency system" has been removed for Article 517.
- NFPA 99 Section 6.3.2.2.6.2 requires each patient bed location in critical care areas, where considered a Category 1 application, to be provided with a minimum of fourteen receptacles.
- Category 1 covers facility systems in which failure of such equipment or system is likely to cause major injury or death of patients or caregivers.

227

517.19(B) Patient Bed Location Receptacles

The minimum number of receptacles required for critical care area patient bed locations of health care facilities was increased from six to fourteen receptacles



Critical care patient bed locations

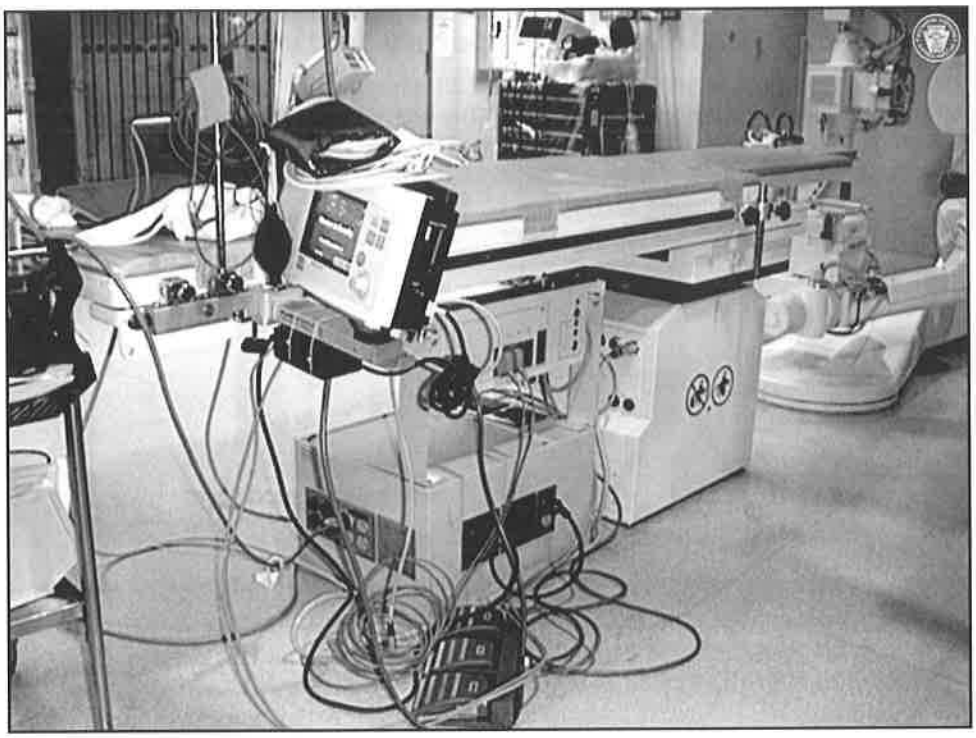
Minimum of fourteen receptacles

Listed hospital grade

Permitted to be single, duplex, or quadruplex type or any combination thereof

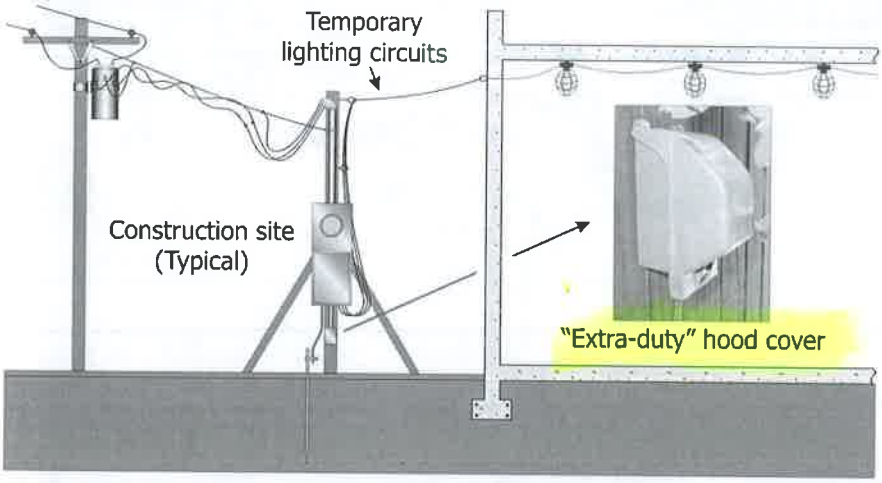
Permitted to be connected to either the normal system branch or the critical branch

228

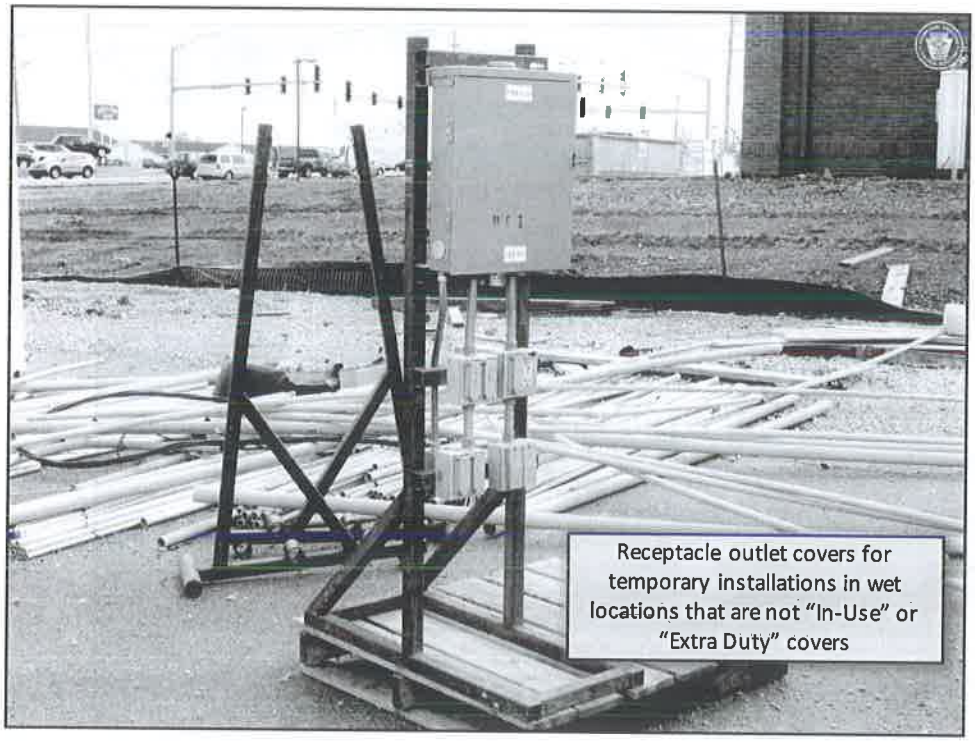


590.4(D)(2) Receptacles (Temporary Installations)

"Extra duty" covers now required for all 15- and 20-ampere, 125- and 250-volt receptacles installed at temporary installations in a wet location *(not just those supported from grade)*



All 15- and 20-ampere, 125- and 250-volt receptacles installed in a wet location shall comply with 406.9(B)(1) *[see changes for "extra duty" covers at 406.9(B)(1)]*



Chapter Six Special Equipment

Chapter 6 – Special Equipment

- 600 Electric Signs
- 620 Elevators, Escalators
- 625 EV Charging System
- 645 IT Equipment
- *646 NEW* *Modular Data Centers*
- 680 Swimming Pools & Spas
- 690 Solar PV Systems
- 692 Fuel Cell Systems
- 695 Fire Pumps

California Building Officials

600.4(E) Installation Instructions (Signs)

- All signs, outline lighting, skeleton tubing systems and retrofit kits required to be marked to indicate that field-wiring and installation instructions are required *(not just section signs).*
- Title of this subsection changed from "Section Signs" to "Installation Instructions."
- Revision will require manufacturers of listed signs components to provide installation instructions for the field installer.

235

236

600.6(A)(1) At Point of Entry to a Sign Enclosure [Disconnect(s) for Signs]

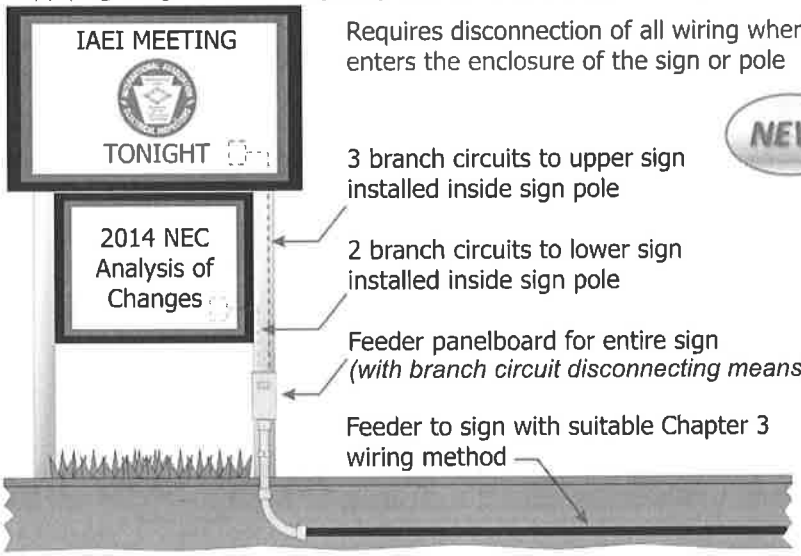
NEW

- Disconnect required to be located at the point feeder(s) or branch circuit(s) supplying a sign or outline lighting system enters a sign enclosure or pole.
- Requires disconnection of all wiring where it enters the enclosure of the sign or pole.
- Installing sign disconnecting means randomly without taking into consideration where the supply source enters these same sign enclosure can create a false sense of security for service personnel.
- An exception to this new rule will allow a branch circuit or feeder to pass through a sign where enclosed in a Chapter 3 listed raceway allowing the disconnecting means at each section of a large sign.

