

TOWN OF PAYSON
BUILDING ADVISORY BOARD
MINUTES OF THE PUBLIC MEETING
MAY 18 & 19, 2012

- A Chairman Bossert called the duly posted public meeting of the Building Advisory Meeting Time Board to order at 8:10 a.m. on May 18 and reconvened at 8:03 a.m. on May 19 in & Place the Town Council Chambers.
- B MEMBERS PRESENT: Ralph Bossert; Bret Balog; Gary deSzendeffy; Bill Roll Call Easton; and Todd Brahm. ABSENT: Herm Holtz and Rob Myer
- C STAFF PRESENT: Ray LaHaye, Chief Building Official; Bob Lockhart, Fire Staff Present Marshal; Don Monteath, Permit Technician (on May 19); Sean Tanner, Building Inspector/Code Enforcement; Bernie Gilson, Building Inspector; and Chris Floyd, Executive Assistant.
- D Bret Balog moved, seconded by Gary deSzendeffy, to approve the minutes of the Approval of April 13, 2012, pages 440-441. Minutes
- Motion carried 5-0.
- E Presentation by Mark Ptashkin, Electrical Inspector Supervisor for the City of 2011 NEC Glendale, regarding 2011 National Electrical Code (NEC). The Town will be considering adoption (with possible amendments) of the 2011 NEC sometime in late 2012 or 2013. (PowerPoint presentation attached)
- F Several members of the audience and Board asked questions, for clarification Questions purposes, that were answered by Mark Ptashkin and staff.
- G With no further items on the agenda, Chairman Bossert adjourned the Building Adjournment Advisory Board meeting at approximately 10:47 a.m. on May 19.

NOTE: The Board recessed/reconvened at the following times:

Friday, May 18, 2012:

The Board recessed at 9:45 a.m.

The Board reconvened at 10:00 a.m. with all Board members present.

The Board took a lunch recess at 11:57 a.m.

The Board reconvened at 1:23 p.m. with all Board members present.

The Board recessed at 2:37 p.m.

The Board reconvened at 2:55 p.m. with all Board members present.

The Board recessed at 3:15 p.m.

The Board reconvened at 3:30 p.m. with all Board members present.

The Board recessed at 4:47 p.m. to reconvene at 8:00 a.m. on Saturday, May 19, 2012.

The Board reconvened at 8:03 a.m. on Saturday, May 19, 2012, with all Board members present.

The Board recessed at 9:32 a.m.

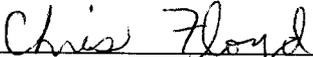
The Board reconvened at 9:50 a.m. with all Board members present.



Ralph Bossert, Chairman



Approved



Chris Floyd, Executive Assistant

Today's Presentation

The intent of this presentation is to highlight the most significant code changes from the 2008 and 2011 National electrical code and excludes topics that are unusual, of a minor nature or rarely encountered.

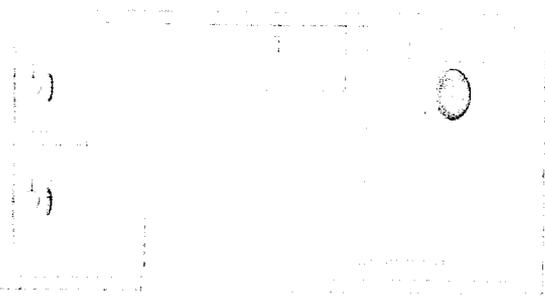


90.5(C) and (D) Explanatory Material and Informative Annexes

- "Fine Print Notes" are now referred to as "Informational Notes"
- This revision will more clearly define the adoptable and enforceable requirements of the NEC from these non-mandatory, but important forms of information
- The term "fine print" in some legal documents does not necessarily make the text unenforceable requirements
- New subdivision (D) (Informative Annexes) has been added referencing the informational annexes contained in the NEC
- Nonmandatory information relative to the use of the NEC is provided in informative annexes

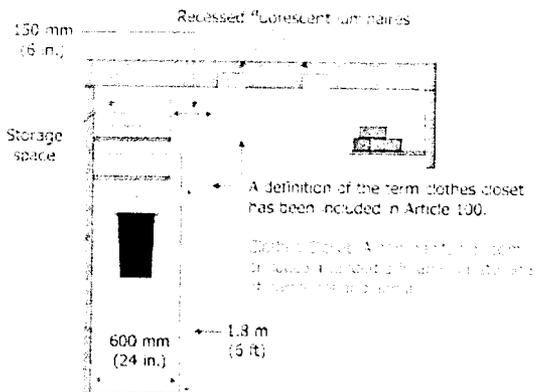
Article 100 Definitions: Bathroom

Bathroom - An area including a basin with one or more of the following: a toilet, a sink, a tub, a shower, or a combination of two or more of these.



The definition of a bathroom has been revised to include areas with a basin and such things as a urinal.

Article 100 Clothes Closet



Article 100 Device

Duplex receptacle	Locking type	Fan control	GFCI receptacle
Single receptacle	Switches	Dimmers	Occupancy sensors

A device is a unit of the electrical system that carries or controls electrical energy in a building.

Article 100 Bonded (Bonding)

Bonded (Bonding). Connected to establish electrical continuity and conductivity.

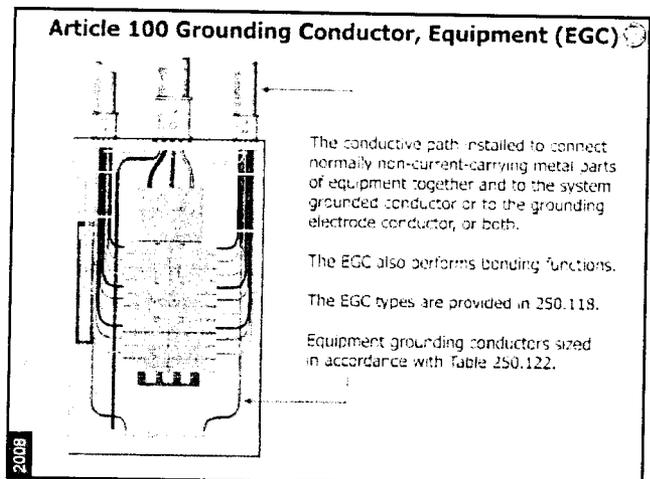
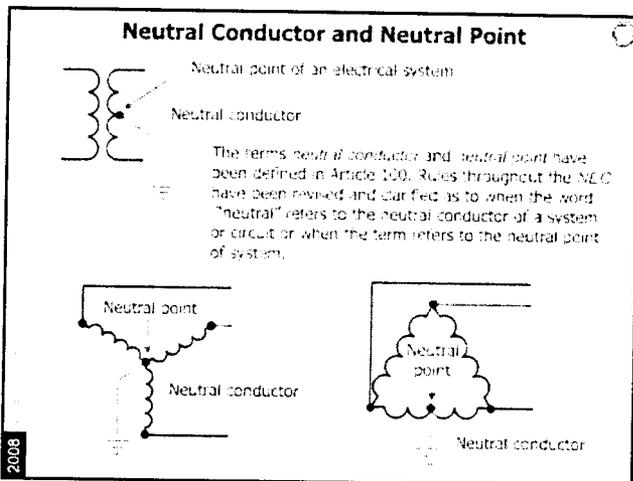
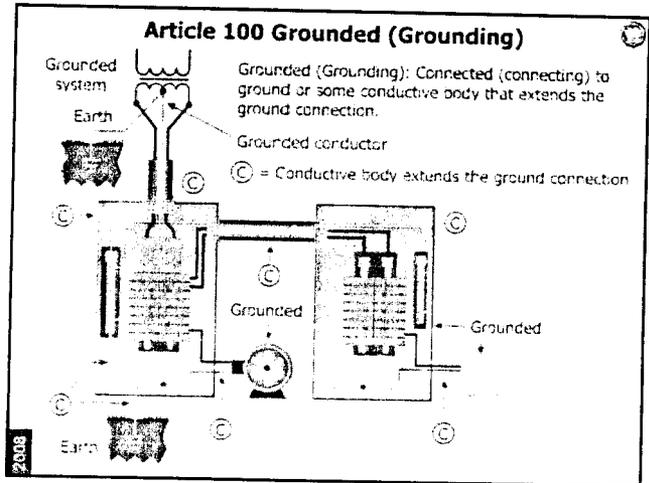
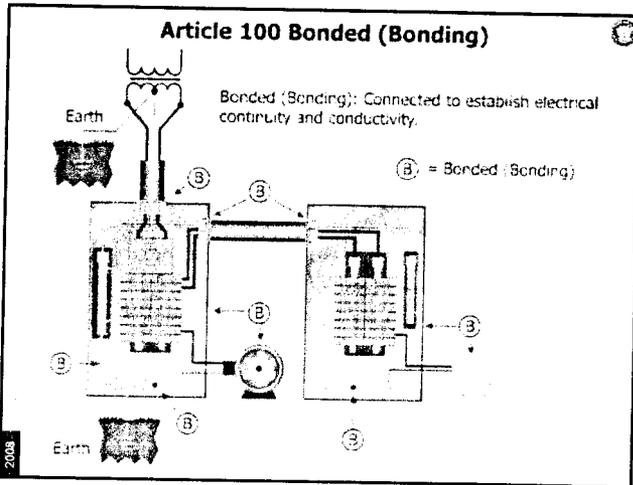
Article 100 Grounded (Grounding)

Grounded (Grounding). Connected (connecting) to ground or to some conductive body that extends the ground connection.

Article 100: System Bonding Jumper

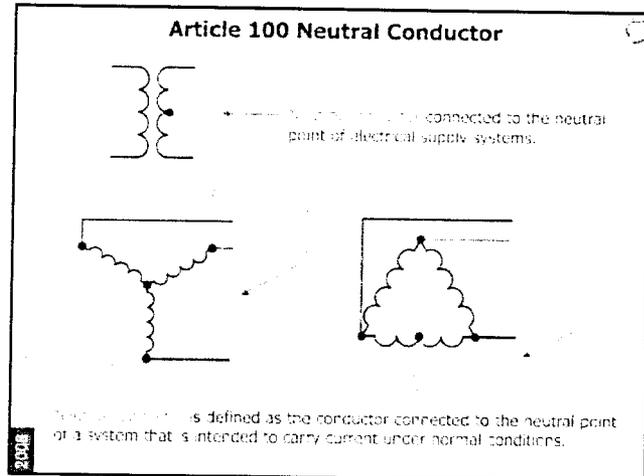
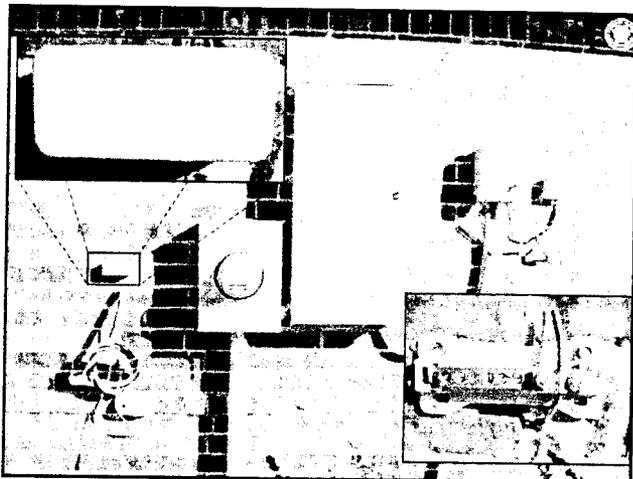
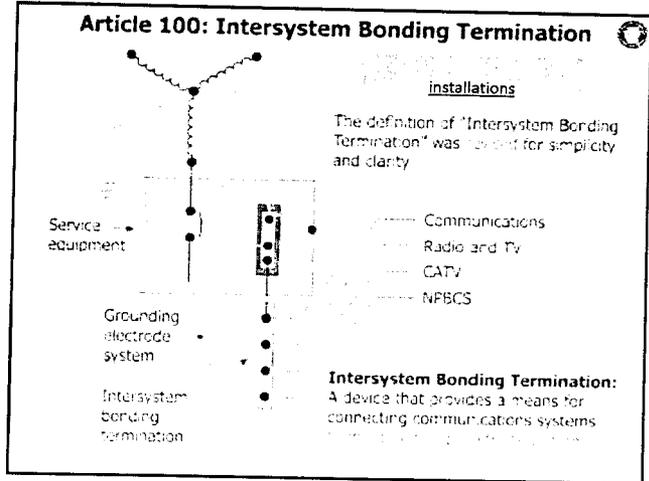
Bonding Jumper System - The connection between the grounded circuit conductor and the equipment grounding conductor, either at a separately derived system.

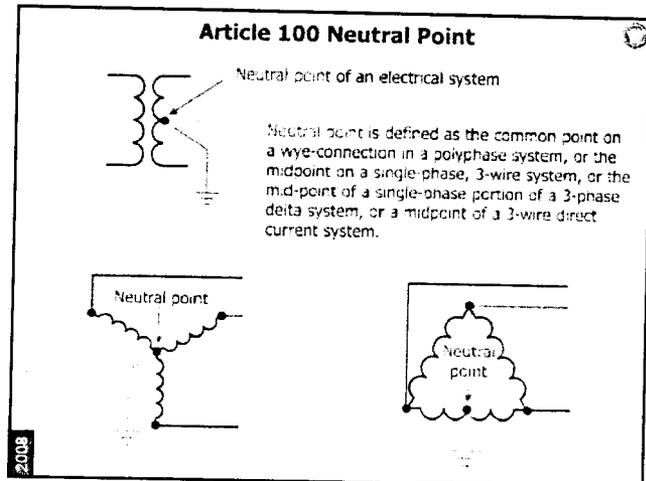
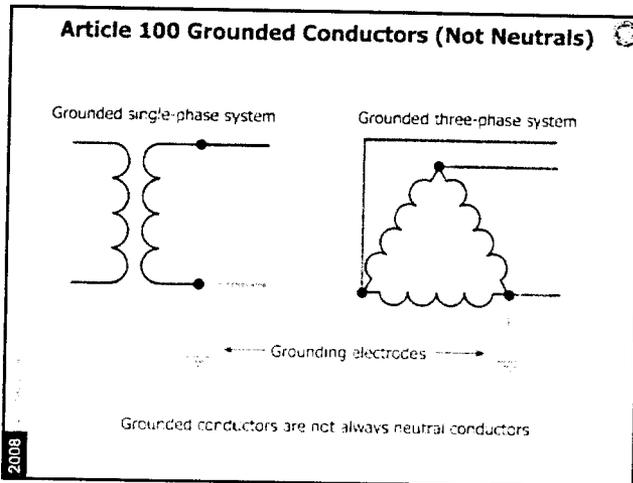
The definition of "System Bonding Jumper" has been revised to include the new term "supply-side bonding jumper" and has been relocated to Article 100.



Article 100 - Definitions

- **Intersystem Bonding Termination** - A device that provides a means for connecting bonding conductors for communications systems grounding conductor(s) and bonding conductor(s) at the service equipment or at the disconnecting means for buildings or structures supplied by a feeder or branch circuit to the grounding electrode system



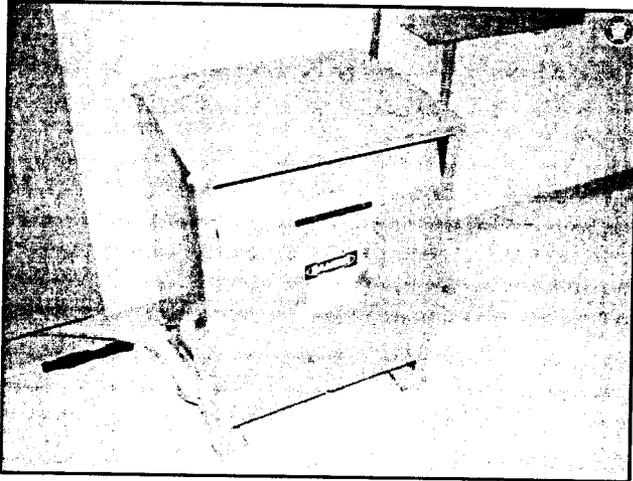


Article 100 – Kitchen

- New definition of the term *kitchen* has been added to Article 100.
- **Kitchen.** An area with a sink and permanent facilities for food preparation and cooking.
- A sink and permanent provisions for food preparation and cooking are required for an area to qualify as a *kitchen*.

Article 100 - Definitions

- The definition of a "Separately Derived System" was amended and simplified for clarity
- **Separately Derived System.** A premises wiring system whose power is derived from a source of electric energy or equipment other than a service
- Such systems have no direct electrical connection from circuit conductors of one system to circuit conductors of another system, other than connections through the earth, metal enclosures, metallic raceways, or equipment grounding conductors ~~including a solidly connected grounded circuit conductor, to supply conductors originating in another system~~



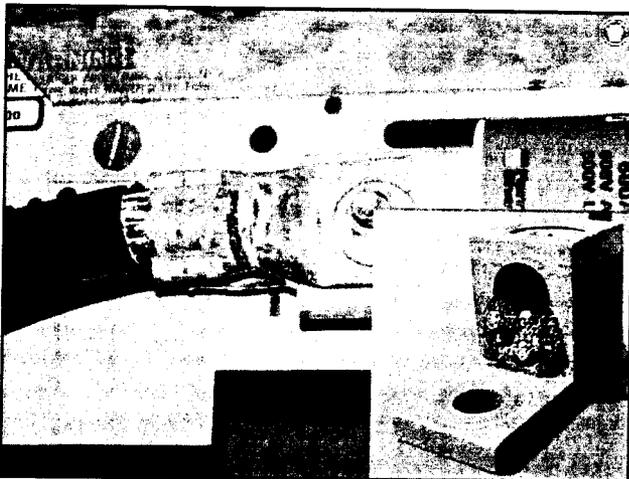
110.14 Electrical Connections

Flexible fine-stranded cable

Listed lugs

Connectors and terminals for conductors more finely stranded than Class B and Class C stranding as shown in Chapter 9, Table 1.1 shall be identified for the specific conductor class or classes.

General requirements for terminating flexible, fine-stranded cables and conductors have been added to 110.14



Article 100 Short-Circuit Current Rating

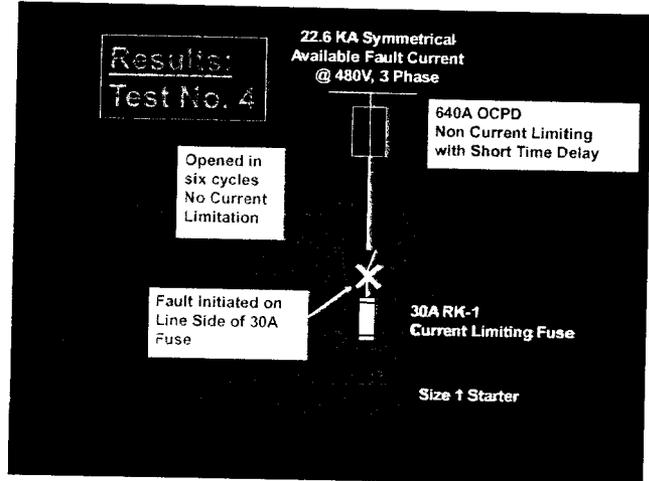
Short-circuit current ratings marked on equipment

2008

The prospective symmetrical fault current at a nominal voltage to which an lettered bus or system is able to be connected without sustaining damage exceeding defined acceptance criteria.

Fault Current

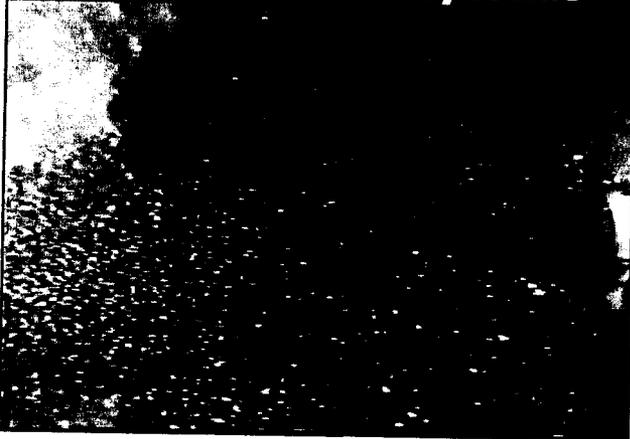
- Where does it come from?
- Contributions include
 - Utility, consult the utility
 - Motors, use locked rotor current
 - Generators, photovoltaics, and other “Co Generation equipment”.
- What reduces this energy?
 - Conductor Size (smaller)
 - Conductor Length (longer)
 - Transformers (impedance)
 - Reactors (impedance)
 - Anything that introduces additional resistance in the circuit.
 - The “quality” of the connection, intentional or not.



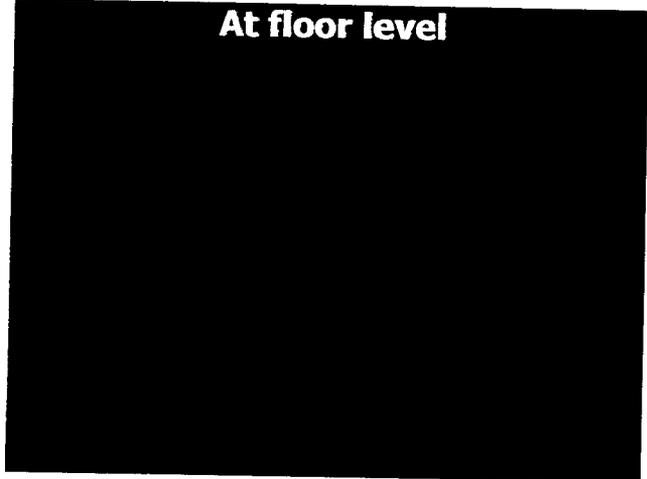
Properly Protected

Unprotected Normal Speed

Unprotected Frame by Frame



At floor level



Results: Test No.4

Sound

141.5 db @ 2 ft.