237

600.6(A)(1) Disconnect Locations (Signs)

Disconnect required to be located at the point feeder(s) or branch circuit(s) supplying a sign or outline lighting system enters a sign enclosure or pole



* *Exception to this new rule for branch circuit or feeder passing through a sign section enclosed in a Chapter 3 listed raceway*

238

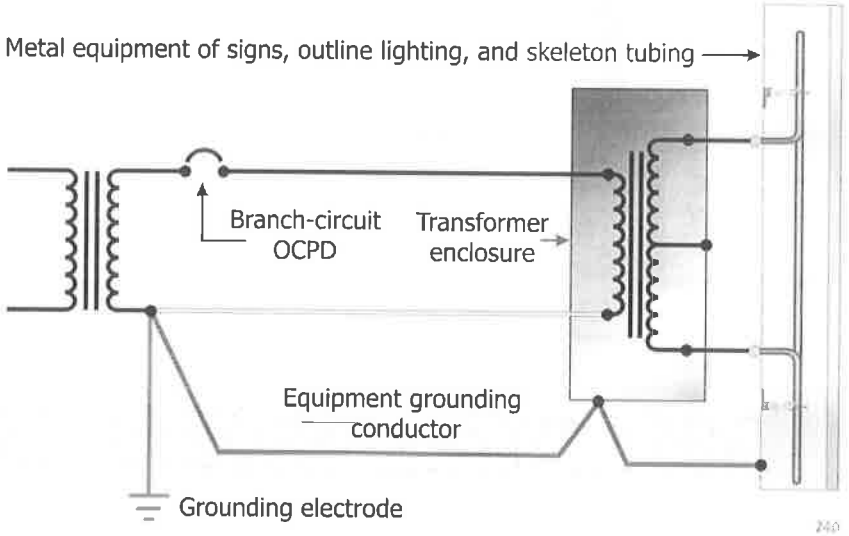
600.7(A)(1) Equipment Grounding (Signs)

- Metal parts of skeleton tubing as well as signs and outline lighting systems are required to be grounded by connection to the equipment grounding conductor of the supply branch circuit(s) or feeder.
- Skeleton neon tubing systems operate at voltages over 1000 volts and are field assembled similar to section signs with neon illumination.
- These metal parts need to be properly bonded to the equipment grounding conductor of the supply branch circuit(s) or feeder for electrical continuity and safety the same at metal parts of section signs and outline lighting systems.

239

600.7(A)(1) Equipment Grounding (Signs)

Metal parts of skeleton tubing as well as signs and outline lighting systems are required to be grounded by connection to the equipment grounding conductor of the supply branch circuit(s) or feeder



240

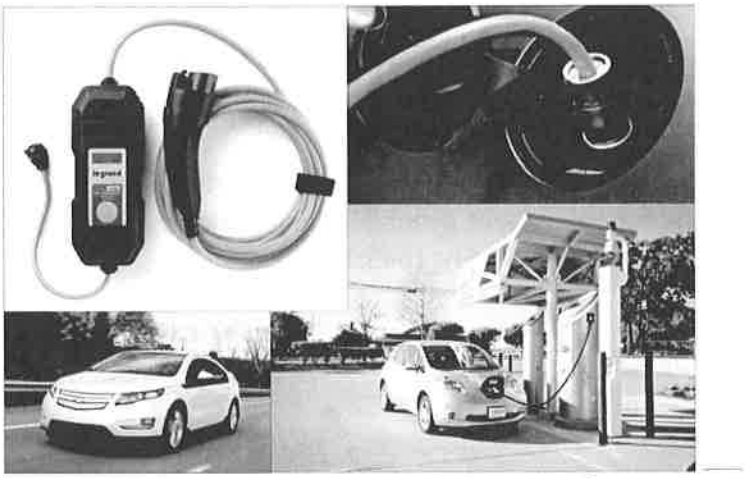
Article 625 Electric Vehicle Charging System

- Article 625 was renumbered and reorganized to provide a logical sequence and arrangement into three parts; Part I General, Part II Equipment Construction, and Part III Installation.

241

Article 625 Electric Vehicle Charging System

Article 625 was renumbered and reorganized to provide a logical sequence and arrangement



Article 625 now consist of three parts; Part I General, Part II Equipment Construction, and Part III Installation

242

645.14 System Grounding and 645.15 Equipment Grounding and Bonding

- New 645.14 titled, "System Grounding" was added and existing 645.15 was retitled, "Equipment Grounding and Bonding" and revised.
- Revision divides the grounding requirements into two different sections, one for equipment grounding and bonding (645.15) and one for systems grounding (645.14).

NEW

645.27 Selective Coordination (Critical Operations Data Systems)

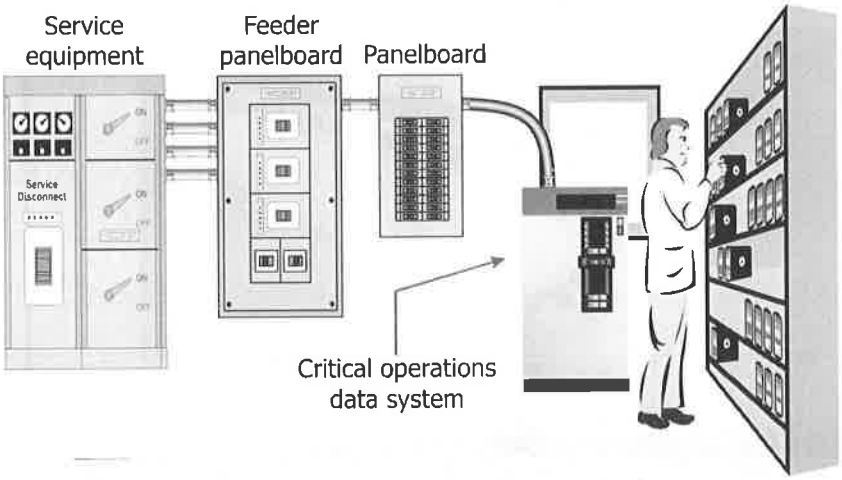
- All overcurrent devices in critical operations data systems are required be selectively coordinated with all supply-side overcurrent devices.
- Critical operations data systems require continuous operation for reasons of public safety, emergency management, national security, or business continuity.

245

NEW

645.27 Selective Coordination

All overcurrent devices in critical operations data systems are required be selectively coordinated with all supply-side overcurrent devices



Critical Operations Data Systems: "An information technology equipment system that requires continuous operation for reasons of public safety, emergency management, national security, or business continuity"

246

NEW

Article 646 Modular Data Centers

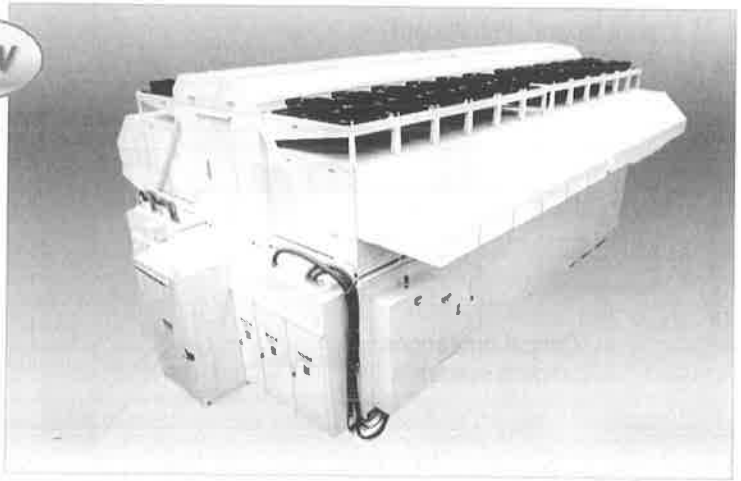
- A new Article 646 titled, "Modular Data Centers" was added to the 2014 *NEC.*
- New article draws a distinction between data centers that currently fall under the scope of Article 645 *(Information Technology Equipment)* and those described in this new article.
- Modular Data Centers (MDCs) are an important emerging trend in data center architecture.
- Their construction, installation and use results in a unique hybrid piece of equipment that falls somewhere in between a large enclosure and a pre-fabricated building.
- This new article identifies those areas of the *NEC* that should be applied to MDCs and also includes additional new requirements where necessary.

247

Article 646 Modular Data Centers

New Article was added to draw a distinction between data centers that currently fall under the scope of Article 645 *(Information Technology Equipment)* and those described in this new article

NEW



New article identifies those areas of the *NEC* that should be applied to MDCs and also includes additional new requirements where necessary

248

2014 National Electrical Code
Model Code Change Highlights

Chapter 6
Article 680 Swimming Pools

Over 10 Significant Changes

California Building Officials

CACACACACACACACA

Section 680.13(A), (B), (C)

Gas Chlorination Equipment Rooms

- *[DPH]*

(A) Switch Location.

(B) Equipment Interlocks.

(C) Emergency Switch for Spa Pools.

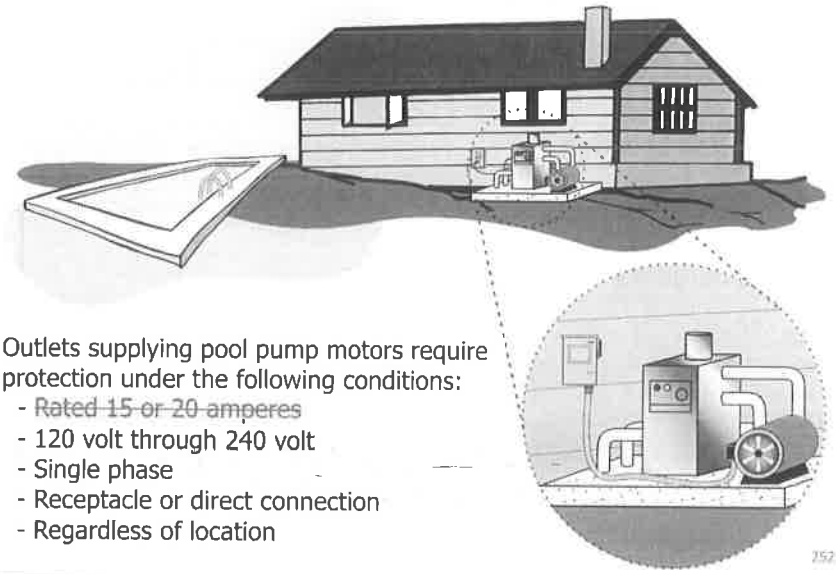
680.21(C) GFCI Protection (Motors)

- All single-phase, 120 volt through 240 volt outlets supplying pool pump motors now require GFCI protection *(regardless of ampacity).*
- The applicable limitation of motors "rated 15 or 20 amperes" has been removed.
- Any concerns of shock hazard potential for 20 ampere branch circuits feeding pool pump motors are also present for a 25 or 30 ampere branch circuits or any size branch circuits feeding single-phase pool pump motors.

251

680.21(C) GFCI Protection (Motors)

All single-phase, 120 volt through 240 volt outlets supplying pool pump motors now require GFCI protection *(regardless of ampacity)*



Outlets supplying pool pump motors require protection under the following conditions:

- ~~Rated 15 or 20 amperes~~
- 120 volt through 240 volt
- Single phase
- Receptacle or direct connection
- Regardless of location

252

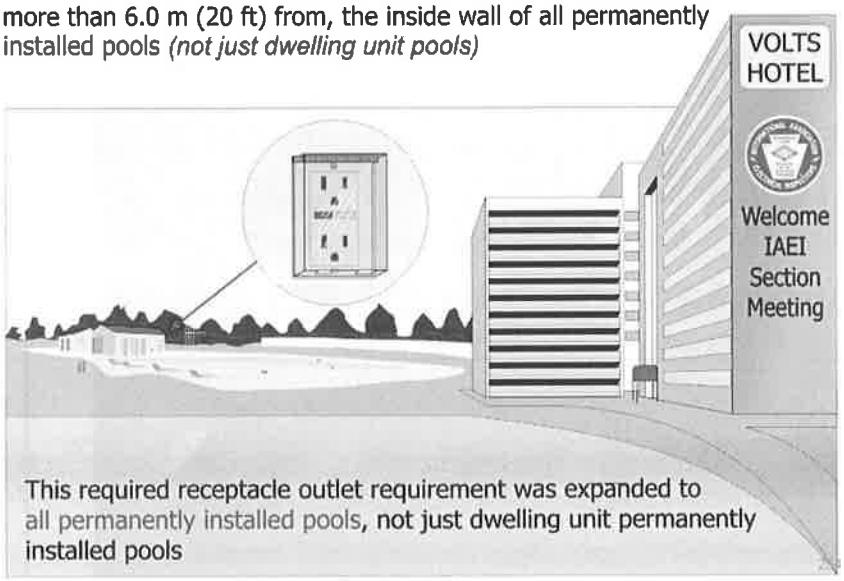
680.22(A)(1) Required Receptacle - Location

- At least one 125-volt, 15- or 20-ampere receptacle on a general-purpose branch circuit must to be located not less than 1.83 m (6 ft) from, and not more than 6.0 m (20 ft) from, the inside wall of all permanently installed pools *(not just dwelling unit pools).*

253

680.22(A)(1) Required Receptacle - Location

At least one 125-volt, 15- or 20-ampere receptacle on a general-purpose branch circuit must to be located not less than 1.83 m (6 ft) from, and not more than 6.0 m (20 ft) from, the inside wall of all permanently installed pools *(not just dwelling unit pools)*



This required receptacle outlet requirement was expanded to all permanently installed pools, not just dwelling unit permanently installed pools

NEW

680.22(B)(6) Low-Voltage Luminaires

- Specific low-voltage luminaires are now permitted to be installed within 1.5 m (5 ft) of the inside walls of permanently installed pools.
- A new definition for "Low Voltage Contact Limit" was introduced at 680.2 in the 2011 *NEC.*
- Even with this new definition, previous language at 680.22(B) did not allow low voltage lighting to be installed in close proximity to swimming pools.
- The provisions of 411.4(B) allow low voltage lighting systems to be installed in close proximity to swimming pools if "permitted by Article 680."
- This new allowance will give this needed Article 680 permission.

255

NEW

680.22(B)(6) Low-Voltage Luminaires

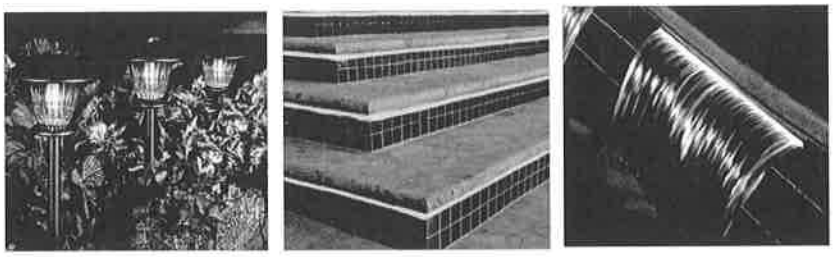
Specific low-voltage luminaires are now permitted to be installed within 1.5 m (5 ft) of the inside walls of permanently installed pools

256

NEW

680.22(B)(6) Low-Voltage Luminaires

Specific low-voltage luminaires are now permitted to be installed within 1.5 m (5 ft) of the inside walls of permanently installed pools



These luminaires must be of the type that...

- does not require connection to an equipment grounding conductor
- cannot exceed the voltage limitations defined in the definition of "Low Voltage Contact Limit" at 680.2
- are supplied by listed transformers or power supplies that comply with 680.23(A)(2) for transformers or power supplies listed for swimming pool and spa use

257

680.25(A)(1) ~~Exception~~: Wiring Methods (Feeders)

- **Note from IAEI**
- An errata from NFPA will remove the exception for 680.25(A)(1) from the second printing of the 2014 NEC.
- *See 2014 NEC errata at NFPA website.*
- Proposal 17-119 removed the exception.
- Comment 17-37 sought to remove references to this exception found at 680.25(B) and 680.25(B)(2) *(not to reinstate deleted exception).*

258

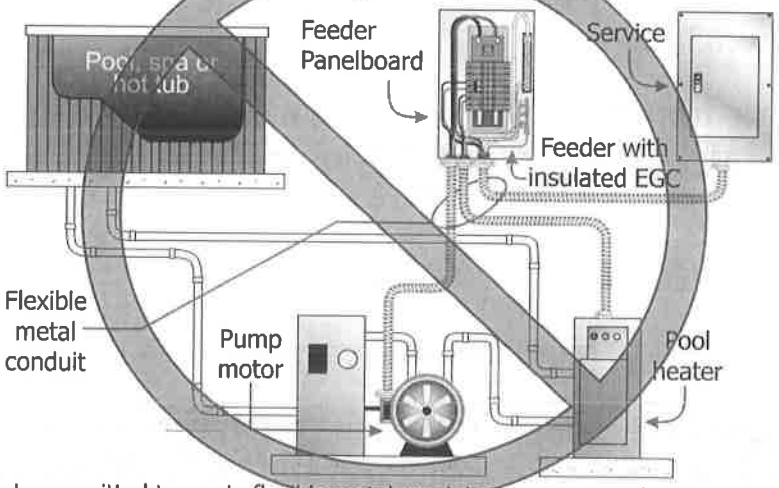
680.25(A)(1) Wiring Methods (Feeders)

- Exception allowing an "existing" feeder between an "existing" remote swimming pool panelboard and service equipment to be run in flexible metal conduit or an approved cable assembly has been deleted.
- What does "existing" mean? When does an installed feeder become "existing"?
- Feeder required to have an insulated EGC as part of or installed with the permitted wiring methods identified at 680.25(A)(1).