T2

225 C / 437 F

T3

50 C / 122 F



P1

2160 lbs/sq.ft

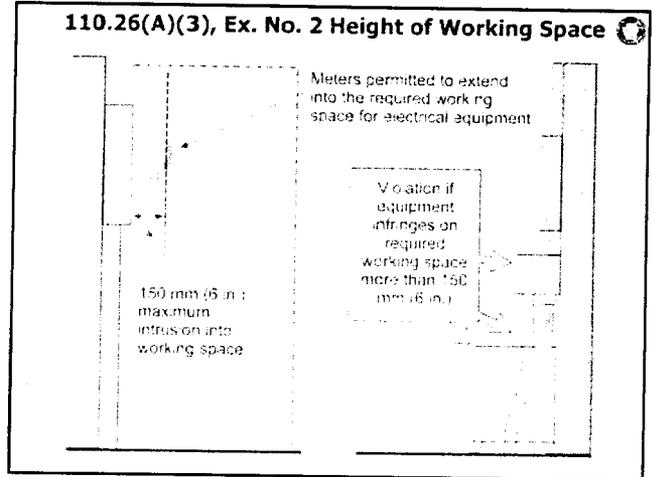
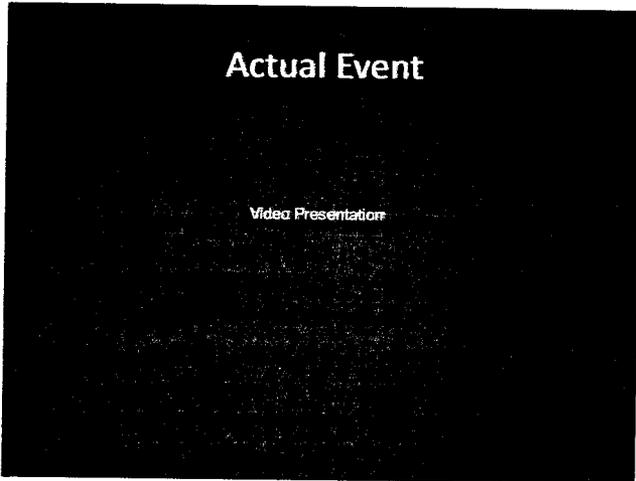
T1

225 C /
437 F

Indicates Meter Pegged

Arc Flash and Blast

- Arc Flash
 - The temperature of an electrical arc can reach 35,000 degrees.
 - Majority of electrical injuries are the result of the flash/blast. Not the shock.
 - More than 2000 people each year admitted to burn centers.
 - Arc flashes can kill at distances of 10 feet or more.
- Arc Blast
 - Copper expands 67,000 times from solid to vapor
 - Pressures can exceed thousands of pounds per square foot.
 - Speed of the explosion can exceed 700 miles an hour, this is roughly equal to TNT.
 - A 22KA fault at 480 volts that lasts for 10 cycles (1/6th of a second) will expend energy equivalent to approx .8 of a lb of TNT.
 - A 100KA fault at 480 volts lasting for 1/2 second measured at a distance of 4 feet is equivalent to over 4 1/2 lbs of TNT!



110.26(G) Locked Electrical Rooms or Enclosures

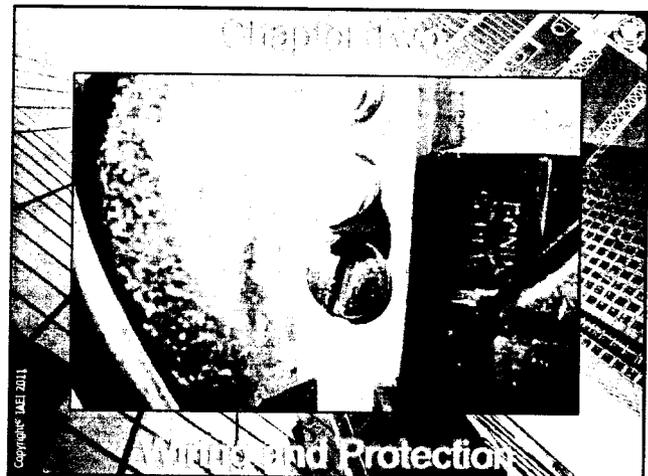
Locked Electrical Equipment Rooms or Enclosures.

Electrical equipment rooms or enclosures housing electrical apparatus that are controlled by a lock(s) shall be considered accessible to qualified persons.

QUALIFIED PERSONS ONLY

2008

The slide features a photograph of a locking device with the text "QUALIFIED PERSONS ONLY" below it. Below the text is a diagram of a large electrical room with a door that is locked. A vertical dimension line on the right side of the diagram indicates the height of the room. The year "2008" is printed in the bottom left corner.



200.2 General Use of Grounded Conductors

Various references to sections of the Code where a grounded conductor was not required was eliminated at 200.2.

Requirement to install a grounded conductor is adequately covered in other sections of the Code such as 250.24(C).

200.2(B) Continuity

The continuity of a grounded conductor shall not depend on a connection to a metallic enclosure, raceway, or cable armor.

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Violation

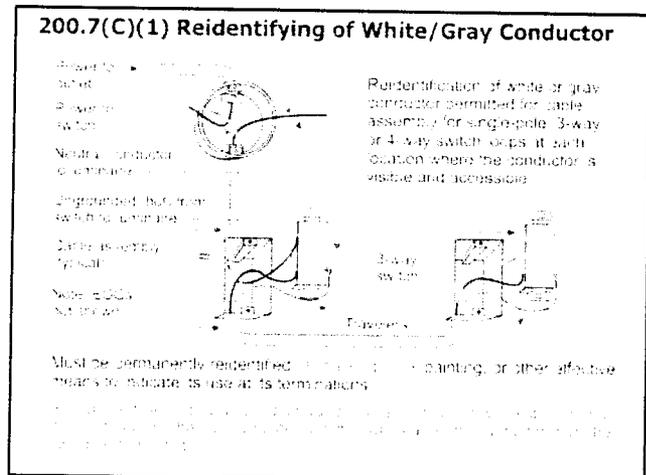
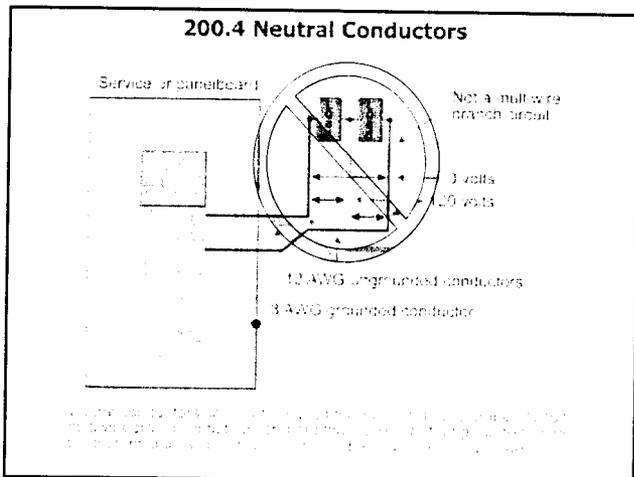
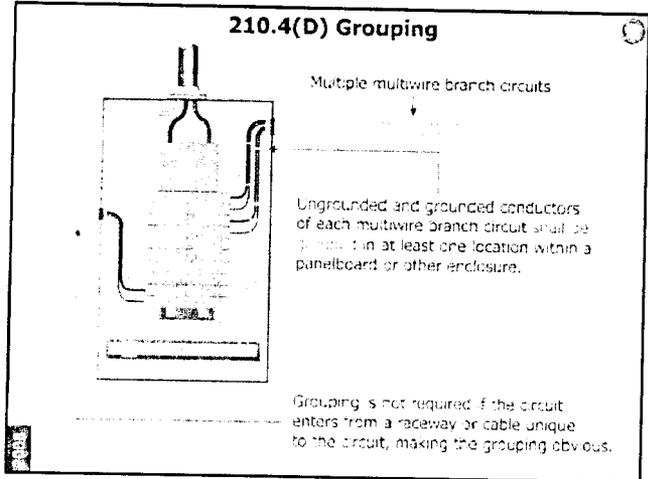
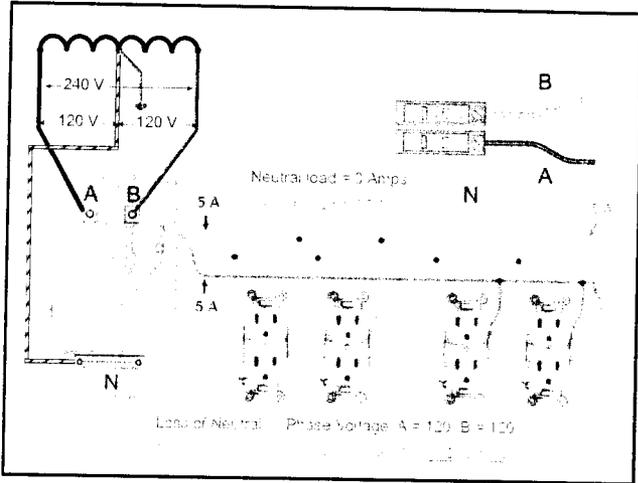
Main bonding jumper

210.4 Multiwire Branch Circuits

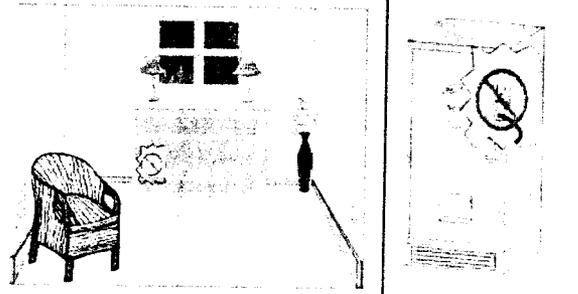
210.4 Multiwire branch circuits.

(A) General. All conductors of a multiwire branch circuit shall originate from the same panelboard or similar distribution equipment.

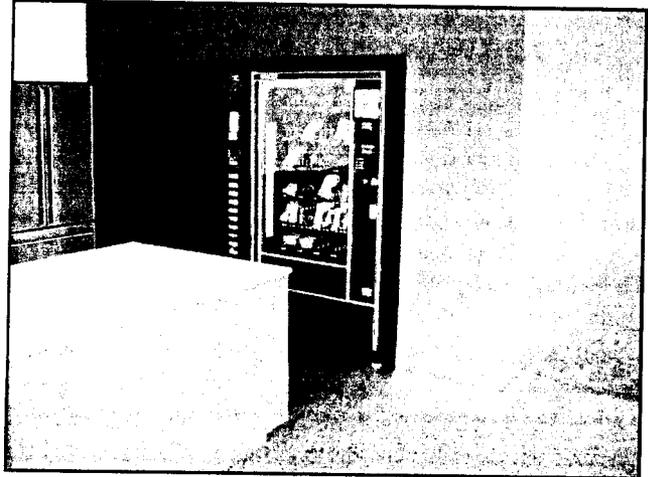
(B) Disconnecting means. Each subboard branch circuit shall have a disconnecting means installed at the point where the branch circuit originates.



210.8 Ground-Fault Circuit-Interrupters



- All GFCIs in basements that are required to protect a specific outlet.
- This includes 210.8(A)(1), (2), and (5).



210.5(C) Ungrounded Conductors

- Where a premises wiring system is supplied by more than one nominal voltage system, each branch circuit is required to be identified by phase and system.
- This identification shall be used at all termination, connection, and splice points.
- The means of identification is required to be permanently posted at each branch-circuit panelboard or similar branch-circuit distribution equipment.

2008

210.8(A)(2) & (A)(5) Exceptions No. 1 and 2 Deleted

All 125-volt, single-phase, 15- and 20-ampere receptacles in dwelling unit basements, including finished basements, are required to have ground-fault circuit-interrupter protection.

See exception to 210.8(A)(5) for a receptacle for fire alarm or burglar alarm system located in basements.



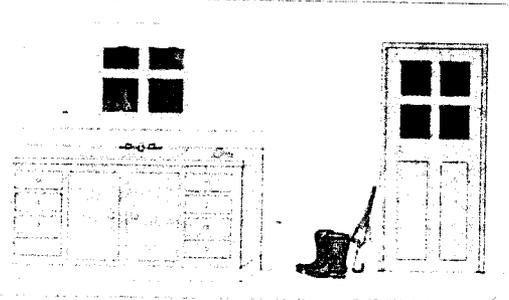
2008

210.8(A)(2) and (A)(5) Exceptions Deleted

- Dwelling unit GFCI Exceptions Nos. 1 and 2 to Section 210.8(A)(2) and (A)(5) have been deleted.
- Additional text added to 210.8(A)(5) indicates that any receptacles installed under the exception to 210.8(A)(5) shall not be considered as meeting the requirements of 210.52(G).
- Deleting the two exceptions creates consistency between the requirements in 210.8(A)(2) and 210.8(A)(7)
- The revision enhances the level of shock protection for persons where leakage levels in appliances could develop and present shock hazards.

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

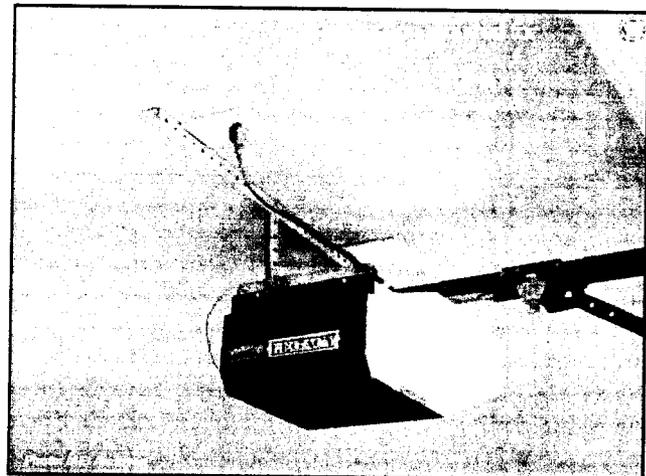


GFCI is now required for all 125-volt, single-phase, 15- and 20-ampere receptacles installed within 1.8 m (6 ft) of the outside edge of a dwelling unit sink, not just laundry utility or wet bar sinks.

GFCI requirements for kitchen sinks still covered by 210.8(A)(6)

210.8(B)(5), Ex. No. 2 to(5) GFCI - Sinks

- Receptacles located around sinks at a dentist's or doctor's office or clinic do require GFCI protection
 - (B) Other Than Dwelling Units – All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in (1) through (8) shall have ground-fault circuit-interrupter protection for personnel.
 - (5) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink
 - Exception No 2 to (5): For receptacles located in patient bed locations of general care or critical care areas of health care facilities other than those covered under 210.8(B)(1) (Bathrooms), GFCI protection shall not be required



210.8(B)(6) GFCI - Indoor Wet Locations

GFCI protection required for all 125-volt, 15- and 20-ampere receptacles installed at non-dwelling unit indoor wet locations.

**210.8(B) Other Than Dwelling Units**

- All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in (1) through (5) shall have ground-fault circuit-interrupter protection for personnel.

- (1) Bathrooms
- (2) Kitchens
- (3) Rooftops
- (4) Outdoors

See *Code* text for exceptions.

210.8(B)(4) Other Than Dwelling Units

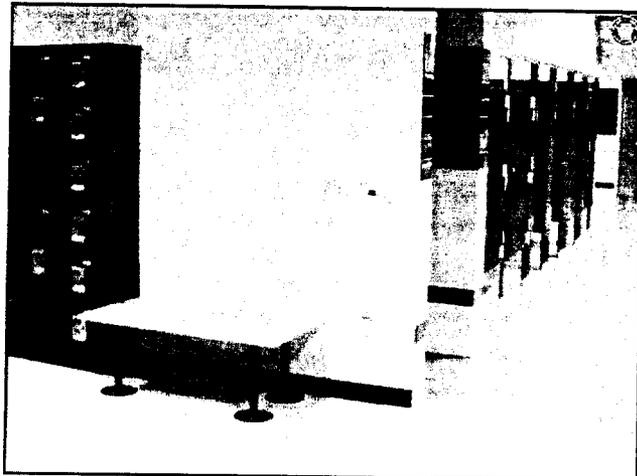
- GFCI protection is required on all 15- and 20-ampere outdoor receptacles installed in the locations specified in (1) through (5).
- Exception No. 2 to (4) applies to industrial establishments only, where conditions of maintenance and supervision ensure that only qualified persons are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or having a design that is not compatible with GFCI protection.

210.8(B)(5) Sinks

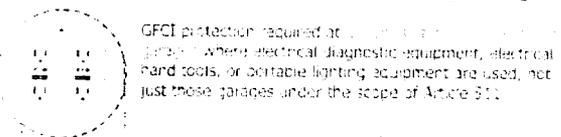
- Other than Dwelling Units
- Receptacles installed within 1.8 m (6 ft) of the outside edge of a sink are required to be protected by ground-fault circuit-interrupter protection.
- Exception No. 2 to (5): For receptacles located in patient care areas of health care facilities other than those covered under 210.8(B)(1), GFCI protection shall not be required.

210.8(B)(7) GFCI - Locker Rooms

- Receptacles installed in locker rooms now require GFCI protection
 - (B) Other Than Dwelling Units. All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in (1) through (8) shall have ground-fault circuit-interrupter protection for personnel.
 - (7) Locker rooms with associated showering facilities



210.8(B)(8) GFCI Required: Non-Dwelling Garages



GFCI protection required at all receptacles in garages where electrical diagnostic equipment, electrical hand tools, or portable lighting equipment are used, not just those garages under the scope of Article 511.

125-volt, 15- and 20-ampere receptacles required to be GFCI-protected

210.12(B) Dwelling Units

- Dwelling Units. All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, or similar rooms or areas shall be protected by a listed arc-fault circuit interrupter, combination-type, installed to provide protection of the branch circuit.

210.12(B) Dwelling Units

Receptacle or other outlet

Single circuit type

Receptacle or other outlet

Multewire branch circuit type

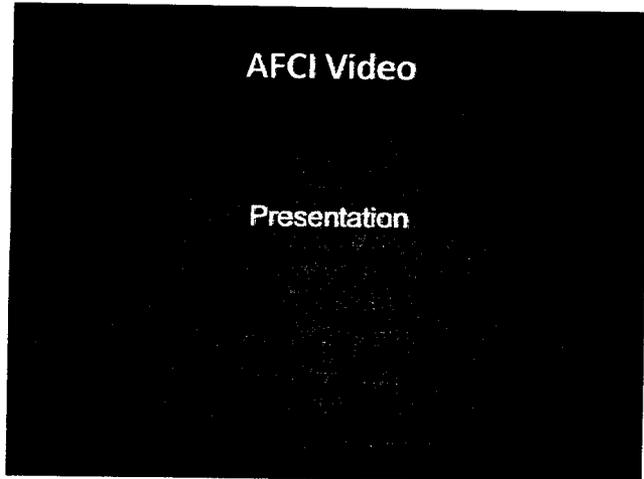
Neutral terminal bar in panelboard

Neutral terminal bar in panelboard

AFCI protection required for 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sun rooms, recreation rooms, closets, hallways, or similar rooms or areas.

A listed arc-fault circuit interrupter, combination-type, shall be installed to provide protection of the branch circuit.

2008



210.12(B) Exception No. 1

AFCI protection required to be a combination type January 1, 2008

Branch circuit panelboard

AFCI outlet devices

No length limitation

Device-type AFCI protection is permitted at first outlet where the branch circuit is installed using RMC, IMC, EMT, Type MC cables meeting the requirements in 250.118 and using metal conduit and outlet boxes.

Combination-type listed AFCI device is required to be installed at the first outlet to provide protection for the remaining portion of the branch circuit.

2008

210.12(A) Ex. No. 1 Outlet Type AFCI

Main rule at 210.12(A) requires AFCI combination-type protection installed to provide protection of the entire branch circuit.

Branch-circuit panelboard

No length limitation

AFCI outlet device installed at first outlet

Ex. No. 1: If RMC, IMC, EMT, Type MC or steel armored Type AC cables meeting the requirements of 250.118 and metal outlet and junction boxes are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a combination-type listed Type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

210.12(B) and 406.4(D)(4) Arc-Fault Circuit-Interrupter Protection

Listed Outlet Branch-Circuit Type AFCI Device

Courtesy of Pass & Seymour Company

210.12(B) AFCI - Extensions or Modifications

Existing branch circuit No. 1
(No extension or modification)

New outlet added (extended) from branch circuit No. 2

Listed outlet branch-circuit AFCI at the first receptacle outlet of extended branch circuit No. 2

In a dwelling unit, where a branch circuit is extended from an existing branch circuit, the branch circuit shall be protected by a listed outlet branch-circuit AFCI at the first receptacle outlet of the extended branch circuit.

210.52 Dwelling Unit Receptacle Outlets

Entire duplex receptacle switched

Does not meet the requirement for required receptacle outlet

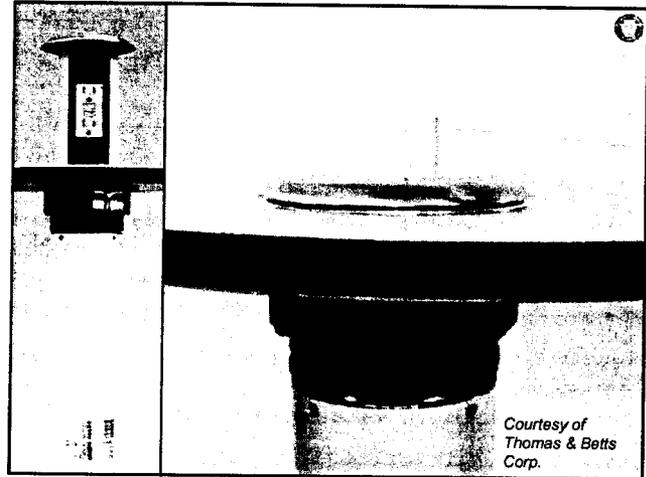
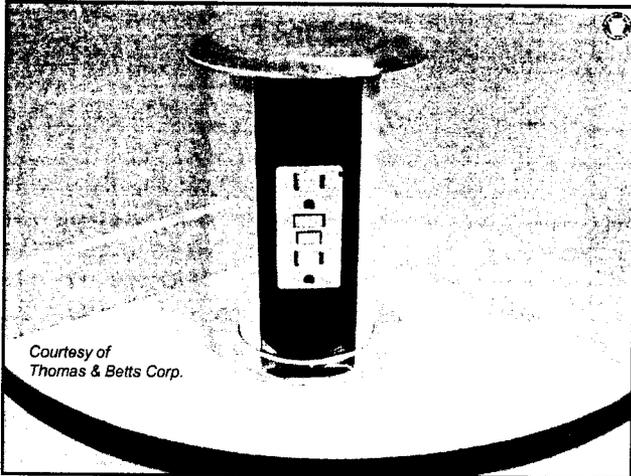
Switched receptacle [210.70(A)(1) Exc. No. 1]

Unswitched receptacle [210.52]

Switched receptacles do not count as receptacle outlets required by 210.52

210.52(C)(5) and 210.52(D)

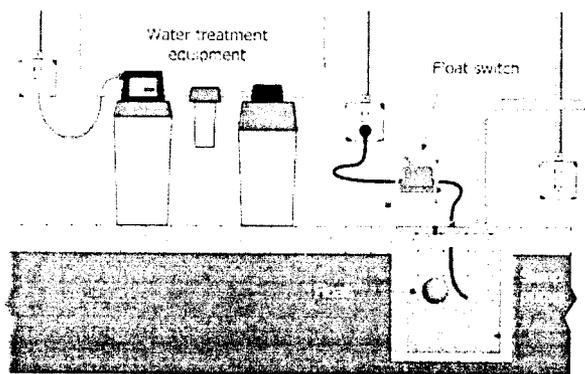
- **Dwelling Unit Receptacle Outlet Locations:**
 - Listed receptacle outlet assemblies are now permitted to be installed on or in kitchen and bathroom countertops to serve as the required countertop receptacles
 - Receptacle outlets must be located on, or above the countertop
 - Applies to countertops in bathrooms, kitchens, pantries, breakfast rooms, dining rooms, and similar areas of dwelling units
 - Receptacles shall not be installed in a face-up position in countertops or similar work surfaces [406.5(E)]



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

- Balconies, decks, and porches that are accessible from inside the dwelling unit required to have at least one receptacle outlet installed within the perimeter of the balcony, deck, or porch (regardless of size)
- Receptacle not be located more than 2.0 m (6½ ft) above the balcony, deck, or porch surface
- Exception for balconies, decks, or porches with a usable area of less than 1.86 m² (20 ft²) has been deleted

210.52(G) Basements and Garages



At least one receptacle outlet shall be installed in basements to supply the water treatment equipment.

210.52(G) Accessory Buildings with Power

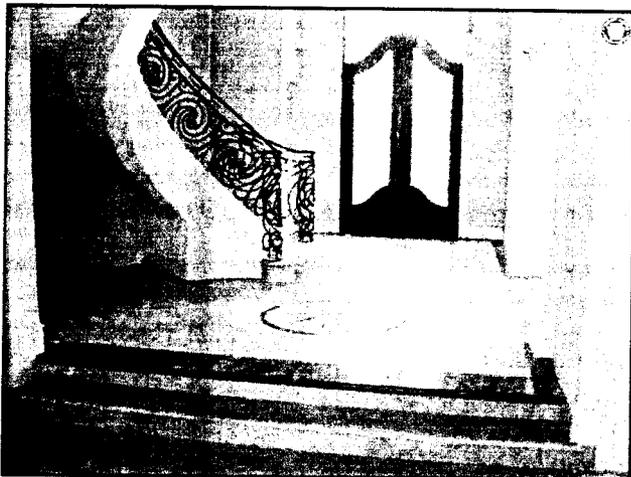
At least one receptacle outlet required

210.52(G) - Basements, Garages, and Accessory Buildings

At least one 125-volt, 15- or 20-ampere receptacle outlet, in addition to those for specific equipment, shall be installed in each basement, in each attached garage, and in each detached garage or accessory building with electric power

210.52(I) Foyers

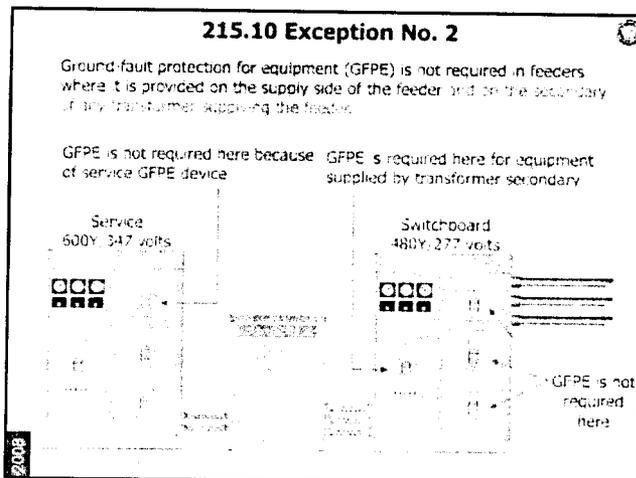
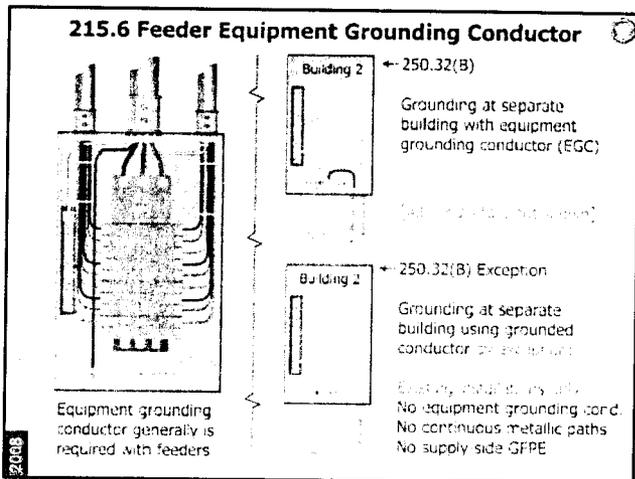
At least one receptacle outlet shall be installed in a hallway serving an area that is greater than 3.7 m (12 ft) long and is required to have a receptacle outlet at the end of the hallway that is 1.8 m (6 ft) or more in width



210.60(A) Guest Rooms, Guest Suites, Dormitories, and Similar Occupancies

- Guest rooms or guest suites in hotels, motels, sleeping rooms in dormitories, and similar occupancies shall have receptacle outlets installed in accordance with 210.52(A) and 210.52(D).
- Guest rooms or guest suites provided with permanent provisions for cooking shall have receptacle outlets installed in accordance with all of the applicable rules in 210.52.

2008



225 Outside Branch Circuits and Feeders

Article 225 may be better entitled: Second Buildings or Structures.

225 Outside Branch Circuits and Feeders

Article 225 may be better entitled: Second Buildings or Structures.

- Applies to any conductor installed between any two structures, two buildings, or a structure and a building.
- Structure and Building as defined by the NEC:
 - Structure. That which is built or constructed.
 - Building. A structure that stands alone or that is cut off from adjoining structures by fire walls with all openings therein protected by approved fire doors.

225 Scope

225.1 Scope. This article covers requirements for outside branch circuits and feeders run on or between buildings, structures, or poles on the premises; and electrical equipment and wiring for the supply of utilization equipment that is located on or attached to the outside of buildings, structures, or poles.

225.18 Clearance of Overhead Conductors

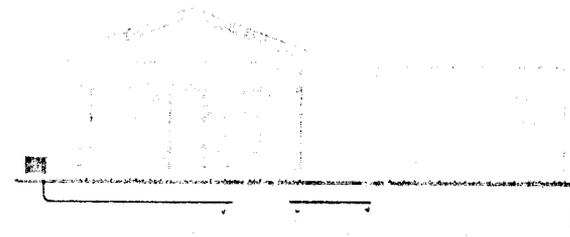
- Overhead spans of open conductors and open multiconductor cables (not over 600 volts) shall have a clearance of not less than the following:
 - 3.0 m (10 ft) - above finished grade, sidewalks, etc. (not to exceed 150 volts)
 - 3.7 m (12 ft) - over residential property and driveways, and commercial areas not subject to truck traffic (not exceed 300 volts)
 - 4.5 m (15 ft) - areas listed in 3.7-m (12 ft) classification (voltage exceeds 300 volts to ground)
 - 5.5 m (18 ft) - over public streets, alleys, roads, etc.
 - 7.5 m (24.5 ft) - over track rails of railroads

225.22 Exception (deleted)

- Flexible metal conduit is no longer permitted to be used in wet locations.

225.27 Raceway Seal

- A raceway seal is required at outside underground raceways entering a building
- Conduits or raceways required to be sealed or plugged at either or both ends

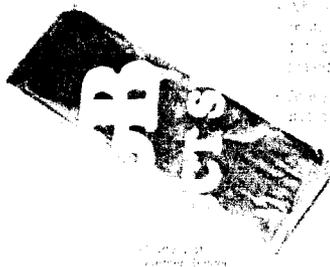


Raceway seal required by 220.8

Raceway seal required by 225.27

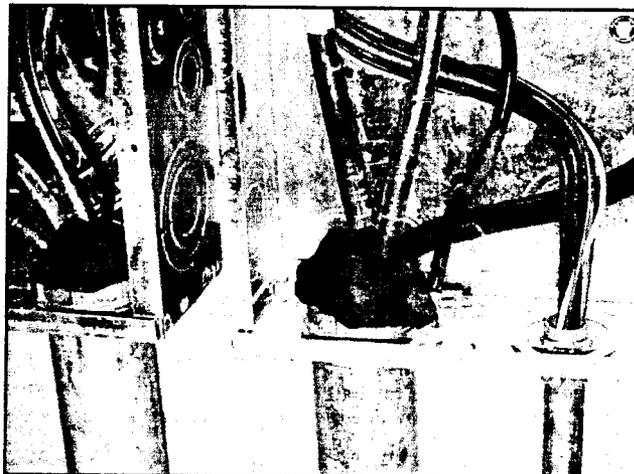
225.27 Raceway Seal

A raceway seal is required at outside underground branch circuit and feeder raceways entering a building.



225.27(A) Raceway seals shall be installed at the entrance of raceways to buildings, and shall be listed for the purpose and shall be installed in accordance with the manufacturer's instructions.

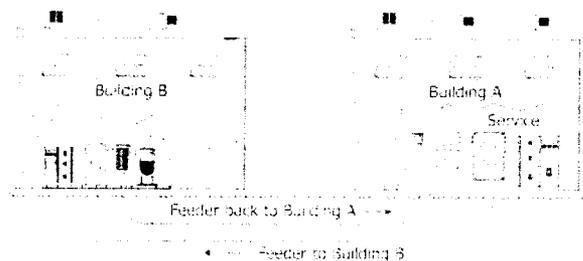
225.27(B) Raceway seals shall be installed at the entrance of raceways to buildings, and shall be listed for the purpose and shall be installed in accordance with the manufacturer's instructions.



225.30 Number of Supplies

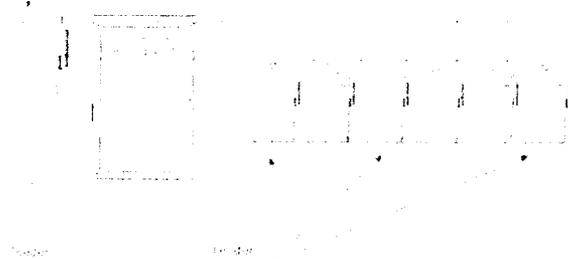
Where more than one building (same property, under single management) exist, each additional building shall be supplied by only one feeder or branch circuit.

225.30(A) Where more than one building (same property, under single management) exist, each additional building shall be supplied by only one feeder or branch circuit. (See 225.35(A) through (E) for additional provisions.)

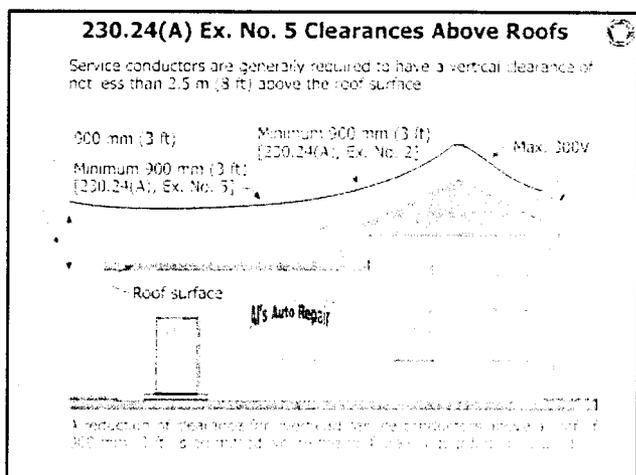
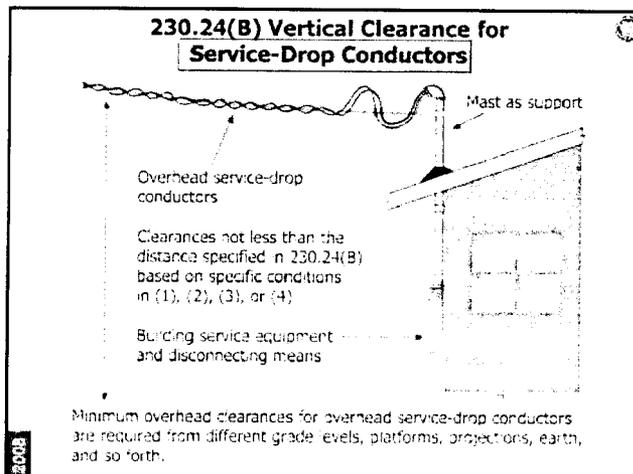
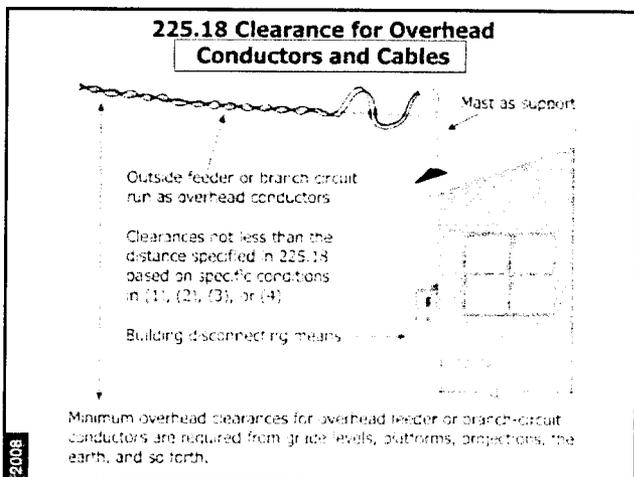


225.39 Rating of Disconnect

The feeder disconnect is required to be rated at not less than the full load to be carried, determined in accordance with Parts I and II of Article 320 for branch circuits, Parts III or IV for feeders, or Part V for farm loads.



225.39(A) The feeder disconnect is required to be rated at not less than the full load to be carried, determined in accordance with Parts I and II of Article 320 for branch circuits, Parts III or IV for feeders, or Part V for farm loads.



- ### 230.24(A) Ex. No. 5 Clearance Above Roofs
- Service conductors generally required to have a vertical clearance not less than 2.5 m (8 ft) above roof surface
 - **Exception No. 5:** Where the voltage between conductors does not exceed 300 and the roof area is guarded or isolated, a reduction in clearance to 900 mm (3 ft) shall be permitted
 - **Guarded** — Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach or contact by persons or objects to a point of danger.
 - **Isolated (as applied to location)** — Not readily accessible to persons unless special means for access are used.

230.42(A)(1) Ex. Size and Rating of Service

- The ampacity of service-entrance conductors (before any adjustment or correction factors) shall not be less than either of the following:
 - The sum of the noncontinuous loads plus 125 percent of continuous loads
 - The sum of the noncontinuous load plus the continuous load if terminated in an overcurrent device (where both overcurrent device and assembly are listed for operation at 100 percent of their rating)
- *Exception: Grounded conductors not connected to an overcurrent device permitted to be sized at 100 percent of the continuous and noncontinuous load*

230.53 Raceways Arranged to Drain

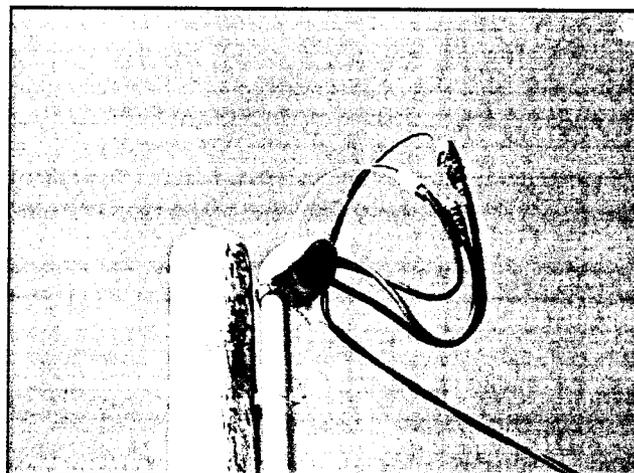
Raceways not required to be raintight, but shall be suitable for wet locations



When exposed to the weather, raceways enclosing service-entrance conductors shall be listed for wet locations and arranged to drain.

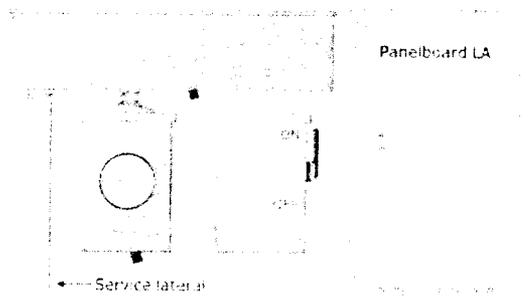
230.54 Overhead Service Locations

- (A) **Service Head.** Service raceways shall be equipped with a service head at the point of connection to service-drop conductors. The service head shall comply with the requirements for fittings in 314.15. (Shall be listed for a wet location)
- (B) **Service Cable Equipped with Service Head or Gooseneck.** Service cables shall be equipped with a service head. The service head shall comply with the requirements for fittings in 314.15. (Shall be listed for a wet location)
- Service heads are required to be listed.



230.79 Rating of Service Disconnect

The service disconnect is required to be rated at not less than the calculated load to be carried, determined in accordance with Part III, IX, or V of Article 220.



2008

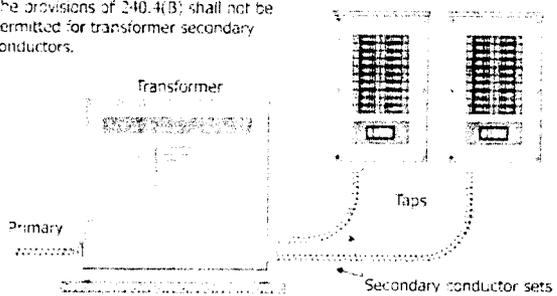
240.15(B) Circuit Breakers as OCP

- Circuit breakers must open all ungrounded conductors of the circuit unless otherwise permitted by the following:
 - Individual single-pole circuit breakers (with identified handle ties) of multiwire branch circuits permitted as OCP serving only single-phase line-to-neutral loads
 - In grounded systems, individual single-pole circuit breakers rated 120/240 volts ac (identified handle ties) permitted as OCP for line-to-line connected loads for single-phase circuits

240.21(C) Transformer Secondary Conductors

Each set of conductors feeding a separate load, or each set of conductors feeding separate loads are required to meet the requirements specified in 240.21(C)(1) through (6).

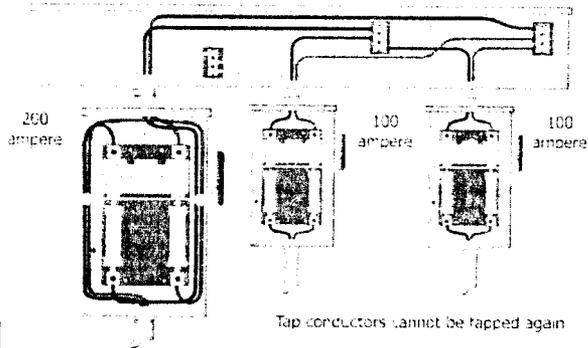
The provisions of 240.4(B) shall not be permitted for transformer secondary conductors.



2008

240.21 Location in Circuit

Conductors supplied under the provisions of 240.21(A) through (H) shall not be permitted to supply another conductor except through an overcurrent protective device in accordance with 240.4.



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240.21(C)(2)(4) Transformer Secondary Conductors

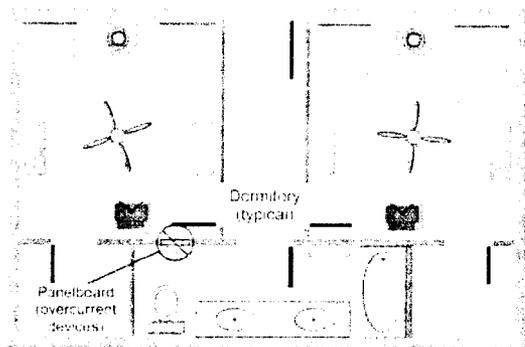
- For field installations where the secondary conductors leave the enclosure or vault in which the supply connection is made, the rating of the overcurrent device protecting the primary of the transformer, multiplied by the primary to secondary transformer voltage ratio, shall not exceed 10 times the ampacity of the secondary conductor.
- This requirement clearly applies to transformer secondary conductors that leave an enclosure or transformer vault.

2008

240.24(B) Occupancy

- The two exceptions have been rewritten into positive text and the section has been arranged to provide a more logical layout for improved clarity and application of the overcurrent device accessibility requirements.
- When electric service is provided by and continuously supervised by building management personnel, the branch-circuit overcurrent devices supplying guest rooms or guest suites without permanent provisions for cooking shall be permitted to be accessible to only authorized management personnel.

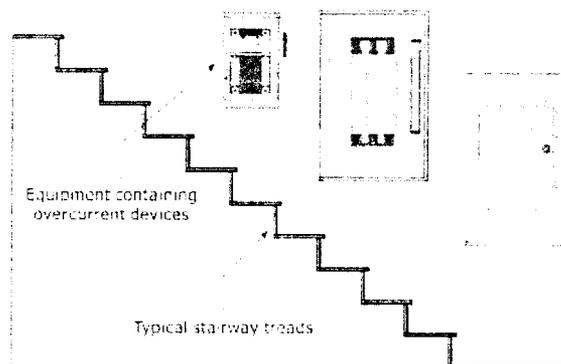
2008

240.24(E) Overcurrent Devices-Not in Bathrooms

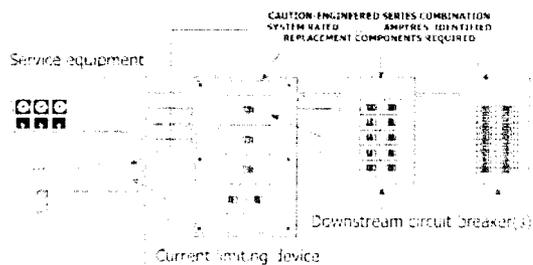
In dwelling units, room suites, and guest rooms or guest suites, overcurrent devices, other than supplementary overcurrent protection, shall not be located in bathrooms.

240.24(F) Not Located Over Steps

Overcurrent protective devices shall not be located over steps or a stairway.