259

680.25(A)(1) Exception: Wiring Methods (Feeders)

Exception for an "existing" feeder between an "existing" remote panelboard and service equipment was revised to include all feeders to remote panelboards *(not just existing feeders and existing remote panelboards)*

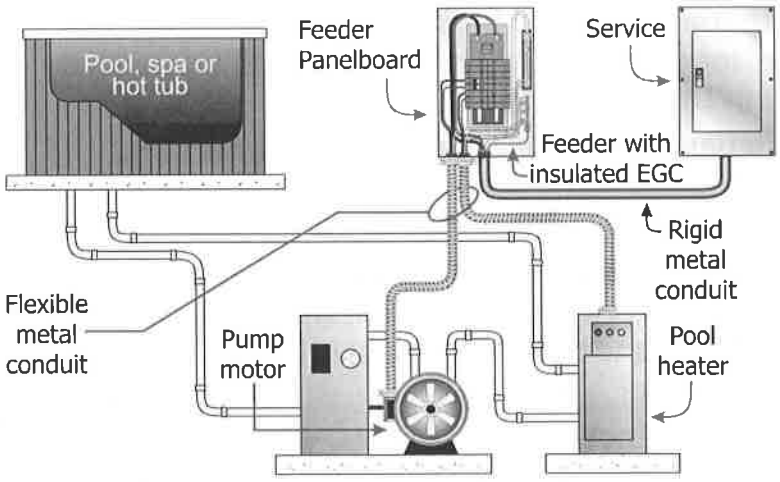


Feeder permitted to run in flexible metal conduit or an approved cable assembly that includes an insulated equipment grounding conductor within its outer sheath

260

680.25(A)(1) Wiring Methods (Feeders)

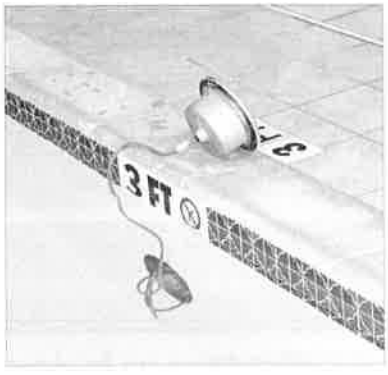
The exception allowing an "existing" feeder between an "existing" remote swimming pool panelboard and service equipment to be run in flexible metal conduit or an approved cable assembly has been deleted



261

680.26(C) Equipotential Bonding (Pool Water)

The requirement for "bonding" of pool water has been revised by removing the term "intentional bond" or "bond"



Where none of the required bonded parts *(ladders, metal forming shells, etc.)* is in direct connection with the pool water, the pool water shall be in direct contact with a conductive surface that exposes not less than 5800 mm^2 (9 in.^{2}) of surface area to the pool water at all times

262

680.42(B) Outdoor Spas and Hot Tubs (Bonding)

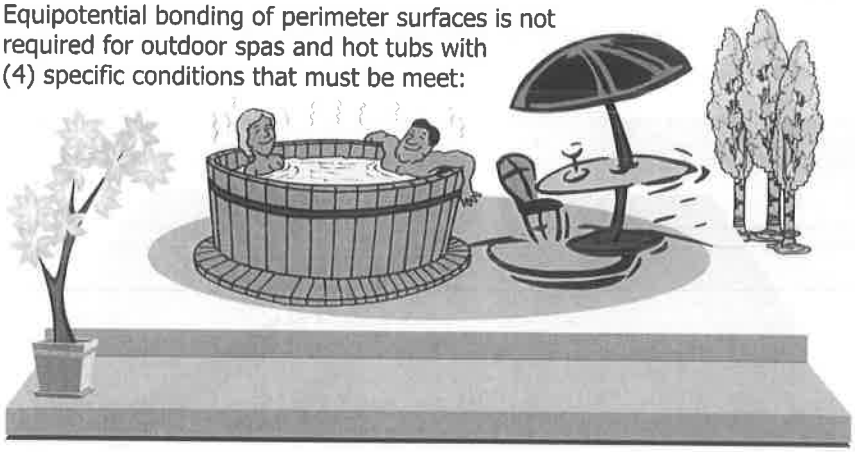
NEW

- Equipotential bonding of perimeter surfaces is not required for outdoor spas and hot tubs with (4) specific conditions that must be met.
- New language will eliminate equipotential bonding requirements for listed self-contained spas or hot tubs for aboveground use under specific conditions.
- These listed self-contained units have very different concerns of safety and enforcement than that of custom in-ground spas and built-in permanently installed swimming pools.
- Indoor spas and hot tubs and storable pools are excluded from perimeter bonding requirements of 680.26.

263

680.42(B) Outdoor Spas and Hot Tubs (Bonding)

Equipotential bonding of perimeter surfaces is not required for outdoor spas and hot tubs with (4) specific conditions that must be meet:



(1) Listed as a self-contained spa for aboveground use

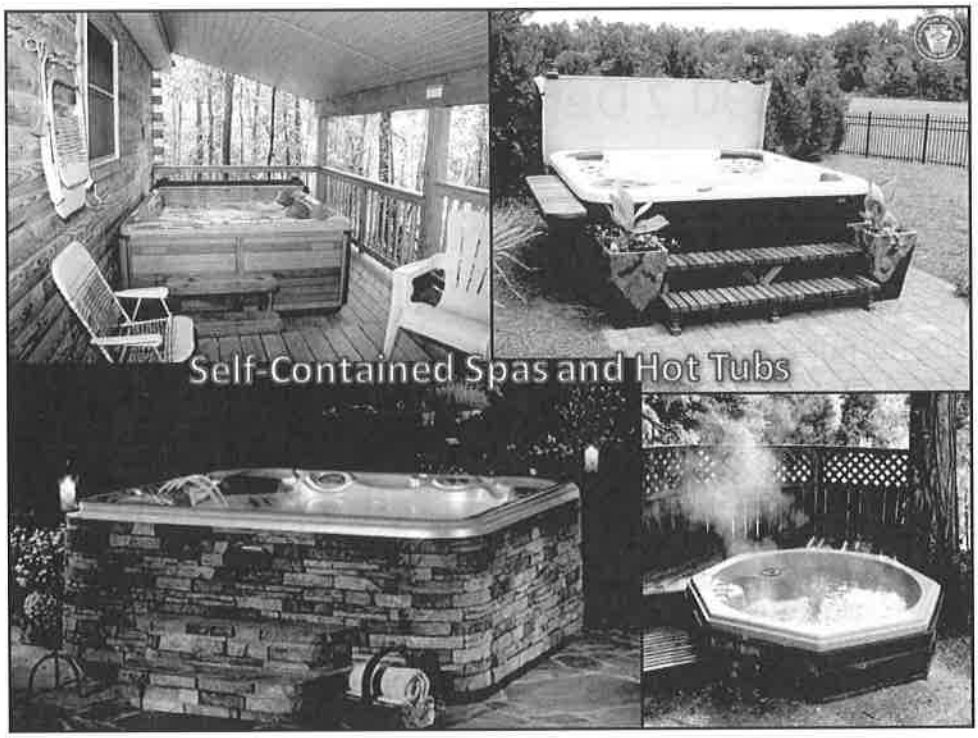
NEW

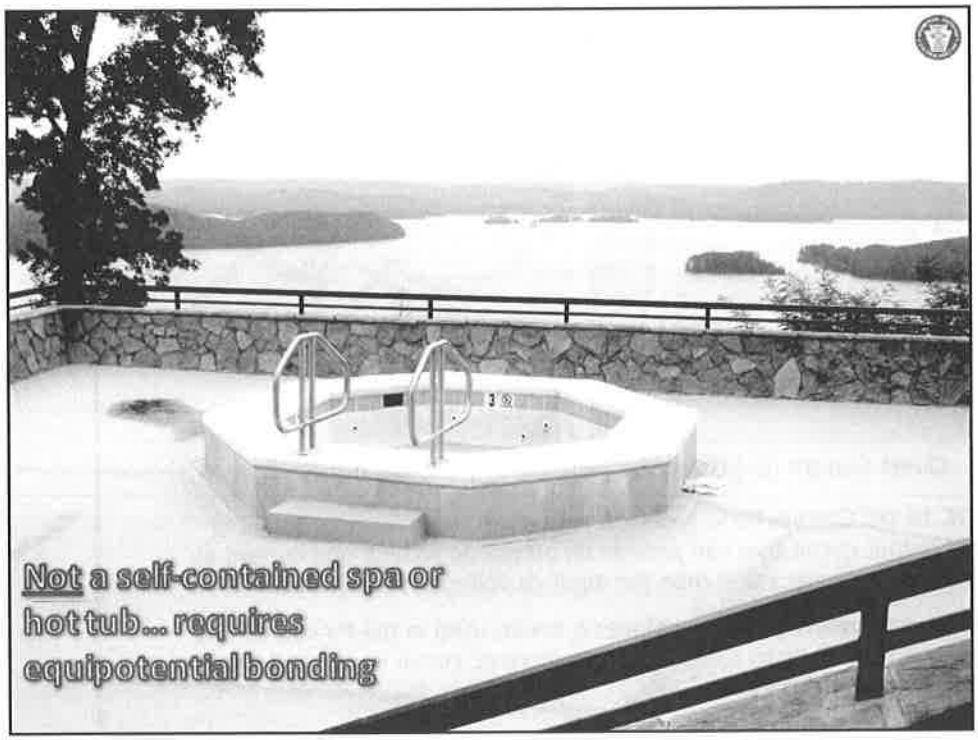
(2) Not be identified as suitable only for indoor use

(3) Installation per manufacturer's instructions and located on or above grade

(4) Top rim located at least 71 cm (28 in.) above all perimeter surfaces that are within 76 cm (30 in.) (horizontally) from the spa or hot tub

264


Self-Contained Spas and Hot Tubs


Not a self-contained spa or
hot tub... requires
equipotential bonding

NEW

690.2 Definitions

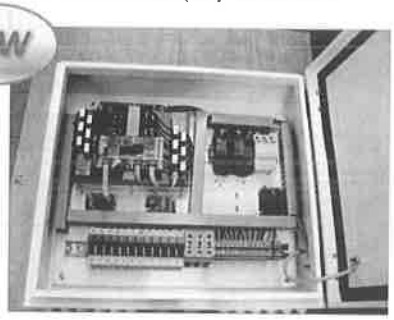
- Two new definitions were added to Article 690 "DC to DC Converter" and "Direct Current (dc) Combiner."
- These devices are becoming more common and have specific requirements unique to these devices.
- The output parameters of these devices can be different than the input parameters, the rating of equipment on the output side may need to be different than that on the input.
- These definitions will make it clear that the PV source or output circuit ends at the input to the device by defining it as dc utilization equipment.
- Since the requirements should be the same regardless of where in the circuit the combiner is located, there needs to be a defined term that covers all dc combiners.

267

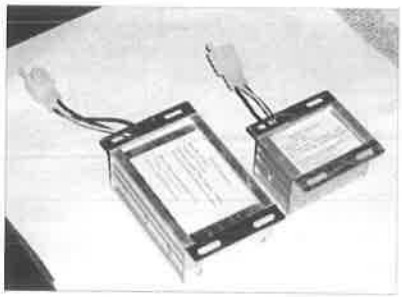
690.2 Definitions

Two new definitions were added to Article 690. "DC to DC Converter" and "Direct Current (dc) Combiner"

NEW



Direct Current (dc) Combiner



DC to DC Converters

DC to DC Converters: A device installed in the PV source circuit or PV output circuit that can provide an output dc voltage and current at a higher or lower value than the input dc voltage and current.

Direct Current (dc) Combiner: A device used in the PV source and PV output circuits to combine two or more dc circuit inputs and provide one dc circuit output.

268

690.9 Overcurrent Protection (PV Systems)

- "Overcurrent Protection" requirements were revised for clarity by grouping similar overcurrent protection requirements for PV systems together in order to make Article 690 easier to use.
- Language was added to insure that listed equipment be used to provide this overcurrent protection.
- OCPDs in PV source and output circuits are subject to wide operating current and temperature cycling, high ambient temperatures, low clearing currents and high open-circuit voltages.
- Product standards have been created specifically for PV dc system overcurrent protection *(both fuses and circuit breakers).*
- New and revised language was added at 690.9(E) to give distinction between a grounded PV source circuit and an ungrounded PV source circuit.

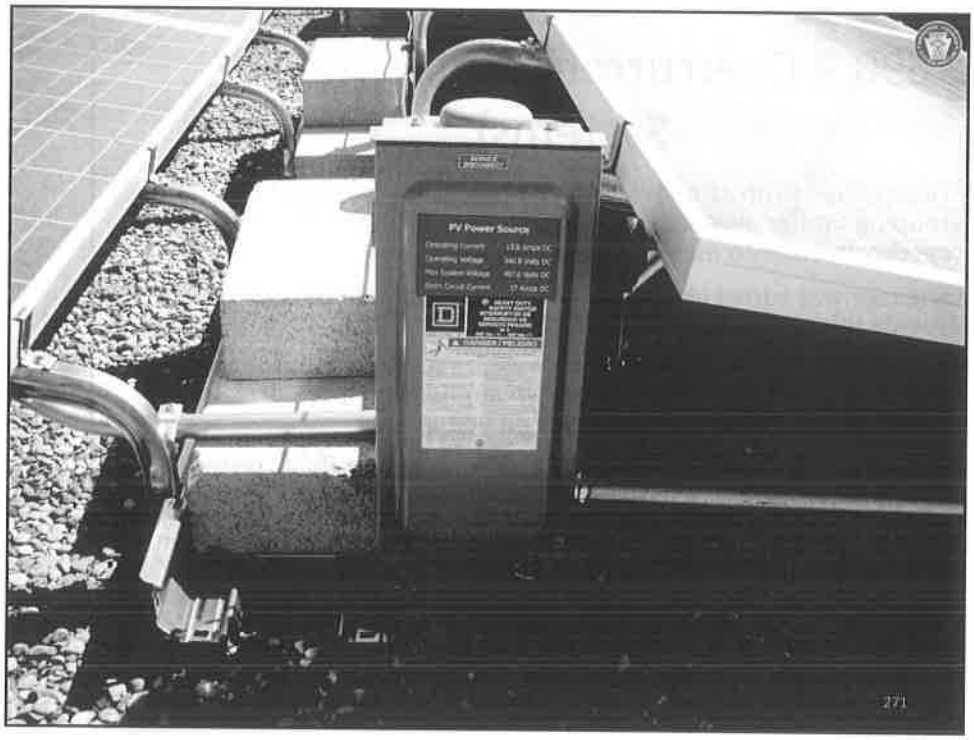
269

690.9 Overcurrent Protection (PV Systems)

"Overcurrent Protection" requirements for PV systems were revised for clarity by grouping similar overcurrent protection requirements together

Circuits Required to be Protected. PV source circuits, PV output circuits, inverter output circuits, and battery circuit conductors	690.9(A), Article 240
Circuits Connected to Current-Limited Supplies. Circuits (ac or dc) connected to current-limited supplies (e.g., PV modules, ac output of utility-interactive inverters), or connected to sources having significantly higher current availability (e.g., parallel strings of modules, utility power), shall be protected at the source from overcurrent	690.9(A)
Rating. OCPDs are required to be rated for not less than 125% of the maximum currents calculated or determined in 690.8(A)	690.9(B), 240.4
DC Rating. OCPDs in DC circuits are required to be listed for such use and have the appropriate voltage, current, and interrupt ratings	690.9(C)
PV Source and Output Circuits. Listed PV overcurrent devices required for overcurrent protection in PV source and output circuits	690.9(D)
Series Overcurrent Protection-Grounded PV source circuits. A single OCPD (where required) permitted to protect the PV modules and the interconnecting conductors. **Ungrounded.** OCPD (where required) shall be installed in each ungrounded circuit conductor and permitted to protect the PV modules and the interconnecting cables	690.9(E)
Transformers. Overcurrent protection required for transformers in accordance with 450.3	690.9(F), 450.3

270



NEW

690.12 Rapid Shutdown of PV Systems on Buildings

- New provisions added for "Rapid Shutdown" of PV systems on buildings.
- PV source circuits required to be de-energized from all sources within 10 seconds of when the utility supply is de-energized or when the PV power source disconnecting means is opened.
- This is an effort to increase the electrical and fire safety on buildings for emergency and fire service first and second responders during emergency operations on PV-equipped buildings and structures.
- There is a need for the ability to de-energize PV-generated power sources in the event of an emergency.

272

NEW

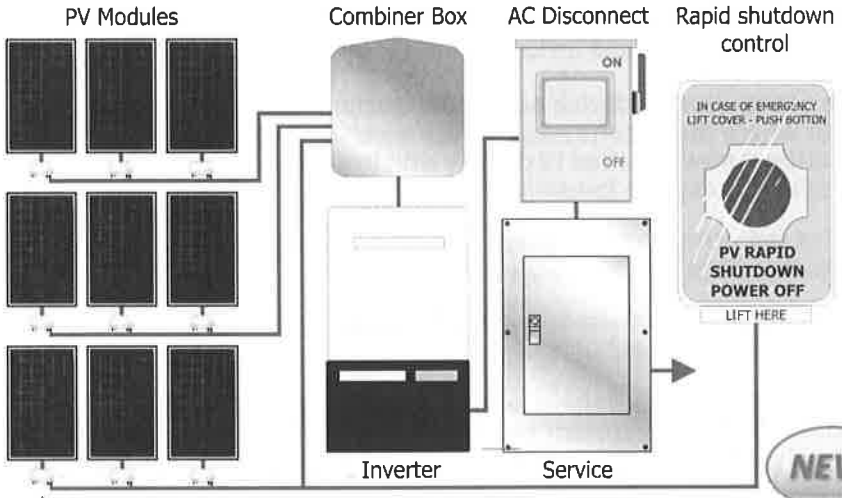
690.12 Rapid Shutdown of PV Systems on Buildings (cont.)

- New section will address the de-energizing of rooftop wiring leaving only the module wiring and internal conductors of the module still energized.
- PV source circuit conductors include all wiring between modules or modular electronic devices up to the combining point.
- An electronic means will be necessary to shutdown the module at the source circuit level.
- PV module-level dc-dc converter, single-module micro-inverter, and ac module can all meet this requirement at the module end of the circuit.
- Simple remotely controlled electronic switches can also meet this requirement.
- A voltage limit of 30-volts and a power limit of 240 watts were established as a safe power limited environment.

273

690.12 Rapid Shutdown of PV Systems on Buildings

PV source circuits to be de-energized from all sources within 10 seconds of when the utility supply is de-energized or when the PV power source disconnecting means is opened



NEW

DC rated relays used as a means for "Rapid Shutdown" of PV systems

274

690.71(H) ~~690.7(F)~~ Disconnects and Overcurrent Protection

- **Note from IAEI:**
- The text added at 690.7(F) was inadvertently duplicated by NFPA at 690.71(H).
- The text at 690.7(F) will be deleted in the second printing of the 2014 *NEC (see 2014 NEC errata)*.
- The change reported at 690.7(F) in the Analysis textbook and PowerPoint will need to be reidentified as 690.71(H) rather than ~~690.7(F)~~.