2008

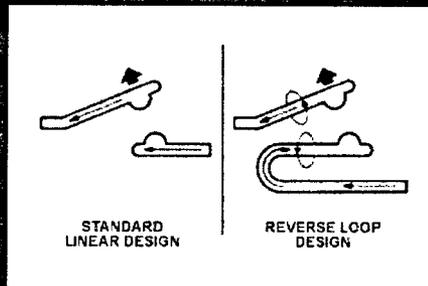
240.86(A) Selected Under Engineering Supervision

For calculated applications, the downstream circuit breaker(s) that are part of the series combination remain passive during the interruption period of the line side fully rated current-limiting device.

Note that Section 240.86(A) applies to the following conditions:

Why are there series rated systems?

Linear and Reverse Loop Contacts

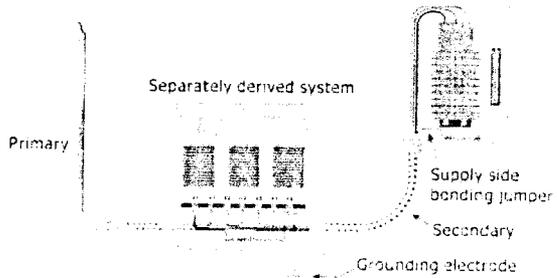
**240.91 Protection of Conductors - Supervised Industrial Installations**

- New provisions were added for limited “round up” conductor protection with overcurrent devices
 - rated over 800 amperes
 - in supervised industrial installations

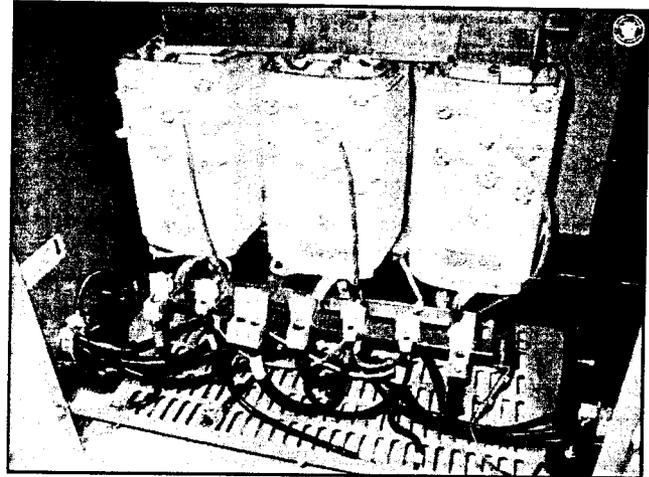
250.2 Definition: Supply Side Bonding Jumper

- New definition for “Supply Side Bonding Jumper” was added to 250.2
- SSBJ also introduced at 250.30(A)(2) for grounding of separately derived AC systems
- In the previous edition of the Code, the term “equipment bonding jumper” was used
- New definition of SSBJ necessary to ensure the proper identification and installation of bonding conductors installed within or on the supply side of service equipment and between the source of a separately derived system and the first disconnecting means
- Equipment bonding jumpers are installed on the load side of the overcurrent device

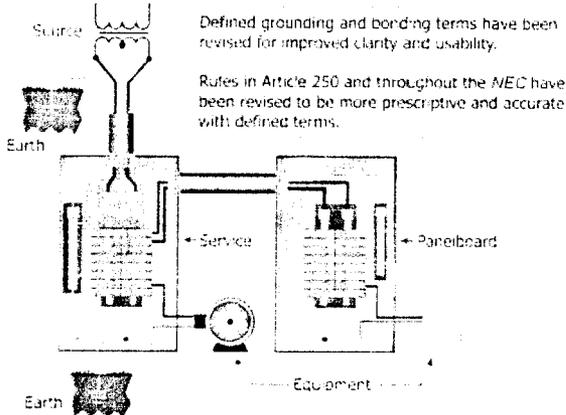
250.2 Definition: Supply Side Bonding Jumper



Bonding Jumper, Supply Side - A conductor installed on the secondary of a separately derived system connecting the secondary to a grounding electrode. A bonding jumper shall always be installed between the secondary and the grounding electrode on the secondary side of the transformer.

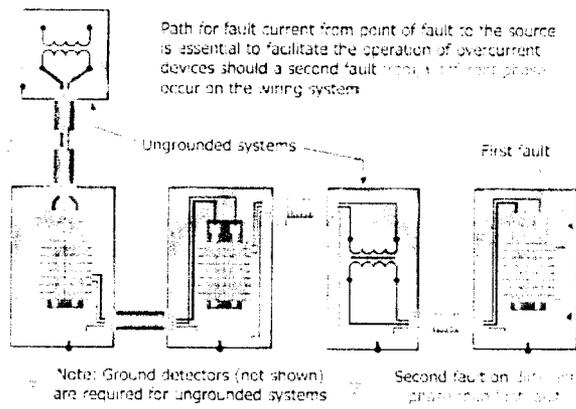


Article 250 and Code-Wide Revisions



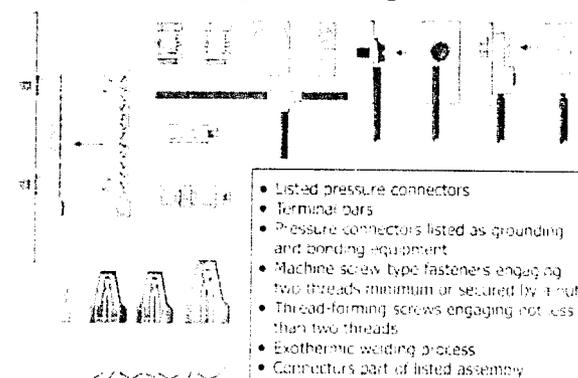
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250.4(B)(4) Path for Fault Current



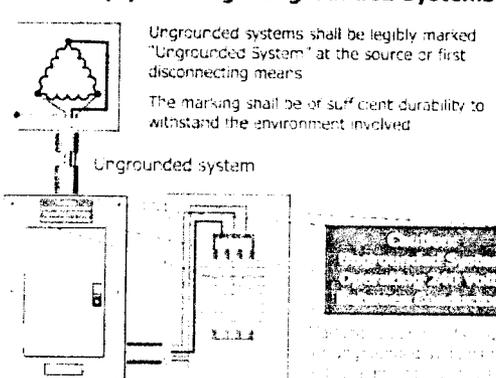
2008

250.8 Grounding and Bonding Connections



- Listed pressure connectors
- Terminal bars
- Pressure connectors listed as grounding and bonding equipment
- Machine screw type fasteners engaging two threads minimum or secured by a nut
- Thread-forming screws engaging not less than two threads
- Exothermic welding process
- Conductor's part of listed assembly
- Other listed means

250.21(C) Marking - Ungrounded Systems



Ungrounded systems shall be legibly marked "Ungrounded System" at the source or first disconnecting means.

The marking shall be of sufficient durability to withstand the environment involved.

250.24(C) Grounded Conductor Brought to Service

- Rules for routing the grounded conductor at service equipment have been revised for clarity
- Requirements on routing the grounded conductor with ungrounded conductors were moved to 250.24(C) from item (1) to clearly indicate that this routing rule applies to single or parallel raceways
- Separate sub-sections have been created for applications installed in a single raceway and conductors installed in parallel in separate raceways
- Rules for sizing grounded conductor of 3-phase systems have been located in a new item (3)

250.24(C) Grounded Conductor Brought to Service



Grounded service conductor must be:

- Routed with phase conductors
- Run to each service disconnecting means
- Connected to the grounded conductor terminal and bonded to service disconnecting means enclosure through the main bonding jumper
- Sized no smaller than grounding electrode conductor
- Sized at least 12% percent of area of conductors where larger than given in Table 250.66
- Based on equivalent area of ungrounded parallel service entrance conductors
- Installed in raceway where service is installed in parallel in separate raceways
- Run in parallel with ungrounded service conductors in raceway
- Sized in accordance with minimum requirements of 250.67

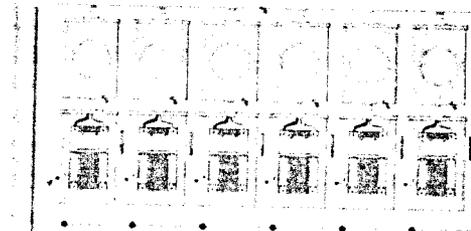
250.28(D) MBJ Size

- This section has been revised and expanded to cover sizing requirements for wire-type main bonding jumpers and system bonding jumpers where installed in more than a single enclosure.
- 250.28(D)(2) Main bonding jumper sizes are based on the largest ungrounded service conductor in each enclosure.
- 250.28(D)(3) System bonding jumper sizes are based on the largest ungrounded derived phase conductor in each individual enclosure.

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250.28(D)(2) Main Bonding Jumper Size

Service with more than a single enclosure as permitted in 230.71(A)



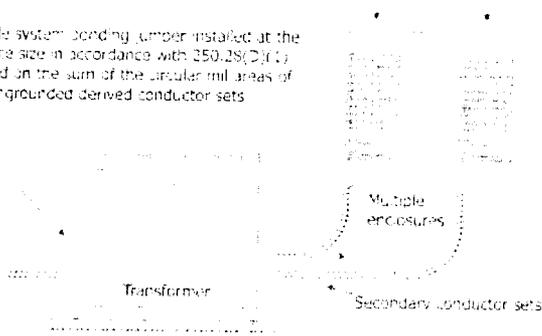
The main bonding jumper shall be sized in accordance with 250.28(D)(2) based on the largest ungrounded service conductor in any enclosure.

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250.28(D)(3) System Bonding Jumper Size

System bonding jumpers in each enclosure shall be sized in accordance with 250.28(D)(3) based on the largest ungrounded feeder conductor serving that enclosure.

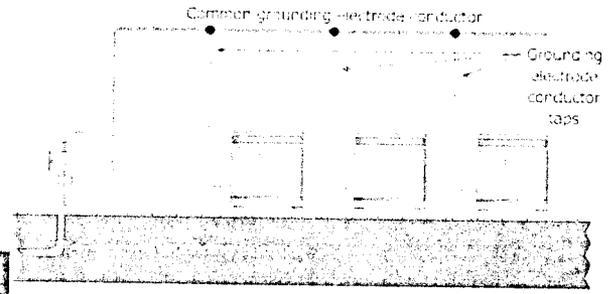
Single system bonding jumper installed at the source size in accordance with 250.28(D)(3) based on the sum of the circular mil areas of all ungrounded derived conductor sets.



2008

250.30(A)(4) Multiple Separately Derived Systems

- Common grounding electrode conductor is required to be sized at minimum 3/8 copper or 250 aluminum.
- The common grounding electrode conductor shall be connected to the grounding electrode conductor of each separately derived system.



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250.32(B) Exception

250.32(B):

- Grounding at separate building or structure using the equipment grounding conductor

250.32(B) Exception:

- Grounding at separate building or structure using the grounded circuit conductor, provided the following conditions are met:
 - No equipment grounding conductor
 - No continuous metal paths
 - No supply-side GPE

250.30 Grounding Separately Derived AC Systems

250.30 Grounding Separately Derived Alternating-Current Systems

(A) Grounded Systems

- (1) System Bonding Jumper
- (2) Grounding Electrode
- (3) Grounded Conductor [see 250.20(A)(3)]
- (4) Grounding Electrode [see 250.20(A)(4)]
- (5) GEC, Single Separately Derived System [see 250.20(A)(5)]
- (6) GEC, Multiple Separately Derived System [see 250.20(A)(6)]
- (7) Installation [see 250.20(A)(7)]
- (8) Bonding [see 250.20(A)(8)]

(B) Ungrounded Systems

- (1) Grounding Electrode Conductor
- (2) Grounding Electrode
- (3) Bonding [see 250.20(A)(8)]

Reorganization and additions to the requirements for grounding of separately derived systems has been employed for usability and clarity.

250.30(C) Outdoor Sources

Installation to comply with 250.30(A) (grounded systems) or with 250.30(B) (ungrounded systems)

Grounding electrode connection must be made at the source location to one or more grounding electrodes in compliance with 250.30

NOTE: It is not permitted to run the grounding electrode conductor in the same raceway as feeders or branch circuits.

250.108

250.32(B) Grounding Separate Buildings

250.32(B)(1)
 Grounding at separate building or structure using the required EGC EGC in accordance with 250.113

250.32(B)(1) Exception
 Grounding at separate building using grounded conductor as follows:
 Equipment bonding jumper (line side), No EGC, No continuous metallic paths, No supply-side GFPE

250.32(B)(2)
 Grounding at separate building using grounded conductor as follows:
 Equipment bonding jumper (load side), No EGC, No continuous metallic paths, No supply-side GFPE

250.35 Permanently Installed Generators

Equipment bonding jumper (line side): size using 250.102(C)

Equipment grounding conductor (load side): size using 250.102(D)

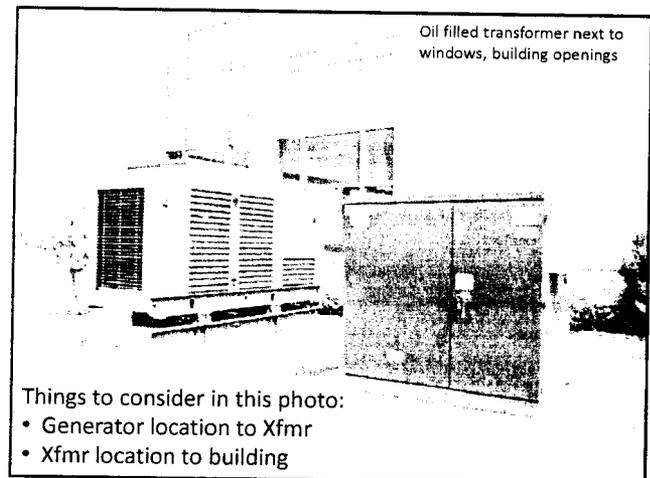
Generator separately derived systems shall be grounded in accordance with the requirements in 250.36(A).

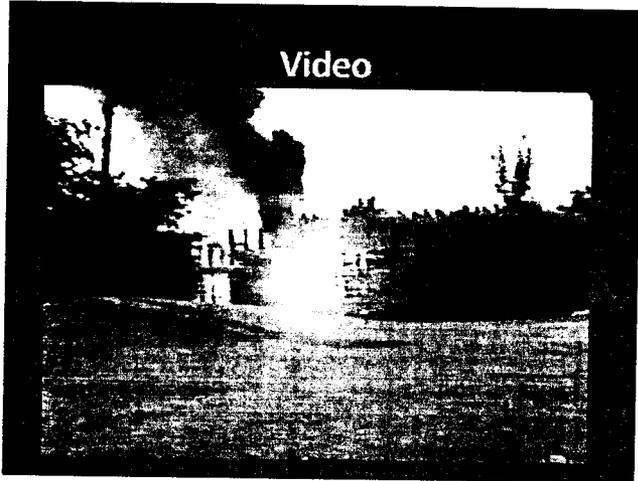
250.35 Permanently Installed Generators

Equipment bonding jumper (line side): size using 250.102(C)

Equipment grounding conductor (load side): size using 250.102(D)

Generator sources that are not grounded as separately derived systems





250.52(A)(2) Metal Frame of Building or Structure

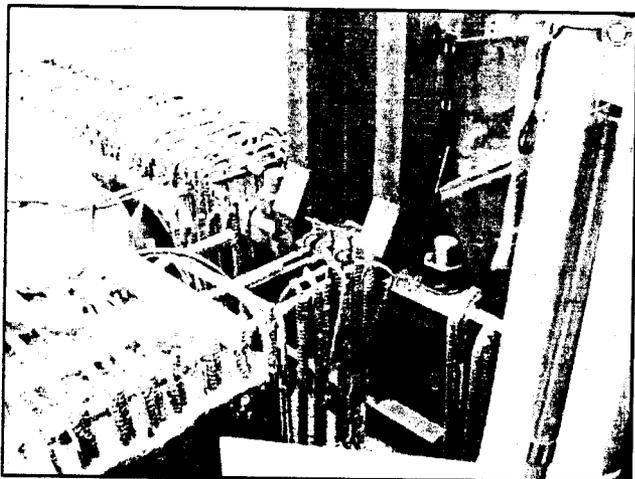
The metal frame of the building permitted as grounding electrode where connected to the earth by one or more of the following methods:

- (1) A vertical structural metal member that is in direct contact with the earth for 3.0 m (10 ft) or more, with or without concrete encasement
- (2) The metal frame of the building with the exception of the metal frame of a building that is not in direct contact with the earth

3.0 m (10 ft) or more

Metal frame of a building

Hold-down bolts connected by welding, exothermic welding, usual steel tie wires, or other approved means



250.52(A)(3) Concrete-Encased Electrode

Encased by at least 50 mm (2 in.) of concrete, and in direct contact with the earth and within the portion of a concrete footing or foundation in direct contact with the earth.

Example 1

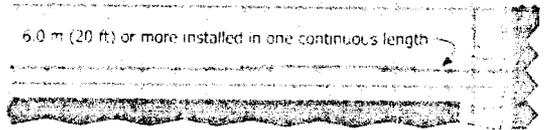
Example 2

250.52(A)(3) Concrete-Encased Electrode

Concrete-encased electrode to consist of:

- At least 6.0 m (20 ft) of either one or more electrically conductive coated steel reinforcing bars or rods of not less than 13 mm (1/2 in.) in diameter,
- Installed in one continuous 6.0 m (20 ft) length, or multiple pieces joined together by the usual steel tie wires, electrothermic welding, etc.,
- To provide a 6.0 m (20 ft) or greater length of bare copper conductor not smaller than 4 AWG
- Metallic components to be encased by at least 50 mm (2 in.) of concrete
- Located horizontally within that portion of a concrete foundation or footing in direct contact with the earth or with a vertical wall if a metallic component is in direct contact with the earth

6.0 m (20 ft) or more installed in one continuous length



Requirement for a horizontal electrode to qualify as a primary electrode may not be applied for a primary electrode.

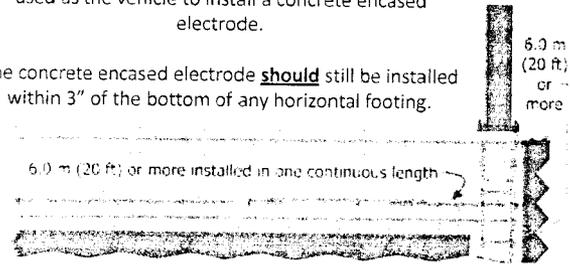
250.52(A)(3) Concrete-Encased Electrode

The requirement for a concrete encased electrode to be within 3" of the bottom of a footing have been removed.

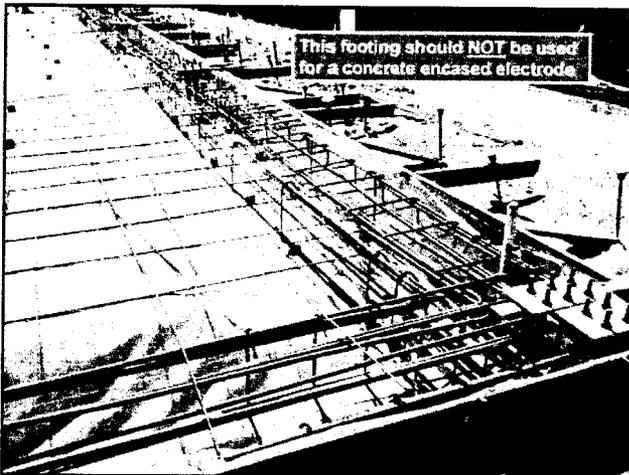
This was done not to allow the UFER to be placed anywhere in the concrete but to allow a caisson to be used as the vehicle to install a concrete encased electrode.

The concrete encased electrode should still be installed within 3" of the bottom of any horizontal footing.

6.0 m (20 ft) or more installed in one continuous length



NOTE: Grounding electrodes should be installed below the frost line. Electrodes become ineffective in frozen soil.



250.53(A) Rod, Pipe, and Plate Electrodes

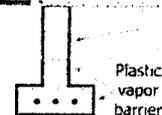
A single rod, pipe or plate electrode shall be supplemented by an additional electrode as specified in 250.53(A)(2) through 250.53(A)(5).

The supplemental electrode permitted to be bonded to one of the following:

- (1) The grounded service entrance conductor
- (2) The grounding electrode conductor
- (3) The grounded service-entrance conductor
- (4) The nonflexible grounded service raceway
- (5) Any grounded service enclosure



Not less than 1.8 m (6 ft) apart



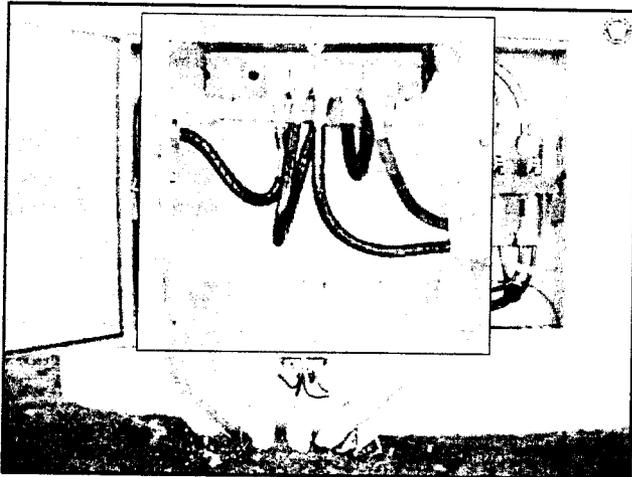
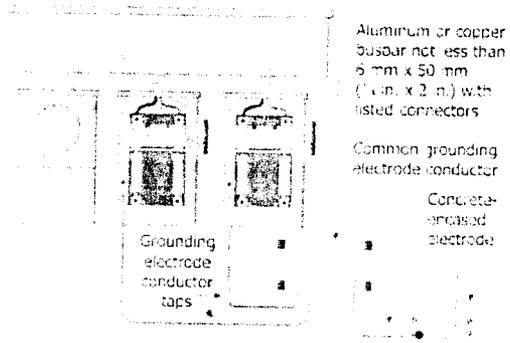
Exception: If a single rod, pipe, or plate grounding electrode has a resistance to earth of 25 ohms or less, the supplemental electrode shall not be required.