275

690.71(H) Disconnects and Overcurrent Protection

- New subsection added for "Disconnects and Overcurrent Protection" dealing with batteries and other energy storage devices.
- Where energy storage device output conductor length exceeds 1.5 m (5 ft), or where the circuits pass through a wall or partition, the installation is now required to comply with five specific provisions *(See Code language on following slides)*.
- Batteries and other energy storage devices represent significant sources of current *(10,000 amps or more)*.
- Circuits connected to these sources must be protected with overcurrent protection.
- These circuits are bidirectional and confusion exists as to where the disconnect(s) and overcurrent protection are required since there are two supply sources.

276

690.7(F) Disconnects and Overcurrent Protection

New subsection was added for "Disconnects and Overcurrent Protection" at the section for "Maximum Voltage" dealing with batteries and other energy storage devices

Where energy storage device output conductor length exceeds 1.5 m (5 ft), or where the circuits pass through a wall or partition, the installation is now required to comply with five specific provisions

277

690.71(H) Disconnects and Overcurrent Protection

New subsection was added for "Disconnects and Overcurrent Protection" at 690.71(H) dealing with batteries and other energy storage devices

Where energy storage device output conductor length exceeds 1.5 m (5 ft), or where the circuits pass through a wall or partition, the installation is now required to comply with five specific provisions

278

690.71(H) Disconnects and Overcurrent Protection

Where energy storage device output conductor length exceeds 1.5 m (5 ft), or where the circuits pass through a wall or partition the installation shall comply with (1) through (5):

(1) A disconnecting means and overcurrent protection shall be provided at the energy storage device end of the circuit. Fused disconnecting means or circuit breakers are acceptable.

(2) Where fused disconnecting means are used, the "Line" terminals of the disconnecting means shall be connected toward the energy storage device terminals.

(3) Overcurrent devices or disconnecting means shall not be installed in energy storage device enclosures where explosive atmospheres can exist.

(4) A second disconnecting means located at the connected equipment shall be installed where the disconnecting means required by (1) is not within sight of the connected equipment.

(5) Where the energy storage device disconnecting means is not within sight of the PV system ac and dc disconnecting means, placards or directories shall be installed at the locations of all disconnecting means indicating the location of all disconnecting means.

279

NEW

690.81 Listing (PV Systems over 1000 Volts)

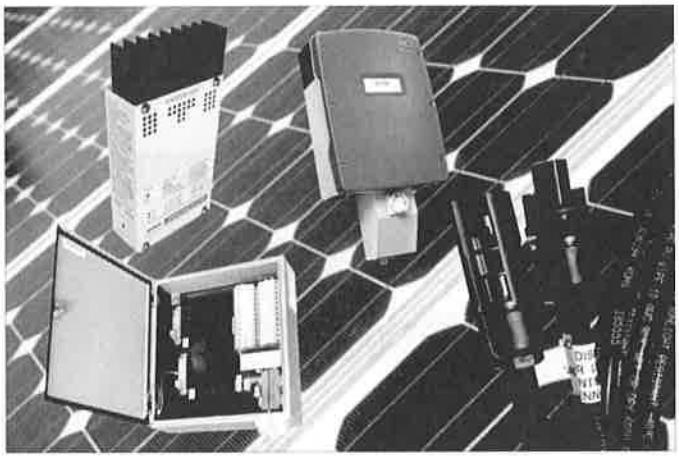
- Products listed for photovoltaic systems are permitted to be used and installed in accordance with their listing.
- PV wire that is listed for direct burial at voltages above 600 volts but not exceeding 2000 volts are required to be installed in accordance with Table 300.50, Column 1.
- Common practice in large utility-scale solar PV systems to direct bury 2000 volt rated conductors used to deliver power from combiner boxes to the inverter.
- There are currently listed PV wire products available that are rated at up to 2000 volts that are also listed for direct burial.

280

690.81 Listing (PV Systems over 1000 Volts)

Products listed for photovoltaic systems are permitted to be used and installed in accordance with their listing

NEW



PV wire that is listed for direct burial at voltages above 600 volts but not exceeding 2000 volts are required to be installed in accordance with Table 300.50, Column 1

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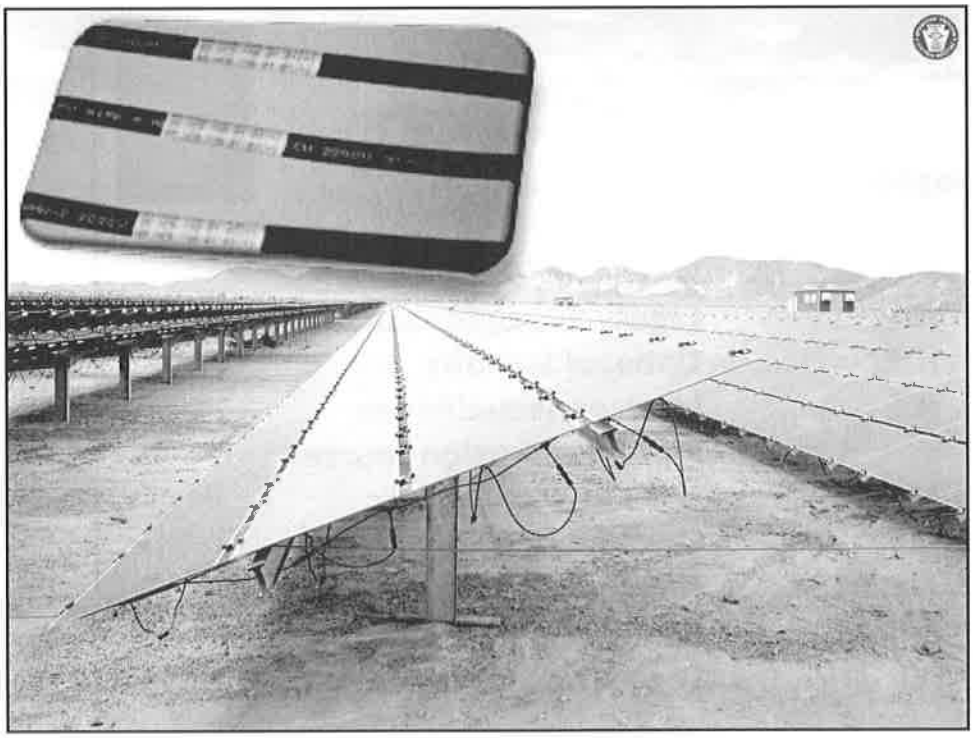


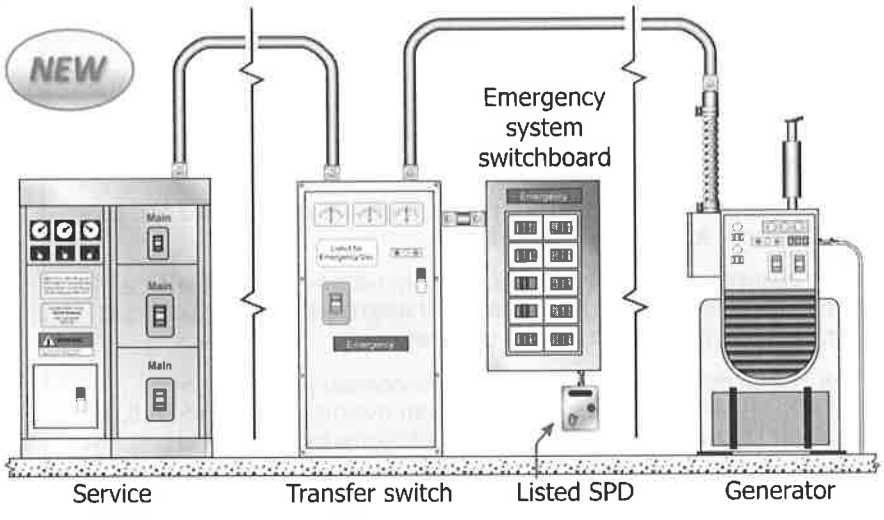
Chapter Seven Special Conditions

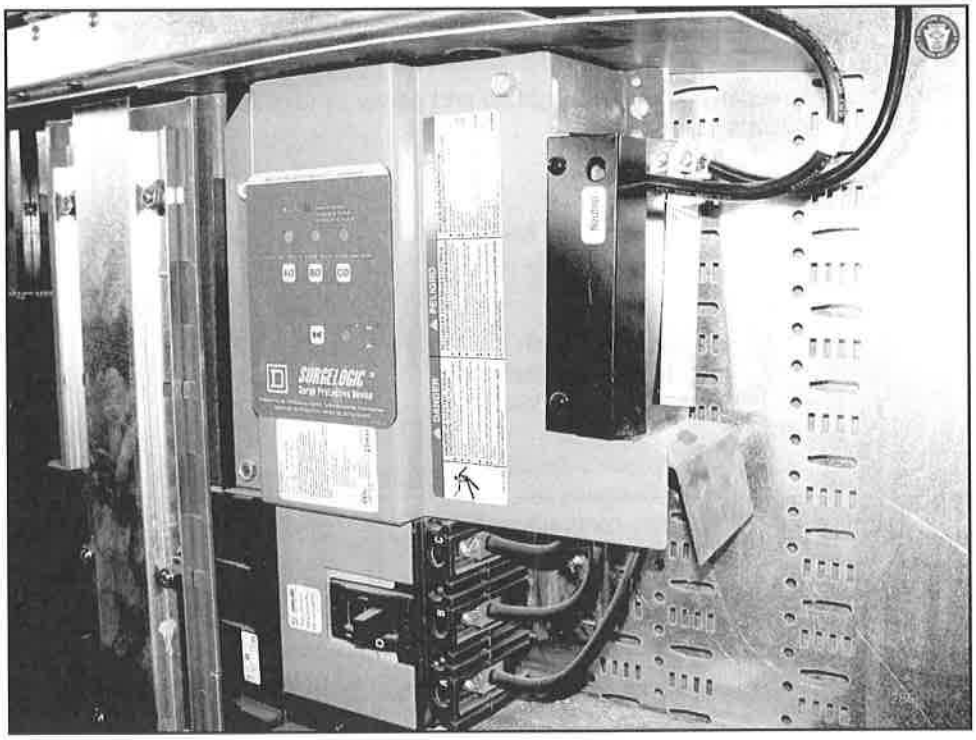
Chapter 7 – Special Conditions

- 700 Emergency Systems
- 701 Legally Required Standby
- 702 Optional Standby
- 705 Interconnected Power Power Production Sources
- 708 COPS
- 725 Class 1, 2, 3 Circuits
- *728 NEW* *Fire-Resistive Cable Systems*
- *750 NEW* *Energy Management Systems*
- 760 Fire Alarm Systems