250.64(B) Securing and Protection - GECs

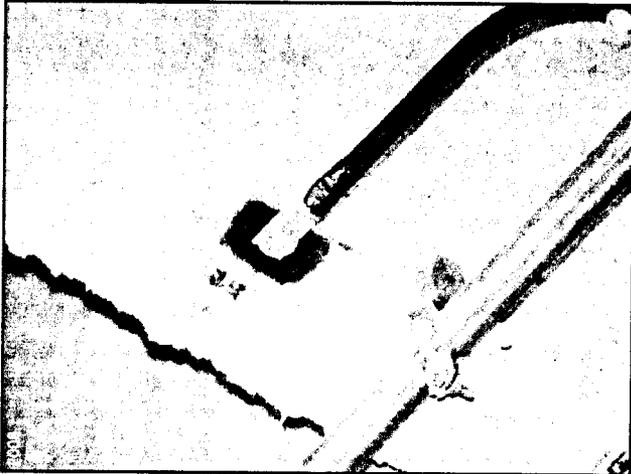
- Where exposed, a grounding electrode conductor (GEC) or its enclosure shall be securely fastened to the surface on which it is carried
- GECs shall be permitted to be installed on or through framing members
- 4 AWG or larger copper or aluminum GEC must be protected if exposed to physical damage
- 6 AWG GEC free from exposure to physical damage permitted to be run along the surface of a building without metal covering or protection (if securely fastened to the construction)
- See 250.64(B) for list of acceptable wiring methods to provide physical protection

250.64(D)(1) GEC Installation - Multiple Disconnects

If service consists of more than one enclosure, a common grounding electrode conductor and associated tap conductors are permitted to be connected at an approved panel.

**250.68 Exception No. 2**

- **Exception No. 2:** Exothermic or irreversible compression connections used at terminations, together with the mechanical means used to attach such terminations to fireproofed structural metal whether or not the mechanical means is reversible, shall not be required to be accessible.



250.68(C) GEC and Bonding Jumpers Connections

New item added at 250.68 (connections to grounding electrodes) to address connection locations for GECs and bonding jumpers that can be used to extend or interconnect the connector(s) to grounding electrode(s)

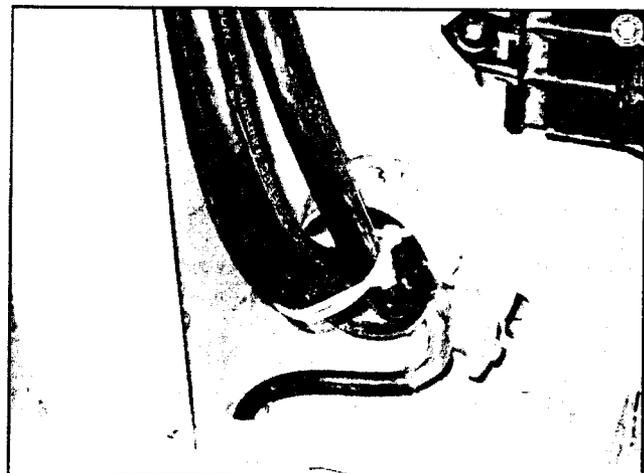
None of this information is permitted from 250.68(A) or (B) or (C) or (D) or (E) or (F) or (G) or (H) or (I) or (J) or (K) or (L) or (M) or (N) or (O) or (P) or (Q) or (R) or (S) or (T) or (U) or (V) or (W) or (X) or (Y) or (Z)

Within the first 1.5 m (5 ft) of where pipe enters the building

 A schematic diagram showing a pipe entering a building from the left. A bonding jumper is connected to the pipe within the first 1.5 m (5 ft) of its entry into the building. The diagram also shows a ground electrode symbol and a ground symbol.

250.92(B) Method of Bonding at Service

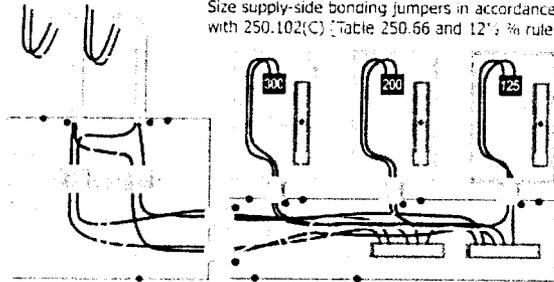
- Bonding requirements were added for bonding around reducer washers at raceways containing service conductors
- Bonding jumpers must be used around impaired connections such as reducing washers or oversized, concentric, or eccentric knockouts
- Standard locknuts or bushings cannot be the only means for the bonding at services but permitted to be installed to make a mechanical connection of the raceway(s)
- Electrical continuity at service equipment, service raceways, and service conductor enclosures shall be ensured by bonding equipment to the grounded service conductor, threaded couplings or threaded hubs, bonding-type locknuts, bonding bushings, etc.



250.102(C) Size: Supply-Side Bonding Jumper

Sizing requirements for supply-side bonding jumpers have been revised and converted into a list format.

Size supply-side bonding jumpers in accordance with 250.102(C) [Table 250.66 and 12½ % rule].

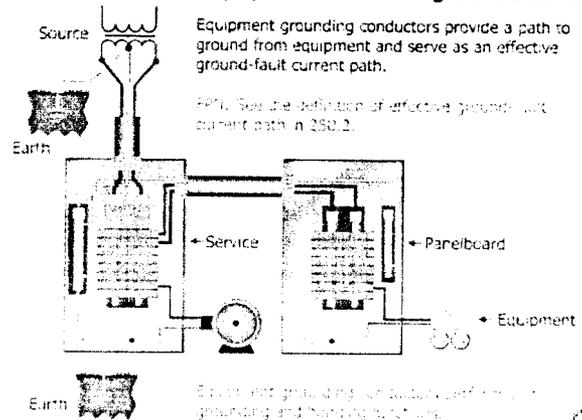


Supply-Side Bonding Jumper: A conductor installed on the supply side of a service or within a service equipment enclosure(s), or for a separately derived system, that ensures the required electrical conductivity between metal parts required to be electrically connected.

250.118 Types of Equipment Grounding Conductors

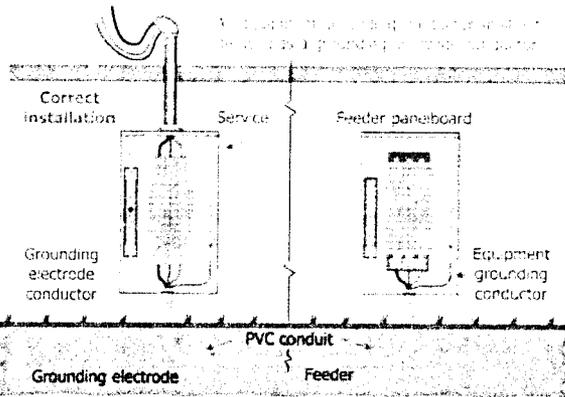
Equipment grounding conductors provide a path to ground from equipment and serve as an effective ground-fault current path.

NOTE: See the definition of effective ground-fault current path in 250.2.



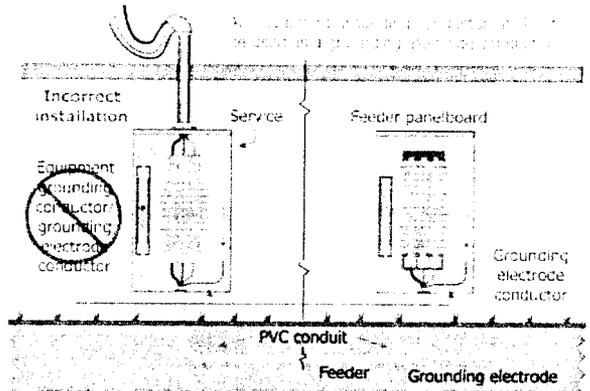
250.121 Use of Equipment Grounding Conductor

A separate metal conductor is required to be used as a grounding electrode conductor.

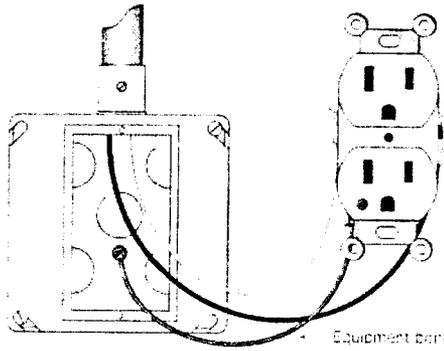


250.121 Use of Equipment Grounding Conductor

A separate metal conductor is required to be used as a grounding electrode conductor.



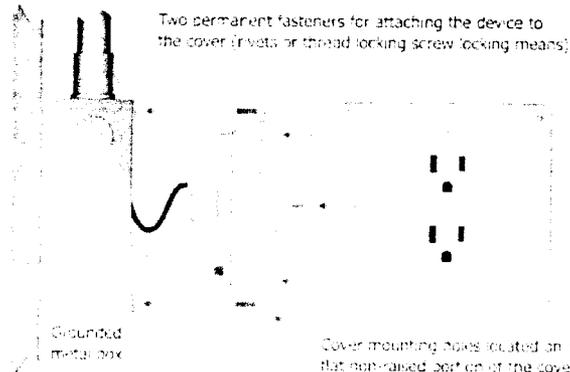
250.146 Connecting Grounding Terminal to Box



Equipment bonding jumper is used based on the branch-circuit equipment device rating using Table 250.122.

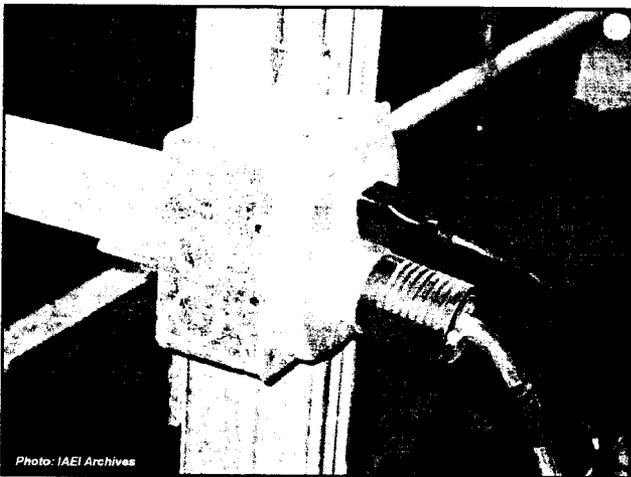
2008

250.146(A) Surface-Mounted Box

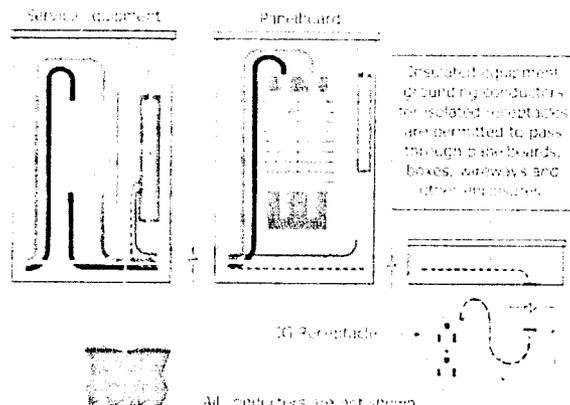


Listed exposed work cover is permitted as the grounding and bonding means

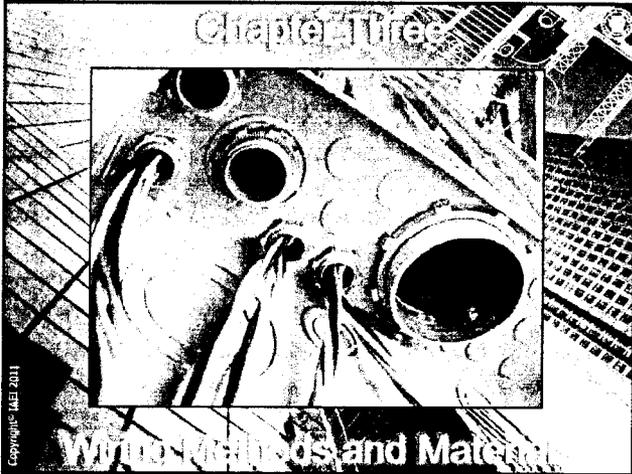
2008



250.146(D) Isolated Receptacles



2008



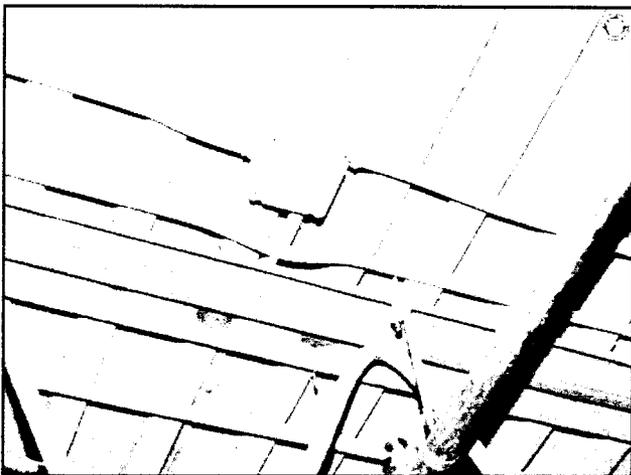
300.4(E) Raceways, Boxes Under Roof Decking

Cables, raceways, or boxes not permitted to be installed in concealed locations in metal corrugated sheet panning type roof.

Expanded cross section

38 mm (1 1/2 in.)

A cable, raceway, or box installed in exposed or concealed locations under metal corrugated sheet roof decking, shall be installed and supported so that it is not less than 38 mm (1 1/2 in.) thick and rests on the upper surface of the roof decking.



300.4(G) Insulating Fittings

- Where raceways containing insulated circuit conductors in sizes 4 AWG and larger enter a cabinet, box, equipment, and so forth, the conductors are required to be protected from abrasion.
- Please note this applies to the installation not only after the conductors are pulled but BEFORE installation.
- The word "insulated" has been inserted in this section for clarification.



300.4(H) Structural Joints

Article 300.4(H) was added to 2008 to cover expansion and deflection at structural joints in a building or other structure.

A listed expansion/deflection fitting or other approved means shall be used where a raceway crosses a structural joint intended for expansion, contraction or deflection, used in buildings, bridges, parking garages, or other structures.

300.5(B) Wet Locations

The interior of enclosures or raceways installed underground shall be considered to be a wet location.

Insulated conductors installed in wet locations are considered to be listed for use in wet locations and shall comply with 300.4(C).

The interior of underground raceways are wet locations.

3008

300.5(C) Underground Cable Under Buildings

Underground cables installed under buildings shall be in a raceway.

This requirement applies to cables routed from under the building to outside the building perimeter and to raceways that remain within the outside perimeter of the building.

Exterior of building

Interior of building

Kitchen is and typical

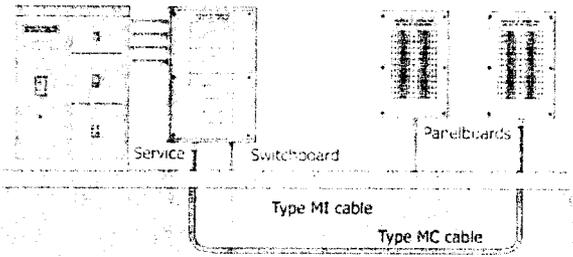
UF cable

LF cable

3008

300.5(C) Underground Cables Under Buildings

Underground cable installed under a building required to be in a raceway

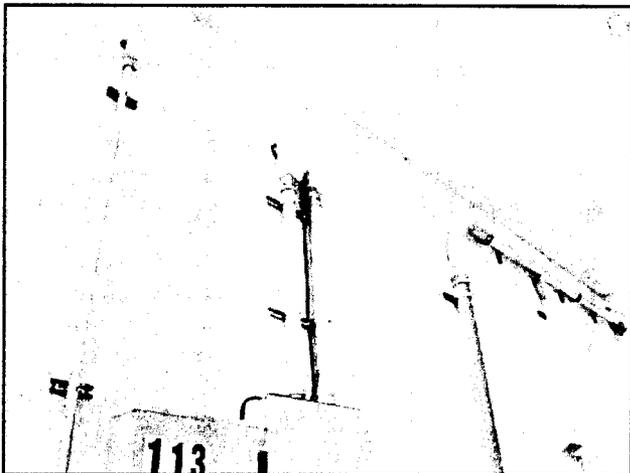


Ex. No. 1. Type MI cable where embedded in concrete, fill, or other masonry or in underground runs where suitably protected against physical damage and corrosive conditions

Ex. No. 2. Type MC cable listed for direct burial or concrete encasement or in wet locations with a covering impervious to moisture

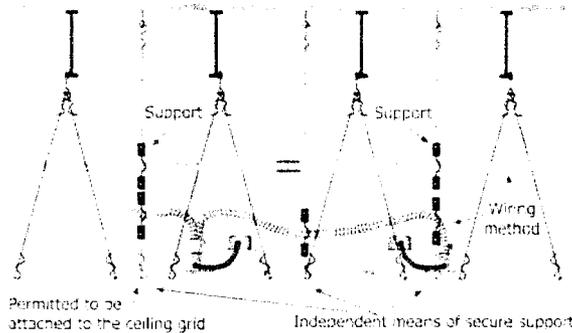
300.9 Raceways in Wet Locations Abovegrade

- Where raceways are installed in wet locations above-grade, the interior of these raceways shall be considered to be a wet location.
- Insulated conductors and cables installed in raceways in wet locations abovegrade shall comply with 310.8(C).



300.11(A)(2) Non-Fire-Rated Assemblies

An independent means of secure support to be provided for wiring methods in non-fire-rated assemblies where the wiring method is not permitted to be attached to the ceiling grid

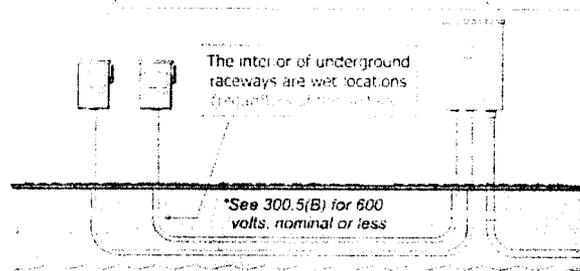


300.11(A)(2) Non-Fire-Rated Assemblies

- New language was added requiring identification of independent wiring method support ceiling wires in non-fire-rated assemblies
- Previous language only required additional wiring method support wires to be distinguishably marked for fire-rated assemblies
- Acceptable identification methods could include such things as painting, tagging or other forms of identification
- This will also assist both installers and inspectors to be able to determine which support wires are acceptable for supporting wiring methods

300.50(B) Wet Locations (over 600 Volts)

The interior of enclosures or raceways installed underground shall be considered to be a wet location (regardless of the voltage). Insulated conductors installed in wet locations are required to be listed for use in wet locations and shall comply with 310.10(C). Any connections or splices in an underground installation shall be approved for wet locations.



Article 310 - Conductors for General Wiring

Article 310 - (2011 NEC)

- 310.1 Scope
- 310.15 Ampacities for Conductors Rated 0- 2000 Volts
- 310.60 Conductors Rated 2001 to 35,000 Volts
- 310.104 Conductor Constructions and Applications
- 310.105 Conductors
- 310.106 Conductor Identification
- 310.107 Marking

Article 310 received an extensive reorganization for the 2011 NEC in an effort to comply with the NEC Style Manual and provide consistency with other NEC Chapter 3 articles.

Article 310 Ampacity Tables

- All tables located within Article 310 were renumbered in the 2011 NEC
- Article 310 (*Conductors for General Wiring*) went through extensive reorganization for the 2011 NEC
- This reorganization had an extreme impact on the tables within the article as well
- This was an effort to bring the table numbering in line with the NEC Style Manual
- NEC Style Manual Section 2.3.1 - "Tables and figures shall be referenced in the text and shall be designated by the number of the NEC rule in which they are referenced"

Article 310 Tables Comparison Chart

Table Number	Description	Table Reference
310.15(B)(2)(a)	Adjustment Factors for More than Three Current Carrying Conductors in a Raceway or Cable	310.15(B)(2)(a)
310.15(B)(2)(b)	Ambient Temperature Adjustment for Conductors Exposed to Sunlight or in Above Ground	310.15(B)(2)(b)
310.15(B)(3)	Conductor Types and Sizes for 120/240 volt, 3-Phase, Single-Phase Dwelling Services and Feeders	310.15(B)(3)
310.16	Allowable Ampacities of Insulated Conductors Rated 60 to and Including 2000 Volts, 90°C Through 90°C (160°F Through 160°F) and More than Three Current Carrying Conductors in Raceway, Cable, or Earth Directly Buried, Based on Ambient Temperature of 30°C (86°F)	310.16(B)(1)
310.16	Ambient Temperature Correction Factors Based on System of Table 310.15(B)(3)	310.16(B)(2)(a)
310.16	Ambient Temperature Correction Factors	310.16(B)(2)(b)
310.16	Ampacities of Insulated Single-Axis Conductor Cables Installed in Air Based on Ambient Temperature of 90°C (160°F) and 135°C (221°F) and Ambient Air Temperature of 30°C (86°F)	310.16(C)

Article 310 Tables Comparison Chart 2012

- ### 310.10(H)(1) Conductors in Parallel
- Revisions were made to the parallel conductors rules found at 310.10(H)(1) [previously 310.4(A)] pertaining to the minimum size conductors permitted to be run in parallel
 - Previous language stated that conductors "1/0 AWG and larger shall be permitted" to be run in parallel
 - The words "shall be permitted" did not act to prohibit the paralleling of smaller conductors
 - This revision states more definitively that "only sizes 1/0 AWG and larger" are permitted to be run in parallel (without employing one of the two existing exceptions to the main rule)

310.10(H)(1) Conductors in Parallel

Two conductors of sizes 1/0 AWG and larger comprising each phase, polar, neutral, or grounded circuit conductor shall be connected in parallel.

Each conductor must be installed as follows:

- (1) Same length
- (2) Made of same conductor material
- (3) Same circular mil area
- (4) Same insulation type
- (5) Terminated in same manner

Connected in parallel (electrically joined at both ends)

- ### Table 310.15(B)(2)(a) Ambient Temperature Correction Factors Based on 30°C (86°F)
- The ambient temperature correction factor table has been relocated from the bottom of previous Table 310.16 to a new Table 310.15(B)(2)(a)
 - Temperature correction factors needed and will now have their own table
 - All temperature applications now at one location as the other temperature correction factor tables previously located at the bottom of the other allowable ampacity tables were relocated to new Table 310.15(B)(2)(b)
 - Ambient temperature correction factor tables were also expanded to include temperatures and correction factors below the previous ambient temperature of allowable ampacity tables

Table 310.15(B)(2)(a) Temperature Correction Factors

Ambient Temperature Correction Factors Based on 30°C (86°F)
 For ambient temperatures other than 30°C (86°F), multiply the allowable ampacities specified in the ampacity tables by the appropriate factor shown below

Ambient Temperature (°C)	Temperature Rating of Conductor			Ambient Temperature (°F)
	60°C	75°C	90°C	
13.0	1.29	1.29	1.19	55.4
15.0	1.22	1.22	1.12	59.0
17.5	1.13	1.13	1.04	63.5
20.0	1.04	1.04	0.97	68.0
22.5	0.96	0.96	0.91	72.5
25.0	0.88	0.88	0.84	77.0
27.5	0.81	0.81	0.78	81.5
30.0	0.75	0.75	0.73	86.0
32.5	0.69	0.69	0.67	90.5
35.0	0.64	0.64	0.62	95.0
37.5	0.59	0.59	0.57	99.5
40.0	0.55	0.55	0.53	104.0
42.5	0.51	0.51	0.49	108.5
45.0	0.47	0.47	0.45	113.0
47.5	0.44	0.44	0.42	117.5
50.0	0.41	0.41	0.39	122.0
52.5	0.38	0.38	0.36	126.5
55.0	0.35	0.35	0.33	131.0
57.5	0.33	0.33	0.31	135.5
60.0	0.31	0.31	0.29	140.0
62.5	0.29	0.29	0.27	144.5
65.0	0.27	0.27	0.25	149.0
67.5	0.25	0.25	0.23	153.5
70.0	0.23	0.23	0.21	158.0
72.5	0.21	0.21	0.19	162.5
75.0	0.19	0.19	0.17	167.0
77.5	0.17	0.17	0.15	171.5
80.0	0.15	0.15	0.13	176.0
82.5	0.14	0.14	0.12	180.5
85.0	0.12	0.12	0.10	185.0
87.5	0.11	0.11	0.09	189.5
90.0	0.10	0.10	0.08	194.0

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

- Table 310.15(B)(3)(a) [formally Table 310.15(B)(2)(a)] contains requirements for adjustment or derating of conductors where the number of current-carrying conductors in a raceway or cable exceeds three
- The first column heading has been changed from "Number of Current-Carrying Conductors" to "Number of Conductors"
- This will take into account "spare" conductors that might be installed in raceways for future expansion or use but are not yet "current-carrying" conductors

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

Percent of Values in Tables 310.15(B)(16) through 310.15(B)(19) as Adjusted for Ambient Temperature, if Necessary

Number of Conductors	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

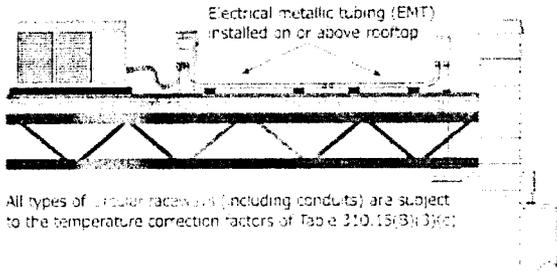
Number of Conductors is the total number of conductors in the raceway or cable adjusted in accordance with 310.15(B)(5) and (6).

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

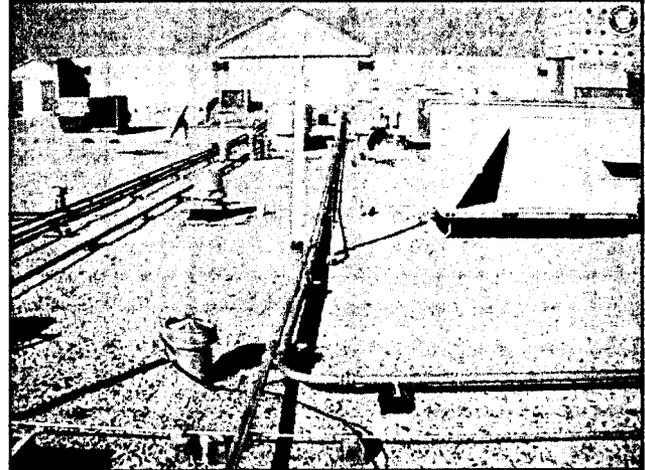
- Revisions were added to require all types of circular raceways to temperature correction factors of 310.15(B)(3)(c) (not just conduits)
- Previous language required conductors or cables installed in conduits exposed to direct sunlight on or above rooftops to be subject to these correction factors
- The term "conduit" was changed to "circular raceway" to indicate that all types of circular raceways are subject to these temperature correction factors
- The term "circular raceways" will include all wiring methods originally tested (such as EMT)
- The term "conduit" is not defined in the NEC; the term "circular raceways" is a broader, and more-encompassing

310.15(B)(3)(c) Circular Raceways on Rooftops

Conductors or cables installed in circular raceways exposed to direct sunlight on or above rooftops require adjustments shown in Table 310.15(B)(3)(c)



All types of circular raceways (including conduits) are subject to the temperature correction factors of Table 310.15(B)(3)(c)

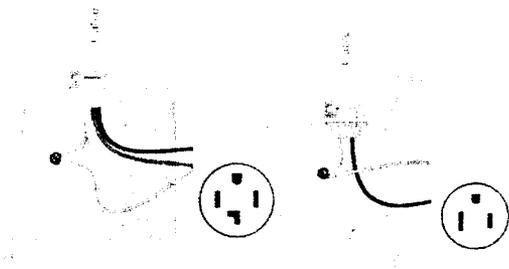


314.16 Device and Equipment Fill

- A new second sentence has been added to Section 314.16(B)(4) as follows: A device or utilization equipment wider than a single 50 mm (2 in.) device box as described in Table 314.16(A) shall have double volume allowances provided for each gang required for mounting.
- A device requiring more than one gang opening in an outlet box requires double conductor volume allowances for each gang required.

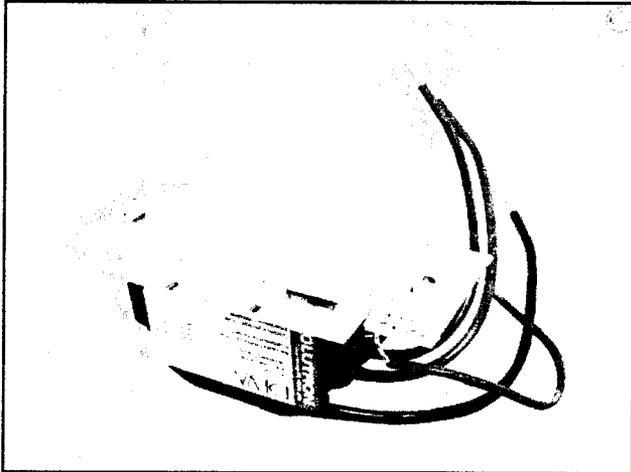
2008

314.16(B)(4) Device or Equipment Fill



A device or utilization equipment wider than a single 50 mm (2 in.) device box as described in Table 314.16(A) shall have double volume allowances provided for each gang required for mounting.

2008



314.27(A) Boxes at Luminaires or Lampholders

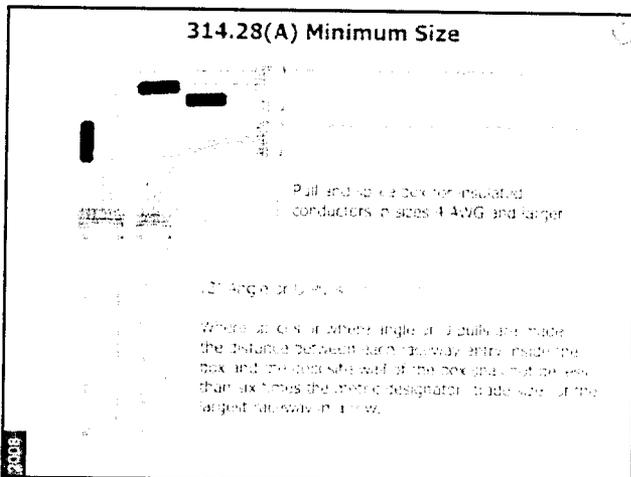
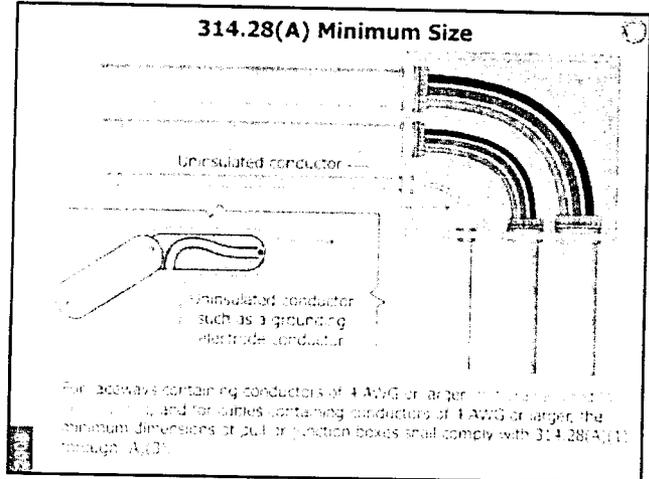
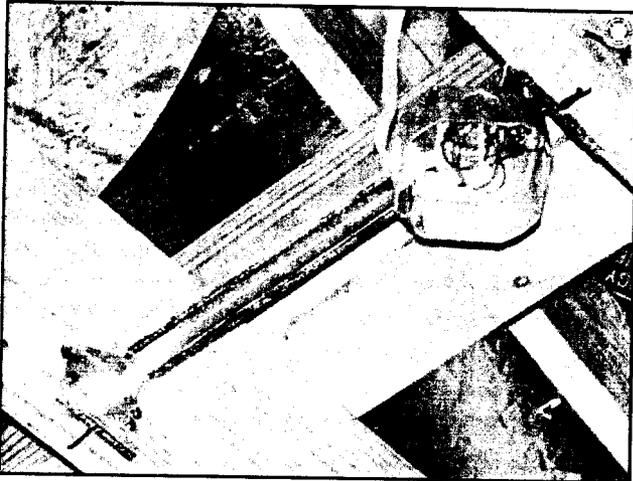
- Revisions were made to the requirements for boxes at luminaires and lampholders for clarity
- Revision incorporates the provisions of previous 314.27(B) (*Maximum Luminaire Weight*) into the revised language of 314.27(1) and (A)(2)
- The requirements for wall-mounted and ceiling-mounted luminaires have been separated into separately numbered subsections
- Manufacturer marking requirements for maximum weight of luminaire support to be marked "on the interior of the box"

314.27(A) Boxes at Luminaires or Lampholders

Boxes at wall-mounted luminaires	Boxes at ceiling-mounted luminaire outlets
<ul style="list-style-type: none"> • Must be specifically designed for luminaire use • Must be designed to support the maximum weight of the luminaire permitted to be supported by the box (314.27(B)) • Inverters and capacitors supporting ballasts must be supported by the luminaire • Luminaires must be specifically designed for luminaire use and marked to indicate the maximum weight of luminaire 	<ul style="list-style-type: none"> • Must be specifically designed for luminaire use and marked to indicate the maximum weight of luminaire permitted to be supported by the box (314.27(B)) • Inverters and capacitors supporting ballasts must be supported by the luminaire • Luminaires must be specifically designed for luminaire use and marked to indicate the maximum weight of luminaire permitted to be supported by the box (314.27(B))

314.27(C) Boxes at Ceiling Fan Outlets

Separate, separately switched, grounded conductor



- 314.28(E) Power Distribution Blocks**
- New provisions added to permit and provide guidelines for the installation of power distribution blocks in pull and junction boxes
 - Basic minimum size pull and junction box permitted to contain power distribution blocks [1650 cm³ (100 in.³)]
 - New provisions ensure that no shock hazard exists from exposed live terminal parts when the pull and junction box cover is removed
 - These new provisions are similar to provisions that already exist in Article 376 for metal wireways

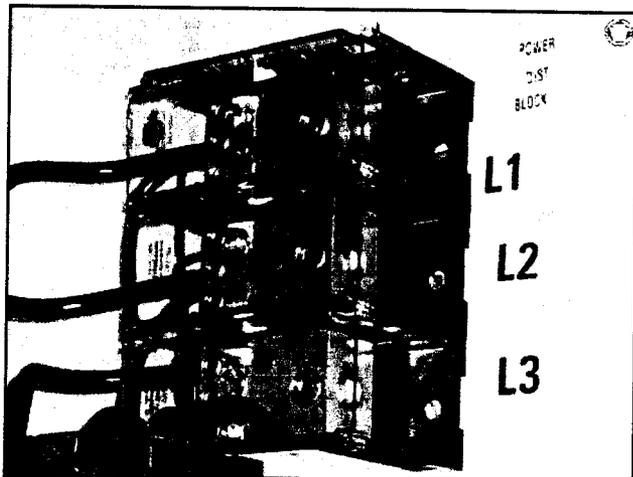
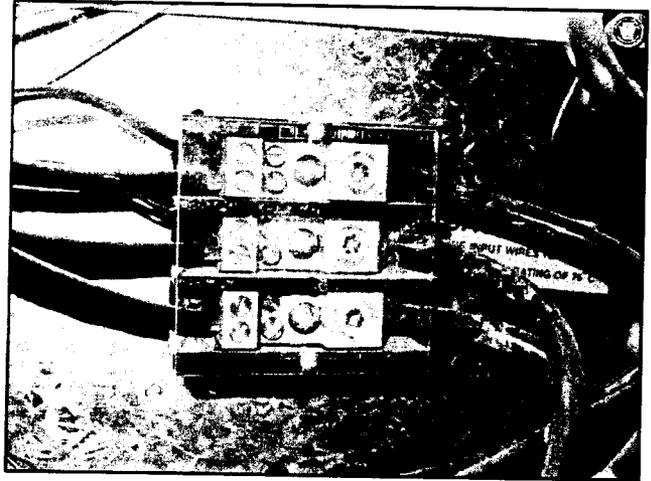
314.28(E) Power Distribution Blocks

Junction box over 1650 cm³ (100 in.³) in size

Listed power distribution blocks

No uninsulated live parts exposed within the box, whether or not the box cover is installed

New provisions and guidelines added to permit the installation of power distribution blocks in wet and damp locations.



314.30(C) Enclosed Wiring

All enclosed conductors and any splices or terminations present shall be listed as suitable for wet locations.

Handhole enclosure with or without a bottom

— Conductors and splices listed for wet locations

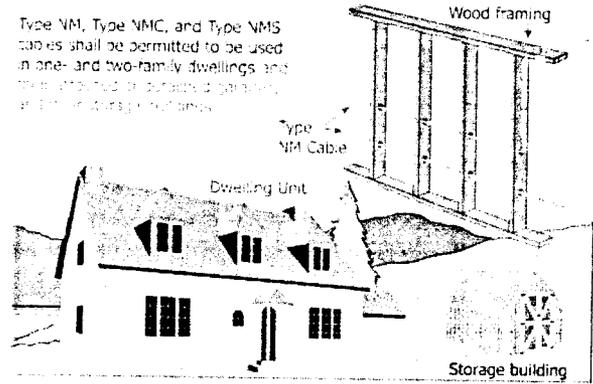
2008

334.10(1) Uses Permitted – Type NM Cable

- Type NM cable can now be used in attached or detached garages, and one- and two-family dwelling storage buildings without concealment behind a finished 15-minute rating thermal barrier
- Previous language permitted Type NM cable as an exposed wiring method at an attached garage, but not a detached garage
- The perception that the installation of Type NM cable in these detached accessory buildings somehow constituted a greater hazard than the dwelling unit structure itself seemed excessive to many users of the *Code*
- **Note:** "attached and detached garages and their storage buildings" are not children's play houses, and other similar structures, which may invite increased use

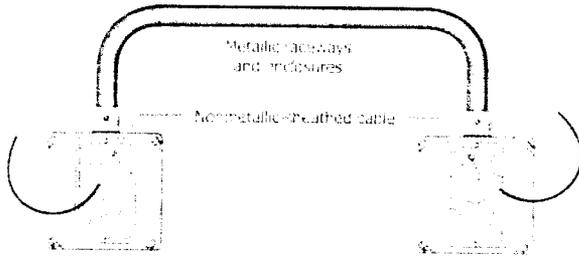
334.10(1) Uses Permitted - Type NM Cable

Type NM, Type NMC, and Type NMS cables shall be permitted to be used in one- and two-family dwellings and their attached or detached garages, and their detached storage buildings.



334.12(A)(1) Exception

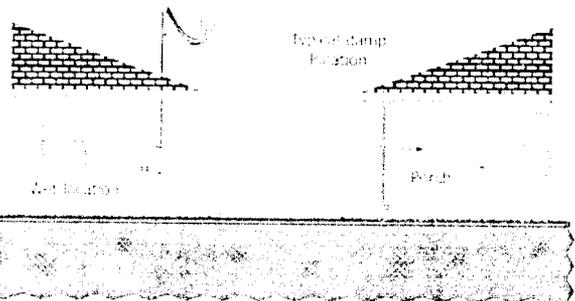
Type I or Type II construction



Type NM cable is permitted for wiring in fire-rated construction, Type I and II provided it is installed in a raceway that is suitable for use in this type of building construction.

334.12(B)(4) Uses Not Permitted

Type NM and NMS cables shall not be permitted in fire-rated construction, such as fire-rated walls, fire-rated floors, fire-rated ceilings, and fire-rated partitions.



2009

2009

334.15(B) Protection From Physical Damage

Labels in diagram:
 - NM-C cable
 - Steel plate
 - Minimum thickness 1.59 mm (1/16 in.)
 - Sleeve, conduit, or tubing permitted for protection

Type NM-C cable installed in shallow chases or grooves in masonry, concrete, or adobe, shall be protected in accordance with the requirements in 300.4(F) and covered with plaster, adobe, or similar finish.

2008

334.15(C) Exposed Work

(C) In Unfinished Basements and Crawl Spaces

Conduit or tubing shall be provided with a suitable insulating bushing or adapter at the point the cable enters the raceway.

The NM cable sheath shall extend through the conduit or tubing and into the outlet or device box not less than 6 mm (1/4 in.).

The cable shall be secured within 300 mm (12 in.) of the point where the cable enters the conduit or tubing.

Metal conduit, tubing, and metal outlet boxes shall be connected to an equipment grounding conductor.

2008

334.80 Ampacity

Labels in diagram:
 - Draft- or fire-stopping materials
 - NM Cables
 - Wood framing
 - Draft- or fire-stopping materials

Ampacity adjustment factors in Table 310.15(B)(3)(a) apply to the following:

- Where more than two cables with two or more current-carrying conductors pass through wood framing without draft- or fire-stopping and the wood framing is draft- or fire-stopped using thermal insulation, sealing foam, or other approved materials.
- Where more than two NM cables with two or more current-carrying conductors are installed in thermal insulation without draft- or fire-stopping approved materials.

2008

This slide, on the left side of the image there are 8 - #12 NM cables.

#12 NM has 90 deg C conductors so derating may start at this ampacity. #12 = 30 Amps.

Per NEC Table 310.15(B)(3)(a) adjustment factors, we would multiply this factor by 70% to arrive at the maximum cable ampacity. $30 \times .70 = 21$ amperes.

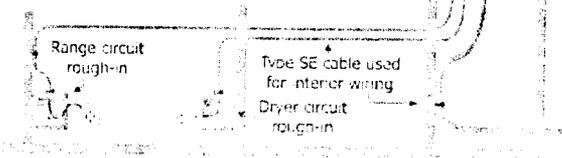
2008

338.10(B)(4)(a) Uses Permitted - Type SE Cable

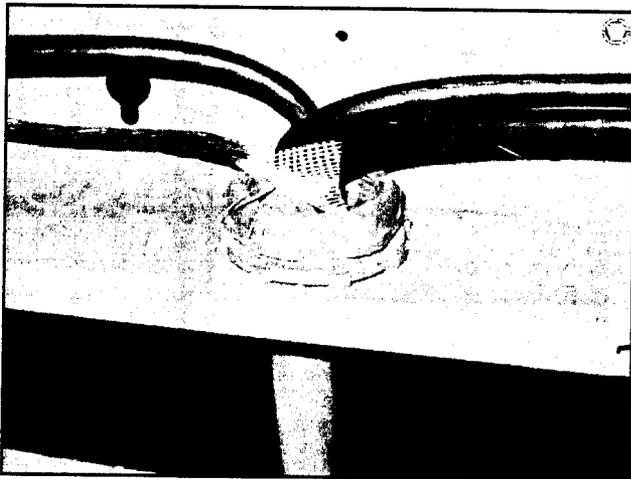
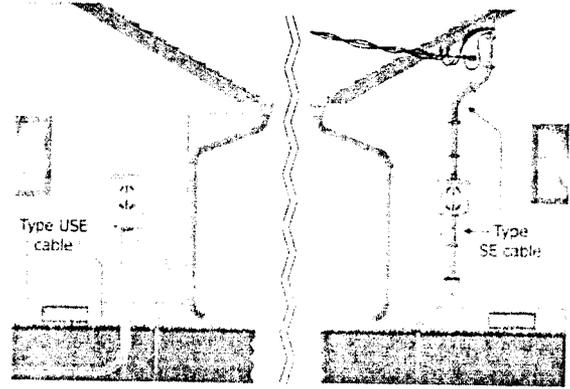
Type SE cable used for interior installations to comply with the provisions in Article 338 and the installation requirements in Part II of Article 334 (Type NM cable) excluding 334.91 (allowable ampacity).

Where installed in thermal insulation, the ampacity to comply with 338.10(B)(4)(a) conductor temperature rating.

Maximum conductor temperature being permitted to be used for ampacity adjustment and correction factors and not to exceed 90°C (194°F) and conductor.



338.12(A) and (B) Uses Not Permitted



342.30 Securing and Supporting Raceways

- Short raceways [450 mm (18 in.) to 900 mm (36 in.)] no longer require additional support
- In previous language, the existence of a coupling in a short conduit nipple instantaneously provoked a support requirement for this conduit
- Raceways generally require support within 900 mm (3 ft) of terminations; when entire length is just that long or shorter, no additional support should be needed
- This section was revised into a list format to make this section more user-friendly

342.30 Securing and Supporting Raceways

875 mm (35 in.) 400 mm (16 in.)