700.8 Surge Protection (Emergency Systems)

A listed surge protective device (SPD) shall be installed in or on all emergency systems switchboards and panelboards





700.19 Multiwire Branch Circuits

- Branch circuits for emergency power or lighting prohibited from being part of a multiwire branch circuit.
- Emergency systems, circuits, and equipment are intended to supply, distribute, and control electricity for illumination, power, or both, when the normal electrical supply or system is interrupted.
- It's critical that these emergency circuits are built and maintained to supply continual and reliable power.
- 210.4(B) requires each multiwire branch circuit be provided with a means to "simultaneously disconnect" all ungrounded conductors at the point where the branch circuit originates.
- This new requirement will prevent the unnecessary opening of all poles of a multiwire branch circuit when an overload, ground-fault, or short-circuit occurs on one pole of the multiwire branch circuit.

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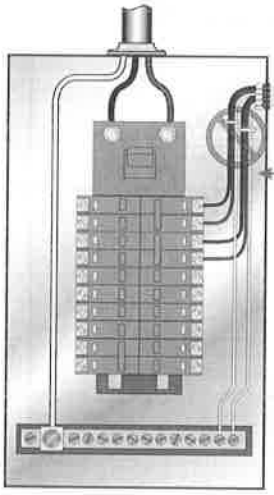
700.19 Multiwire Branch Circuits

The branch circuit serving emergency lighting and power circuits shall not be part of a multiwire branch circuit



To emergency loads

Multiwire branch circuits prohibited to emergency loads

Emergency circuits are designed to supply continual and reliable power

"Simultaneous" disconnection could interrupt that reliable power

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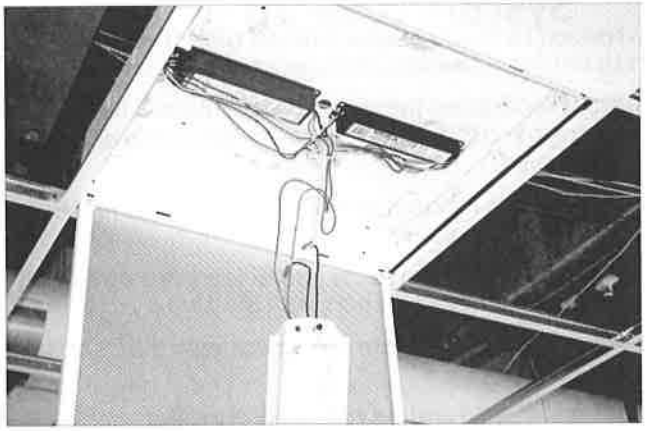
700.24 Directly Controlled Luminaires

- Emergency system luminaire and all external bypass controls are required to be individually listed for use in emergency systems.
- These directly controlled luminaires respond to an external control input to bypass normal control upon loss of normal power.
- Emergency lighting systems are required to be designed and installed so that the failure of any individual lighting element, such as the burning out of a lamp, cannot leave in total darkness any space that requires emergency illumination.
- A new class of light-emitting diode (LED) luminaire has emerged and is being used in emergency lighting systems.
- Some of these LED luminaires are currently not listed for this emergency application and may or may not have sufficient reliability or predictable performance for use in emergency systems.

700.24 Directly Controlled Luminaires

Emergency system luminaire and all external bypass controls are required to be individually listed for use in emergency systems



Where emergency illumination is provided by one or more directly controlled luminaires that respond to an external control input to bypass normal control upon loss of normal power, such luminaires and external bypass controls shall be individually listed for use in emergency systems

700.28 Selective Coordination (Emergency Systems)

A licensed professional engineer or other qualified persons must now design and select the selective coordination of the overcurrent protective devices for emergency systems

Documentation is required to be made available to those authorized to design, install, inspect, maintain, and operate the system

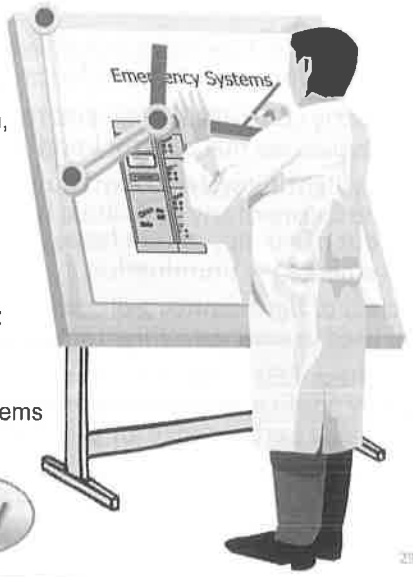
This same new "licensed professional engineer or other qualified persons" selective coordination provision was implemented at the following locations:

620.62 Elevators, Escalators, (Etc.)

701.27 Legally Required Standby Systems

708.54 Critical Operations Power Systems (COPS)

NEW

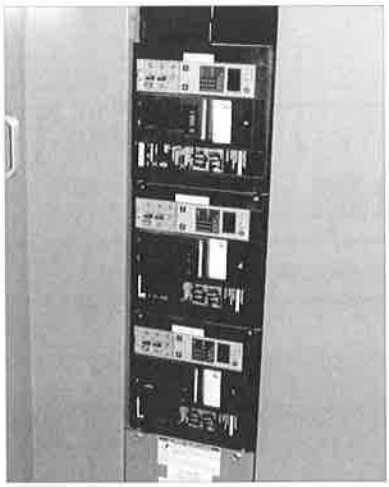


708.52(D) Selectivity of GFP of Equipment [Critical Operations Power System (COPS)]

- 708.52(D) was revised to require separation of GFP time-current characteristics to conform to manufacturer's recommendations.
- "Six-cycle minimum separation between the service and feeder ground-fault tripping bands" and the "time spread between these two bands" was removed.
- In most cases today, GFP is integral to the disconnect devices upon which the ground-fault relay operates.
- Consideration of all required tolerances and disconnect operating time is also required to achieve 100 percent selectivity.
- This revision will bring 708.52(D) into alignment with 517.17(C) for GFP at health care facilities.
- GFP system designers should and do routinely consider manufacturer's recommendations in the selection and setting of these protective devices.

708.52(D) Ground-Fault Protection of Equipment [Critical Operations Power System (COPS)]

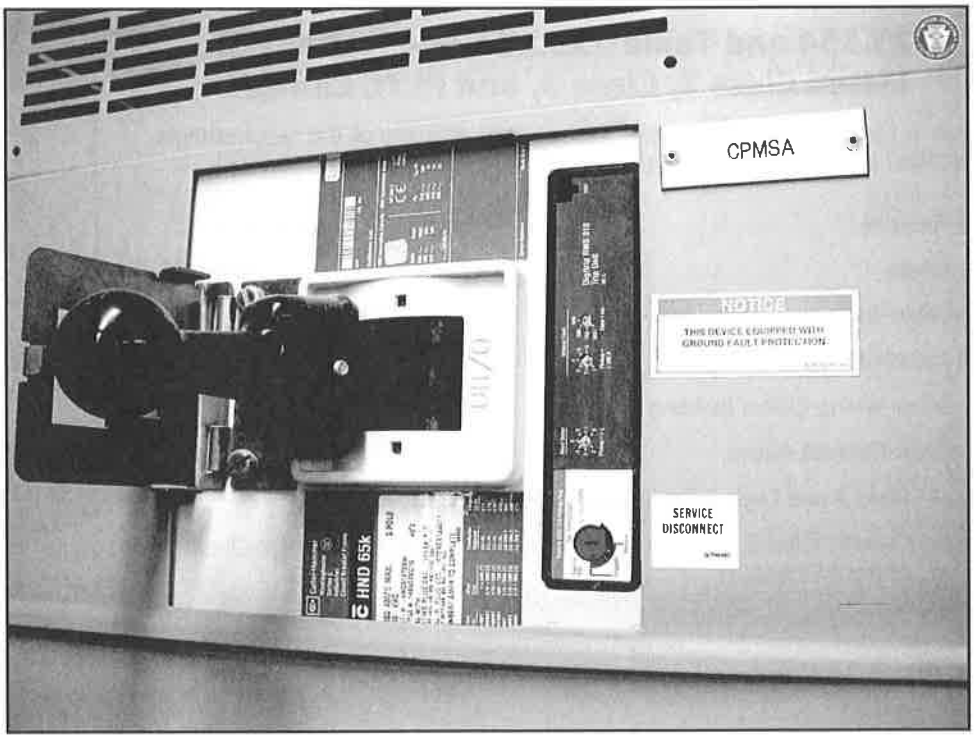
708.52(D) was revised to require separation of GFP time-current characteristics to conform to manufacturer's recommendations