No additional support required

Securely fastened within 900 mm (3 ft) of each outlet box, junction box, device box, cabinet, conduit body, or other conduit termination

Applies to IMC, RMC, PVC, RTRC, and EMT

342.30 Securing and Supporting Raceways

- The deletion of the "Unsupported Raceways" language was uniformly made to five (5) conduit articles:

342.30(C)	Intermediate Metal Conduit (IMC)
344.30(C)	Rigid Metal Conduit (RMC)
352.30(C)	Rigid Polyvinyl Chloride Conduit (PVC)
355.30(C)	Reinforced Thermosetting Resin Conduit (RTRC)
358.30(C)	Electrical Metallic Tubing (EMT)

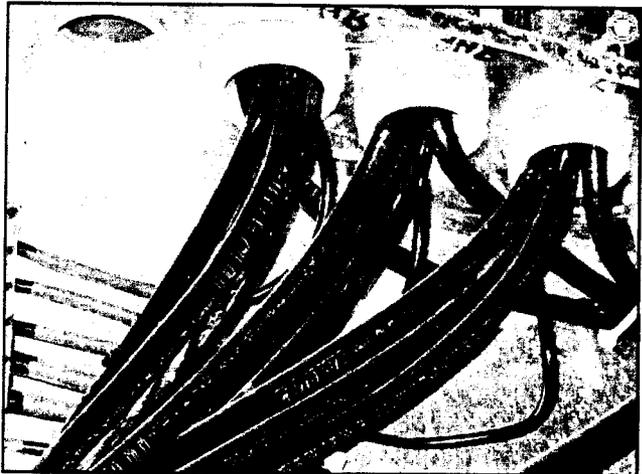
342.46 Bushings

Where a conduit enters a box, fitting, or other enclosure, a bushing is required to protect the wires from abrasion unless the box, fitting, or enclosure is designed to provide equivalent protection.

This change applies to IMC and RMC

Bushings and fittings designed to provide protection from abrasion

Previous language indicated a bushing was required "unless the design of the box, fitting, or enclosure is such as to afford equivalent protection". The term "equivalent" is a subjective term.



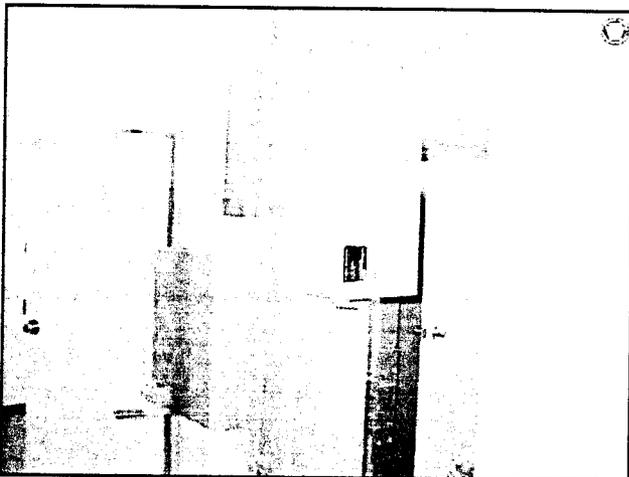
352.10(F) Exposed

- PVC conduit shall be permitted for exposed work.
- PVC used exposed in areas of physical damage shall be identified for the use.
- PVC conduit, Schedule 80, is identified for areas of physical damage.

2008

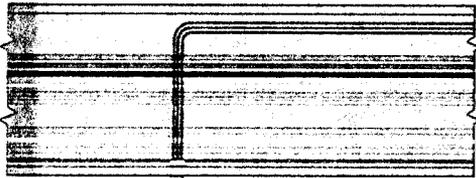
368.10(B) Busways Behind Access Panels

- Busways are permitted to be installed behind access panels
- Previous title of "Concealed" was changed to "Behind Access Panels"
- Busways were previously permitted to be installed behind an access panel, but meeting the definition of "concealed" was difficult at best



376.22 Number of Conductors and Ampacity

Section 376.22 has been restructured into two subdivisions.



Metallic wireways

Signal circuit

Conductors in wireways must not exceed 20 percent of the cross-sectional area of the wireway.

Ampacity adjustment factors apply where the number of current-carrying conductors exceeds 30.

Signal circuit conductors (starting duty) are not considered as current-carrying conductors.

3008

376.56(B)(4) Power Distribution Blocks

Feeder

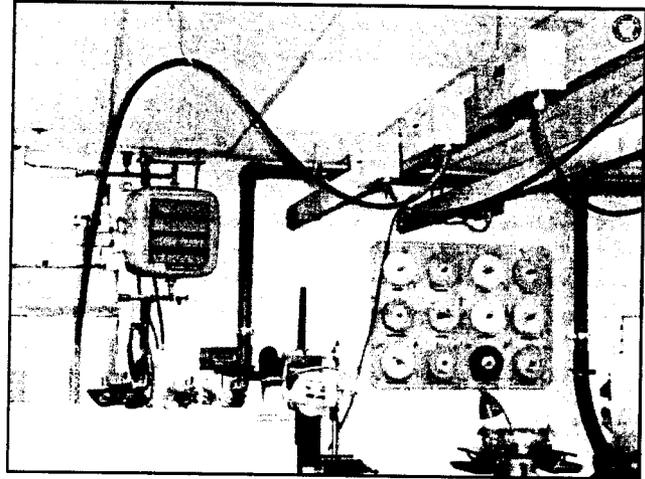
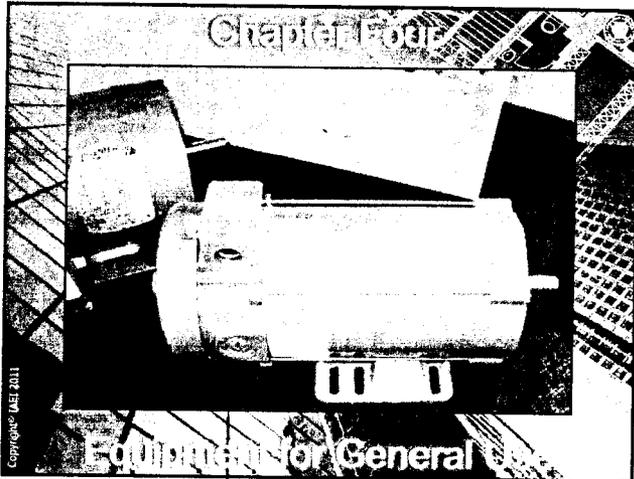
Fill not to exceed 75% of the wireway space area at the splice.

- Required to be listed
- Enclosure sizes adequate
- Wire bending space per 312.5
- No live parts exposed

Metallic wireway

Feeder taps (typical)

3008



400.5(A) Ampacity Tables for Cords and Cables

Temperature correction factors from Table 310.15(B)(1) corresponding to the temperature rating of the cord to be applied to the ampacity from Table 100.5(A)(2)

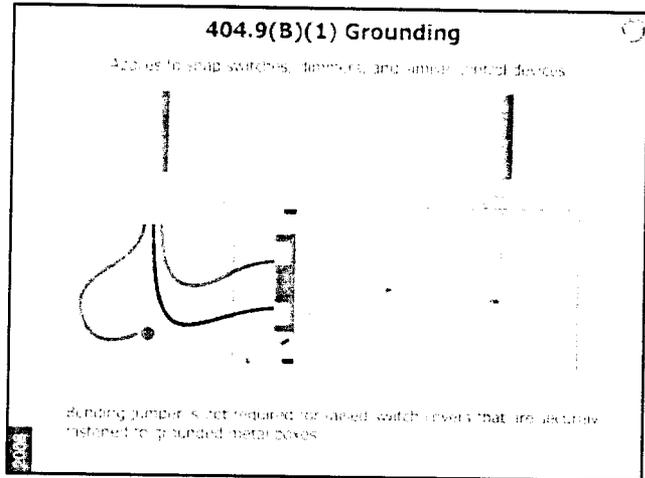
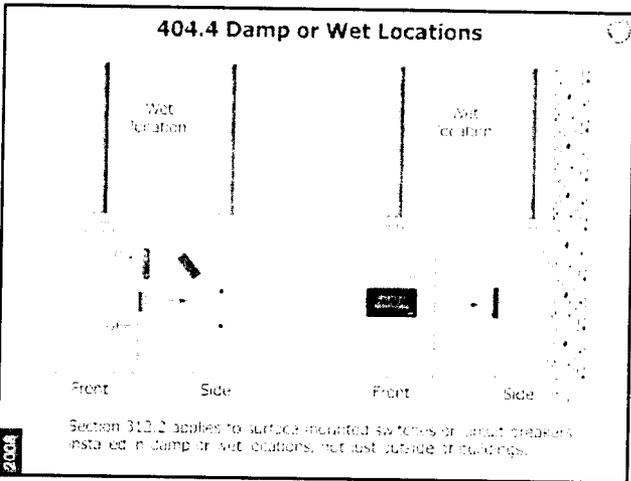
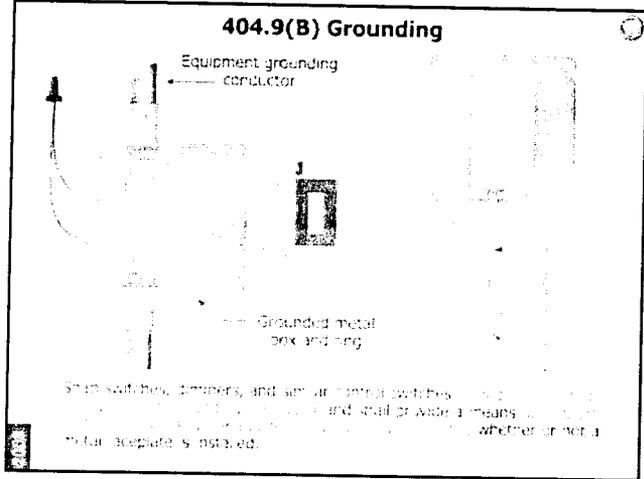
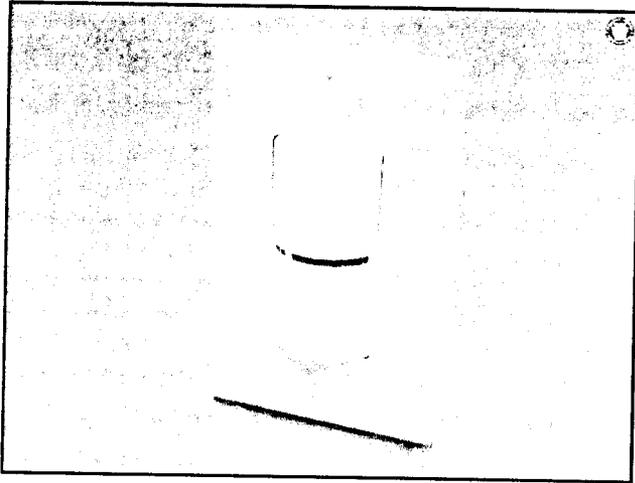
Ambient temperature $> 30^{\circ}\text{C}$ (86°F)

Flexible cord used in ambient temperature $> 30^{\circ}\text{C}$ (86°F)

Flexible cords and cables used in ambient temperatures above 30°C (86°F) require ambient temperature adjustment correction factors

404.2(C) Switches for Lighting Outlets

- Generally, where switches control lighting loads from a grounded general-purpose branch circuit, the grounded circuit conductor for the controlled lighting circuit shall be present at the switch location.
- Many electronic lighting control devices, such as occupancy sensors require standby current to maintain a ready state of detection for the function of these devices
- **Note:** See exceptions for boxes feed by raceways and cable assembly boxes with framing cavity open at the top or bottom on the same floor level, or wall, floor, or ceilings unfinished on one side



404.9(B) Grounding of Switches

Switches generally required to be connected to an equipment grounding conductor and provided a means to ground metal faceplates (whether or not a metal faceplate is installed)



Two new exceptions were added to mandatory provisions for grounding of switches:

- Ex. 404.9(B)(1) - Switches with nonmetallic yokes, faceplates, and accessible parts (after installation) when listed as a kit or assembly
- Ex. 404.9(B)(2) - Snap switch with an integral nonmetallic enclosure

Courtesy of Underwriters Laboratories

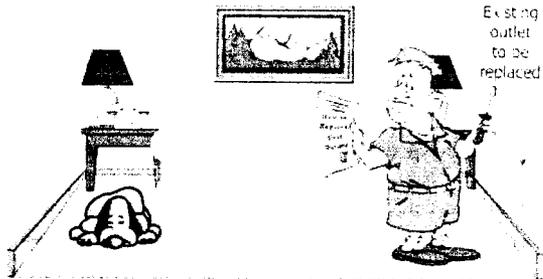
210.12(B) and 406.4(D)(4) Arc-Fault Circuit-Interrupter Protection



Listed Outlet Branch-Circuit Type AFCI Device

Courtesy of Pass & Seymour, Inc.

406.4(D)(4) Receptacle Replacement (AFCI)



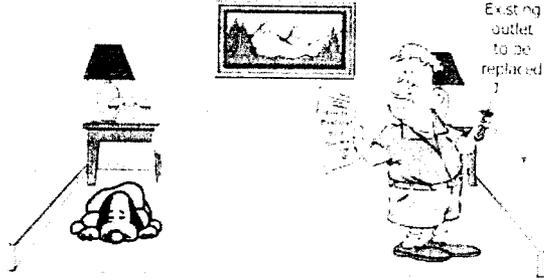
Each fault on the branch circuit must have a listed arc-fault circuit interrupter (AFCI) device installed where a receptacle outlet is supplied by a branch circuit that requires AFCI protection elsewhere in the Code.

Replacement receptacle outlet can be protected by a listed outlet branch circuit type AFCI receptacle or a listed combination type AFCI circuit breaker.

ARC Fault Video

Video Presentation

406.4(D)(5) Receptacle Replacement Tamper-Resistant Receptacles

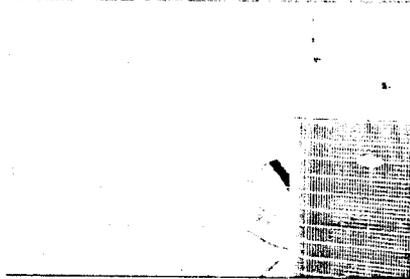


406.4(D)(5) Where a receptacle outlet is required to be tamper-resistant, use tamper-resistant receptacles where in the Code.
See 406.12, 406.13, and 406.14 for tamper-resistant receptacle requirements.

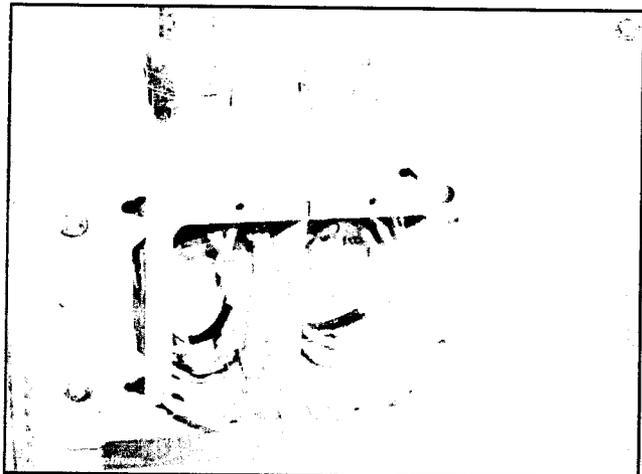
406.4(G) Voltage Between Adjacent Devices

- A new subdivision (G) covering voltage between adjacent receptacles has been added to 406.4.
- Where voltages between adjacent receptacles in ganged enclosures exceed 300, identified and securely fastened barriers are required between the devices.

406.4(D)(6) Receptacle Replacement Weather-Resistant Receptacles

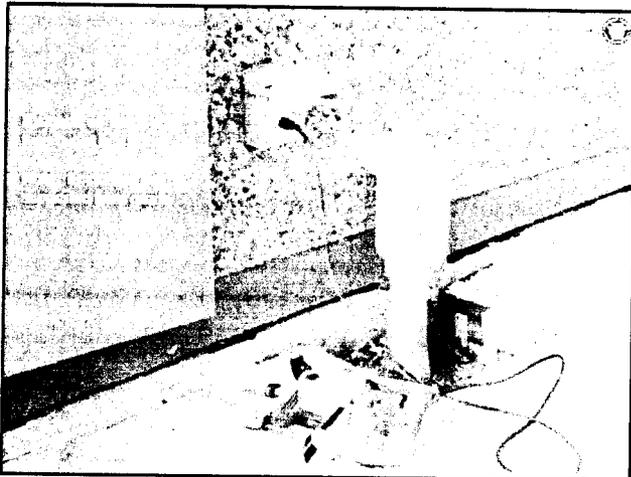
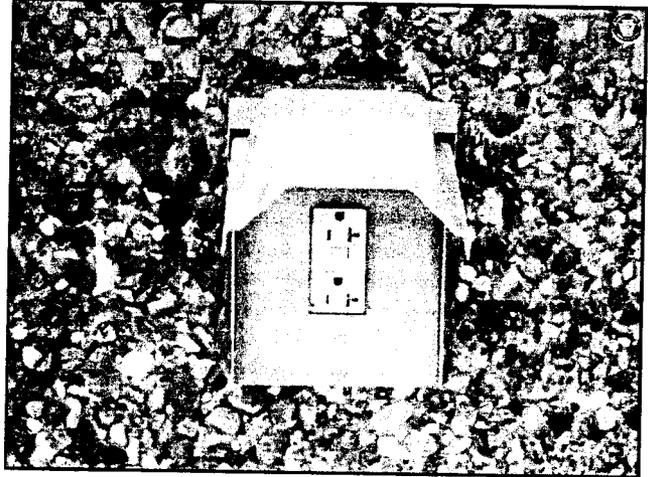


406.4(D)(6) Where a receptacle outlet is required to be weather-resistant, use weather-resistant receptacles where in the Code.
See 406.3(A) and 406.3(B) for weather-resistant receptacle requirements.



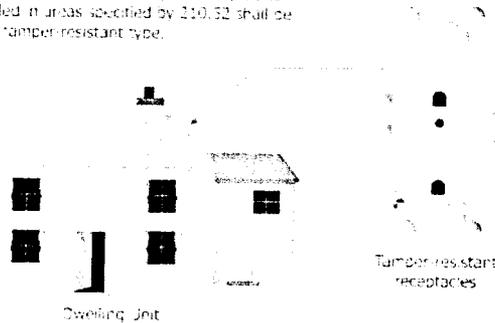
406.9(B)(1) Receptacles in Wet Locations

- All 15- and 20-ampere, 125- and 250-volt receptacles installed in a wet location must have an enclosure that is weatherproof whether or not the attachment plug cap is inserted (in-use cover)
- For other than one- or two-family dwellings, an outlet box hood installed for this purpose shall be listed and where installed on an enclosure supported from grade must be identified as "extra-duty"
- All 15- and 20-ampere, 125- and 250-volt nonlocking type receptacles must be listed weather-resistant type



406.11 Tamper-Resistant Receptacles in Dwelling Units

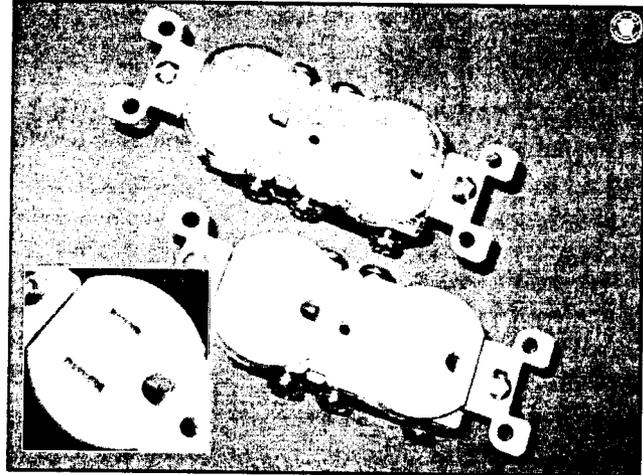
All 125-volt, 15- and 20-ampere receptacles installed in areas specified by 210.52 shall be listed tamper-resistant type.



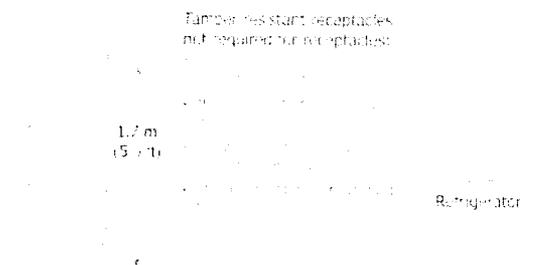
2008

Tamper Proof Receptacles

- Required for
 - All outlets in 1 and 2 family dwellings below 5 ½ feet
 - Guest rooms or suites
 - Child care facilities
 - Pediatric facilities
- This requirement is retroactive anytime a receptacle is changed in any of the above locations.



406.12 Tamper-Resistant Receptacles

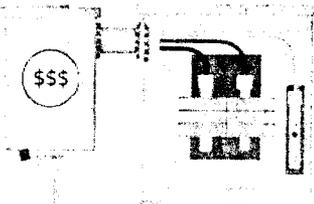


In all areas specified in 210.52, all 125-volt, 15- and 20-ampere receptacles required to be listed tamper-resistant receptacles.

406.8(A) and (B)(1) Damp and Wet Locations

- Standard nonlocking receptacles in 125- and 250-volt configurations are required to be listed weather-resistant type.
- A new second sentence has been added in 406.8(A) and 406.8(B)(1) and a new FPN follows each section.
- All nonlocking 15- and 20-ampere, 125- and 250-volt receptacles shall be listed weather-resistant type.

408.36 Exception No. 1



Suitable for use as service equipment

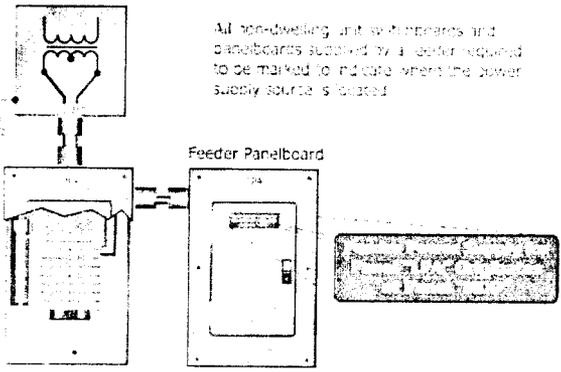
Not more than six single or multiple pole circuit breakers or sets of fuses

Individual protection shall not be required for a panelboard used as service equipment with multiple disconnecting means in accordance with 250.71.

In panelboards protected by three or more main circuit breakers or sets of fuses, the circuit breakers or sets of fuses shall not supply a second bus structure within the same panelboard assembly.