Feeder OCPD and GFP devices

GFP for operation of the service and feeder disconnecting means shall be fully selective such that the feeder device *(but not the service device)* shall open on ground faults on the load side of the feeder device

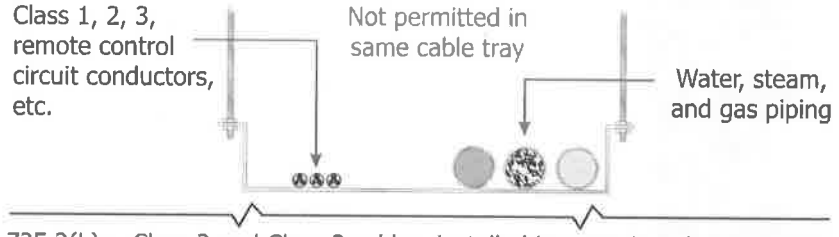
Separation of GFP time-current characteristics shall conform to manufacturer's recommendations and shall consider all required tolerances and disconnect operating time to achieve 100 percent selectivity



NEW

725.3 Other Articles

725.3(K) - Installation of conductors with other systems shall comply with 300.8 (Raceways or cable trays containing electrical conductors shall not contain any pipe, tube, or equal for steam, water, air, gas, drainage, or any service other than electrical)



725.3(L) - Class 2 and Class 3 cables, installed in corrosive, damp, or wet locations, shall comply with the applicable requirements in 110.11, 300.5(B), 300.6, 300.9, and 310.10(G)

Class 1 Class 2, and Class 3 circuits installed in corrosive, damp, and wet locations are required to be identified for these conditions

Type CL2R-CI Cable

725.154 and Table 725.154 Applications of Listed Class 2, Class 3, and PLTC Cables

Class 2, Class 3, and PLTC cables shall comply with any of the requirements described in 725.154(A) through (C) and as indicated in Table 725.154

~~(A) Plenums~~	[Now 725.135(B) and (C)]
~~(B) Risers~~	[Now 725.135(D),)F), and (G)]
~~(C) Cable Trays~~	[Now 725.135(H)]
~~(D) Industrial Establishments~~	[Now 725.135(J)]
~~(E) Other Wiring Within Building~~	[Now 725.135(K), (L), and (M)]
~~(F) Cross-Connect Arrays~~	[Now 725.135(I)]

~~(G)~~ (A) Class 2 and Class 3 Cable Substitutions

~~(H)~~ (B) Class 2, Class 3, PLTC Circuit Integrity (CI) Cable or Electrical Circuit Protective System

~~(I)~~ (C) Thermocouple Circuits

See NEC for complete text and new Table 725.154

NEW

Article 728 Fire-Resistive Cable Systems

- A new article "Fire Resistive Cable Systems" has been added to address installations of fire resistive cables.
- Installations of these cables is critical to their ability to function during a fire.

NEW

Article 728 Fire-Resistive Cable Systems

A new article titled "Fire Resistive Cable Systems" had been added to the 2014 *NEC* to address installations of fire resistive cables

NEW

Article 750 Energy Management Systems

- New article, "Energy Management Systems," added to address the types of loads permitted to be controlled through energy management systems.
- New article includes definitions, requirements for alternative-power sources, load-management provisions and field-marking requirements.

NEW

Article 750 Energy Management Systems

New article, "Energy Management Systems," added to address the types of loads permitted to be controlled through energy management systems

New article includes definitions, requirements for alternative-power sources, load-management provisions and field-marking requirements

An important aspect to consider in regards to an energy management system is to make sure an overall energy management system does not override a system specific to addressing load shedding for an alternate power source for such things as fire pumps and emergency systems

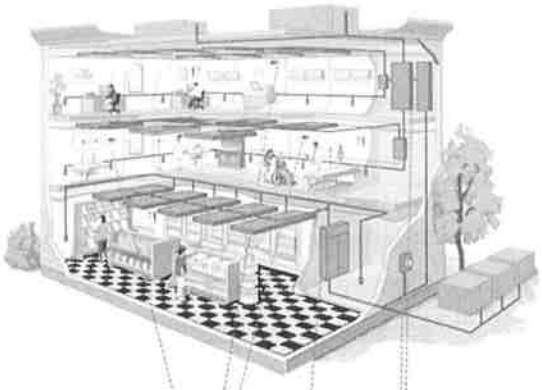
NEW

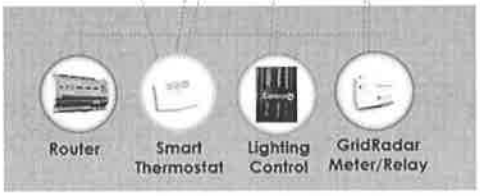
Article 750 Energy Management Systems

NOC
(Network Operating Center)

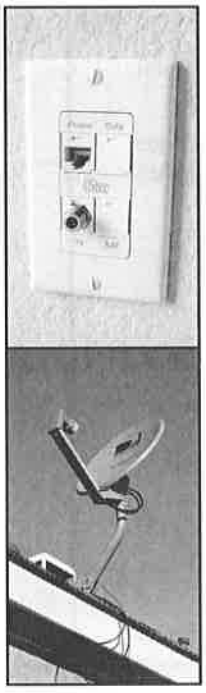
Secured Data Center

Internet





Courtesy of Sentinel Energy Management



Chapter Eight
Communications Systems

Chapter 8 – Communication Systems

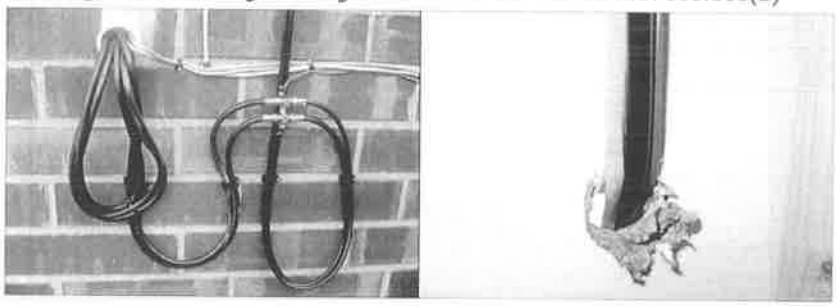
- 800 Communication Circuits
- 810 Radio and TV Equipment
- 820 Community Antenna TV Radio
- 830 Network Powered Broadband
- 840 Premises Powered Broadband

California Building Officials

800.2 Definitions: Point of Entrance

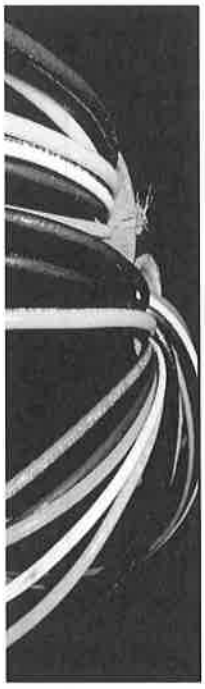
Definition of "Point of Entrance" has been revised by deleting grounding and bonding requirement from definition

The point within a building at which the communication wire or cable emerges from an external wall, from a concrete floor slab, or from a rigid metal conduit (Type RMC) or an intermediate metal conduit (Type IMC) ~~connected by a bonding conductor or grounding electrode in accordance with 800.100(B)~~



This same revision occurred at the definition of "Point of Entrance" at the following locations:

820.2 Community Antenna Television and Radio Distribution Systems
830.2 Network-Powered Broadband Communications Systems



Chapter Nine
Tables

Chapter 9 – Tables

- Table 1 Raceway Fill
- Table 4 Raceway Cross Sectional Areas
- Table 5 Conductor Cross Sectional Areas
- Table 8 Conductor Properties
- Table 11(A) Class 2, 3 AC Power Source
- Table 11(B) Class 2, 3 DC Power Source

California Building Officials

Chapter 9 Tables: Table 1

Table 1: Percent of Cross Section of Conduit and Tubing for Conductors and Cables

Number of Conductors and/or Cables	Cross Sectional Area (%) ~~All Conductor Types~~
1	53%
2	31%
Over 2	40%

53% 31% 40%

NEW Chapter 9 Tables: Notes to Tables - Note (10)

A new Note (10) was added to the Chapter 9 Notes to Tables indicating that the values for approximate conductor diameter and area shown in Table 5 are based on worst-case scenario

Table 5 is based on round concentric-lay-stranded conductors with solid and round concentric-lay-stranded conductors grouped together for the purpose of Table 5

Round compact-stranded conductor values are shown in Table 5A

This new note gives the user of the *Code* permission to use the actual values of the conductor diameter and area if they are known

Solid Conductor	Standard Stranding	Compact Stranding
		
8 AWG THWN Dia = 5.486 mm (0.216 in.) Area = 23.61 mm^2 (0.0366 in.^{2})	8 AWG XHHW Dia = 5.994 mm (0.236 in.) Area = 28.19 mm^2 (0.0437 in.^{2})	8 AWG XHHW Dia = 5.690 mm (0.224 in.) Area = 25.42 mm^2 (0.0394 in.^{2})

Questions

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Thank You!