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408.4(B) Identification - Source of Supply

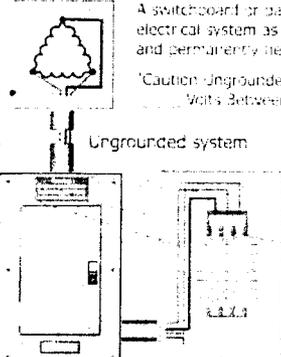


All non-dwelling unit switchboards and panelboards supplied by a feeder required to be marked to indicate where the power supply source is located.

Feeder Panelboard

2008

408.3(F)(2) Marking - Ungrounded Systems



A switchboard or panelboard containing an ungrounded electrical system as permitted in 250.21 shall be legibly and permanently field marked as follows:

'Caution: Ungrounded System Operating Volts Between Conductors'

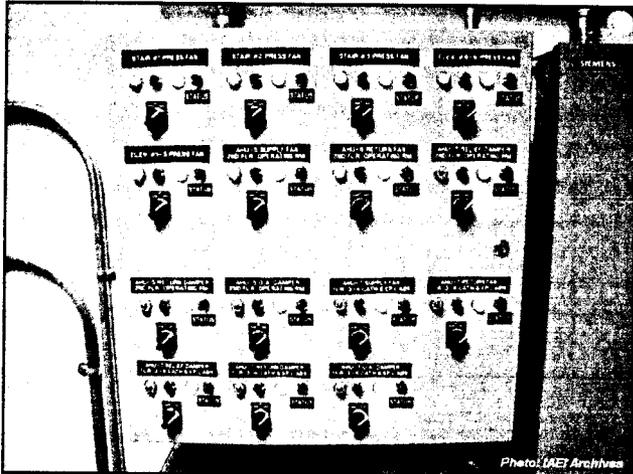
Ungrounded system

2008

409.110(3) Exception to (3)

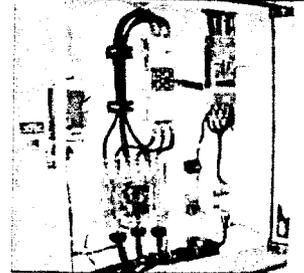
- Short-circuit current rating markings are not required for industrial control panels containing only control circuit components.

2008



409.104(A) Industrial Control Panels - Wiring Space

Other equipment (other than switches or overcurrent devices) permitted to be installed in industrial control panels with adequate wire bending space provided.



Other equipment shall not occupy more than 40 percent of the cross-sectional area of the wiring space, and the volume of the conductors, boxes, and taps shall not fill the wiring space at any cross section to more than 75 percent of the cross-sectional area of that space.

409.104(A) Wiring Space (Industrial Control Panels)

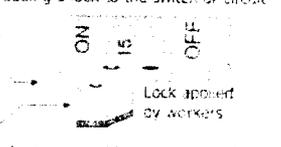
- Other equipment (other than switches or overcurrent devices) permitted to be installed in industrial control panels with adequate wire bending space provided
- The term "other equipment" added here to accommodate other types of devices and equipment (other than switches or overcurrent devices) which are installed in industrial control panels
- Previous language indicated that an industrial control panel could serve as a junction box for conductors tapped off of something like a contactor without adequate wire bending space provided
- "Other equipment" could include such things as terminal blocks, control transformers, and relays

Capable of Being Locked in the Open Position

- The rules for required disconnecting means have been revised to address the specific characteristics of disconnects that are capable of being locked in the open position.
- The provision for adding a lock is required to remain with the switch or circuit breaker whether the lock is installed or not.
- The provision should be inherent to the equipment or be an accessory feature that is provided by the manufacturer for establishing the locking capability.

Disconnects Capable of Being Locked Open

The provisions for locking or adding a lock to the disconnecting means shall remain in place at the switch or circuit breaker whether the lock is installed or not. Portable means for adding a lock to the switch or circuit breaker shall not be permitted.



Lock applied by workers

Applies in multiple sections such as:

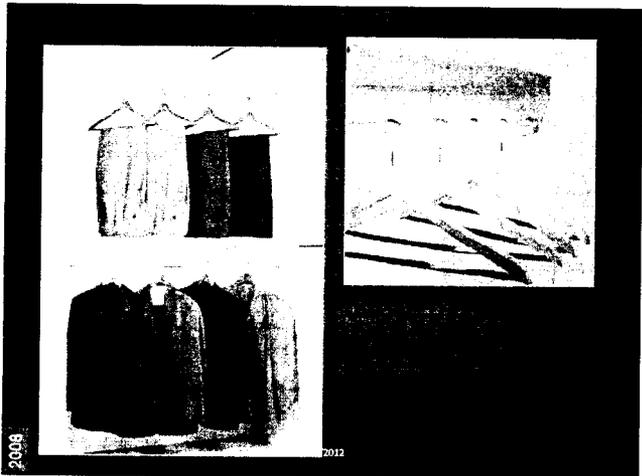
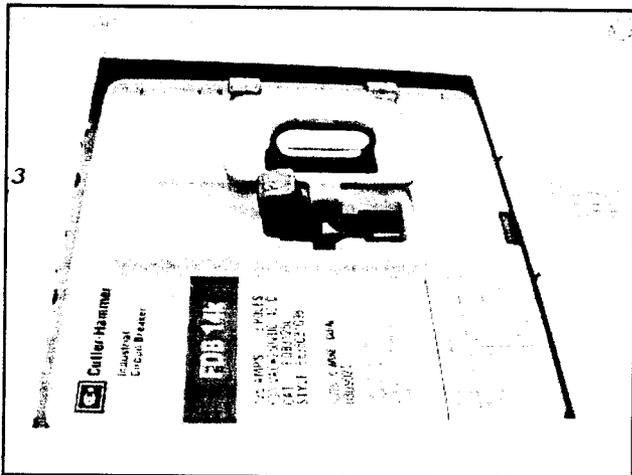
- 410.141(B)
- 422.31(B)
- 424.19
- 410.14 Exception No. 1
- 600.6(A)(2)(3)
- 620.51(A) Exception No. 1
- 620.53
- 620.55

2008

410.16 Luminaires in Clothes Closets

- (A)(3) Surface-mounted fluorescent or LED luminaires identified as suitable for installation within the storage area.
- (C)(1) 300 mm (12 in.) for surface-mounted incandescent or LED luminaires...or on the ceiling.
- (C)(3) 150 mm (6 in.) for recessed incandescent or LED luminaires...or the ceiling.
- (C)(5) Surface-mounted fluorescent or LED luminaires shall be permitted to be installed in the storage space where identified for this use.

2008

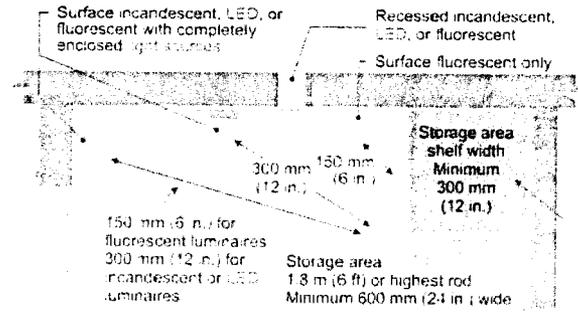


410.30(B)(1) Handhole

- (1) A pole shall have a handhole not less than 50 mm × 100 mm (2 in. × 4 in.) with a cover suitable for wet locations to provide access to the supply terminations within the pole or pole base.

2008

410.16 Luminaires in Clothes Closets

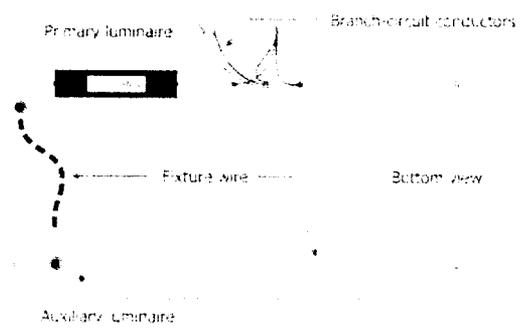


Surface-mounted fluorescent or LED luminaires permitted to be installed within the closet storage area, where identified for this use.

Reference shall be made to 410.16(B)(1) for permitted surface-mounted LED luminaires in clothes closets.



402.11 Uses Not Permitted

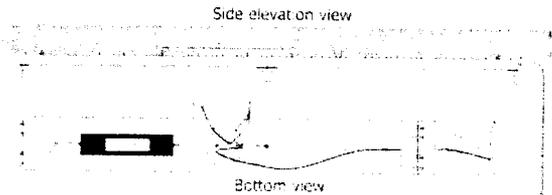


Fixture wire shall not be used as branch-circuit conductors, except as permitted in 402.11(B)(1) and (2).

2008

410.64 Luminaires as Raceways

References to rules for luminaires used as raceways have been incorporated into one section of the Code.



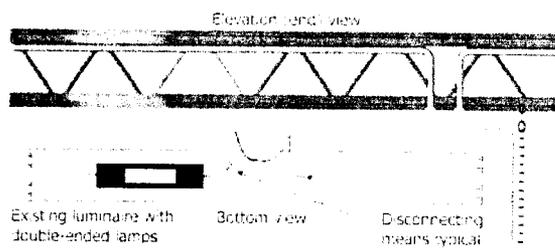
Luminaires shall not be used as a raceway for circuit conductors unless they comply with the following:

- Listed and marked for use as a raceway
- Compliant with the requirements of 410.110
- Designed for end-to-end connection to form a continuous assembly, or connected together by recognized wiring methods (2-wire branch circuit)

410.141(B) Within Sight or Locked Type

- (B) Within Sight or Locked Type. The switch or circuit breaker shall be located within sight from the luminaires (fixtures) or lamps, or it shall be permitted elsewhere if it is provided with a means for locking in the open position.
- The provisions for locking or adding a lock to the disconnecting means must remain in place at the switch or circuit breaker whether the lock is installed or not.
- Portable means for adding a lock to the switch or circuit breaker shall not be permitted to meet the installation requirements in the *NEC*.

410.130(G)(1) Disconnecting Means



In indoor locations (other than dwelling units) fluorescent luminaires that utilize double-ended lamps and contain ballast(s) that can be serviced in place shall have a disconnecting means either internal or external to each luminaire (see exceptions).

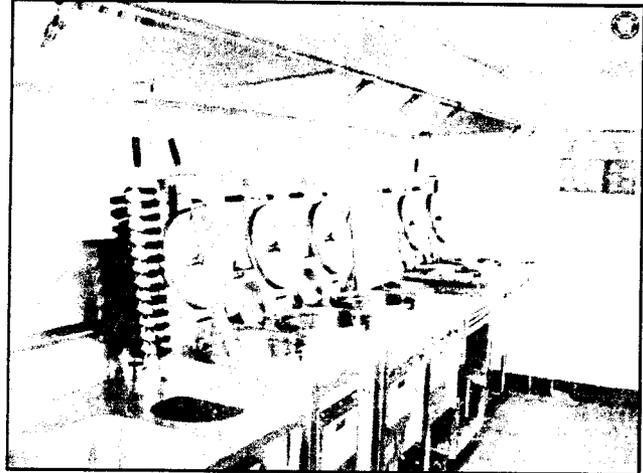
Disconnecting means not used for servicing in place shall be without disconnecting means, and shall be readily accessible.

410.151(B) FPN

- The fine print note to 410.151(B) has been revised to clarify that the length of track and number of luminaires installed on the track are not limited by the provisions in 410.151(B).
- The load calculation in 220.43(B) does not limit the length of track on a single branch circuit, and it does not limit the number of luminaires on a single track.

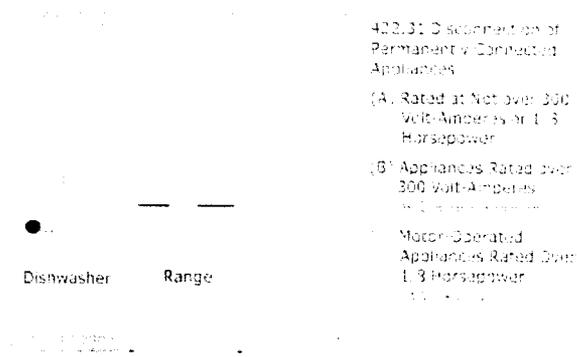
422.30 Disconnecting Means for Appliances

- "Simultaneously" was added to the disconnecting means requirements for appliance
- Required appliance disconnecting means is to disconnect all the ungrounded conductors of each appliance at the same time (*simultaneously*)
- Previous language identified that an appliance could be supplied by more than one source
- Revision clearly identifies these sources as either a branch circuit or feeder



422.31 Disconnecting Means for Appliances

Disconnecting means requirements when an appliance contains a motor over 1/3 horsepower; have been revised and clarified.



422.31 Disconnecting Means for Permanent or Connected Appliances

(A) Rated at Not over 300 Volt-Amperes or 1/3 Horsepower

(B) Appliances Rated over 300 Volt-Amperes or 1/3 Horsepower

Motor-Operated Appliances Rated Over 1/3 Horsepower

422.52 Electric Drinking Fountains

- Electric drinking fountains shall be protected with ground-fault circuit-interrupter protection.
- Bottled water coolers are not affected by this rule.

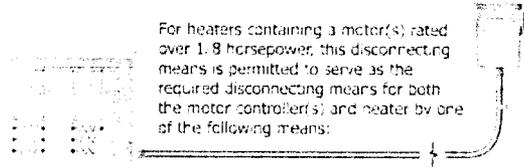
424.19 Disconnecting Means

- The disconnecting means covered by this requirement must have an ampere rating not less than 125% of the total of the motor and heater loads.
- The provisions for adding a lock to the disconnecting means shall be installed on or at the switch or circuit breaker used as the disconnecting means and shall remain in place with or without the lock installed.

4008

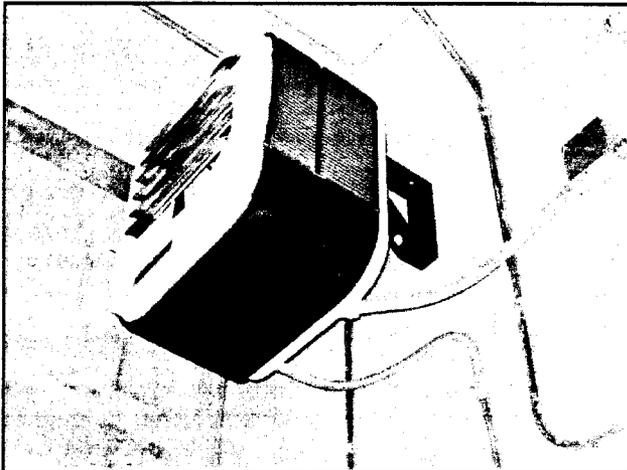
424.19(A)(2) Disconnecting Means (FESE)

Means shall be provided to simultaneously disconnect the heater, motor controller(s), and supplementary overcurrent protective device(s) of all fixed electric space-heating equipment from all ungrounded conductors



For heaters containing a motor(s) rated over 1/8 horsepower, this disconnecting means is permitted to serve as the required disconnecting means for both the motor controller(s) and heater by one of the following means:

- Where the disconnecting means is in sight from the motor controller(s) and the heater, and complying with Part 19 of Article 410 and 412 of the Code, it shall be permitted.
- Where the disconnecting means is not in sight from the motor controller(s) and the heater, the disconnecting means shall be permitted to be out of sight from the motor controller.



424.39 Clearances - Electric Space-Heating Cables

Heating cables require at least 200 mm (8 in.) separation from the edge of surface luminaire outlet boxes and junction boxes

50 mm (2 in.) clearance required from recessed luminaires and their trim, ventilating openings, and other such openings in room surfaces

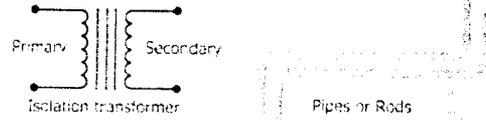


Heating cables shall not be covered by any surface-mounted luminaire

424.44(G) Heating Cables in Floors

- GFCI protection now required for cables installed in electrically heated floors of kitchens as well as in bathrooms and in hydromassage bathtub locations
- GFCI protection of electrical heating cables in kitchen masonry floors should include the same GFCI protection currently provided in bathrooms and hydromassage tub locations
- This GFCI protection will help reduce shock hazards to persons in contact with these heated floors
- This GFCI requirement applies regardless of the type of floor covering over the concrete or poured masonry such as wood, vinyl, or ceramic tile

426.2 and 426.31 Fixed Outdoor Electric Deicing and Snow-Melting Equipment



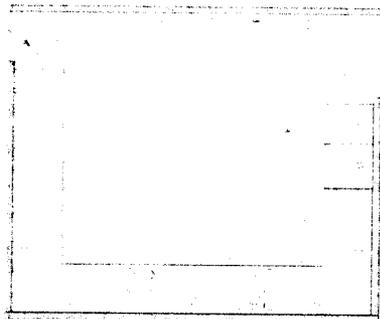
Impedance Heating System - A system in which heat is generated in a pipe or rod, or combination of pipes and rods, by causing current to flow through the pipe or rod by direct connection to an ac voltage source from an isolation transformer.

Isolation Transformer - An isolation transformer with a grounded shield between the primary and secondary windings shall be used to isolate the distribution system from the heating system.

Section 426.31 has been replaced with 426.2 since many transformers have more than two windings.

424.44(G) Heating Cables in Floors

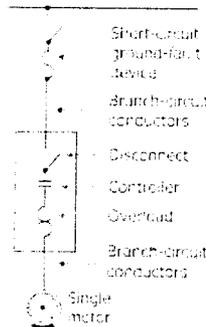
Heating cables or panels in floors (GFCI protection required)



Electric heating cables installed in floors in bathrooms, kitchens, and in hydromassage bathtubs locations required to be GFCI protected

430.22 Motor Circuit Conductors (Single Motor)

Revisions were incorporated to provide clarification as to the application of the 125 percent factor and when to apply it for sizing conductors for a single motor.



430.22 Single Motor (Motor Circuit Conductors)

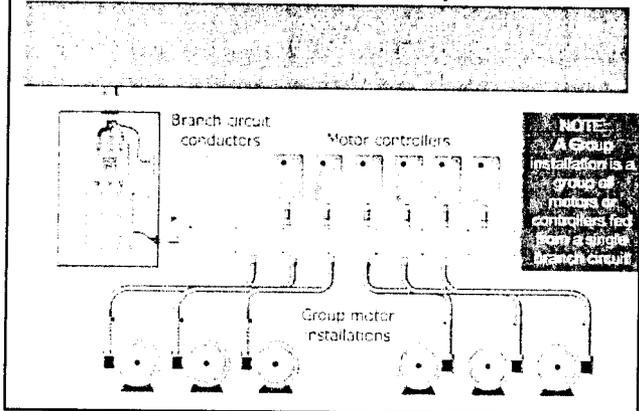
Conductors that supply a continuous duty single motor must have an ampacity of not less than 125 percent of the full-load current (FLC) taken from the appropriate table.

- (A) Inverters
- (B) Air-Handled Motor
- (C) Auto-Start, Direct-Run Motor
- (D) Part-Winding Motor
- (E) Other Than Continuous Duty
- (F) Separate Terminal Enclosure

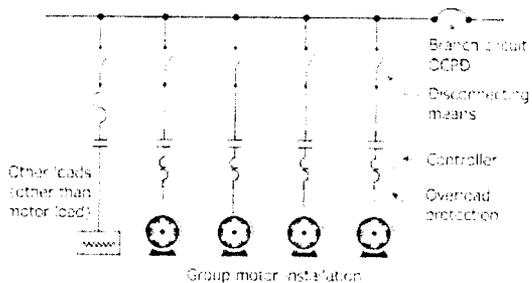
430.53 Several Motors or Loads on One Branch Circuit

- Inverse time circuit breakers and fuses are the only permitted means for providing group motor branch circuit short-circuit and ground-fault protection
- The Code permits more than one motor or motor(s) and other loads to be supplied with one branch circuit (with conditions)
- Instantaneous trip circuit breakers are not permitted to be used in group installations as coordination of these circuit breakers is typically very difficult, if not impossible to achieve when used in these group installations
- Clarifications to this section will help avoid misapplication of these types of devices

430.53(C)(1) and (C)(2) Several Motors or Loads on One Branch Circuit - Other Group Installations



430.53 Several Motors or Loads on One Branch Circuit



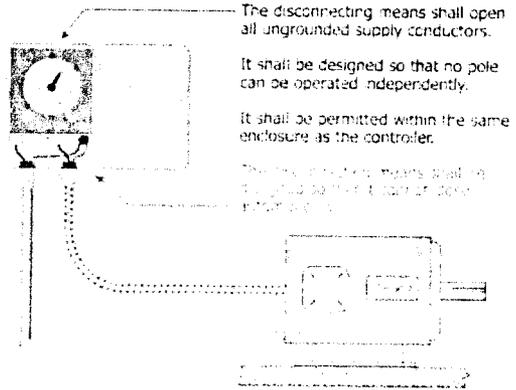
Two or more motors or one or more motors and other loads are permitted to be connected to the same branch circuit under specific conditions. The permitted conditions are listed in 430.53(C)(1) and (C)(2).

Is this a group installation?

430.53(D)(3) Several Motors or Loads on One Branch Circuit – Single Motor Tap

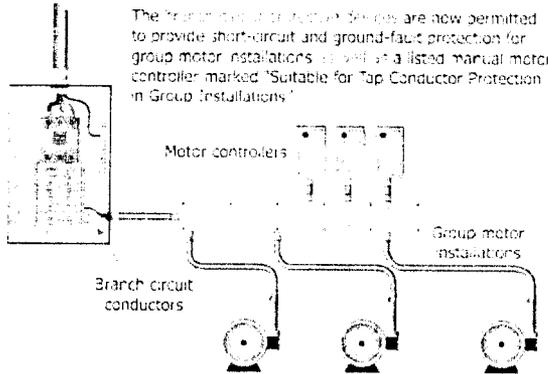
- Branch-circuit protective devices are now permitted to provide short-circuit and ground-fault protection for group motor installations and not required to be identified for group installations
- For group motor applications, 430.53(D)(3) permit tapping a branch circuit to supply a single motor
- These tap conductors are permitted to terminate in a listed manual motor controller that is marked "Suitable for Tap Conductor Protection in Group Installations"
- Revisions will now allow the branch-circuit protective device to provide short-circuit and ground-fault protection for group installations and not be required to be identified for group installations

430.103 Operation



430.53(D)(3) Several Motors or Loads on One Branch Circuit - Single Motor Tap

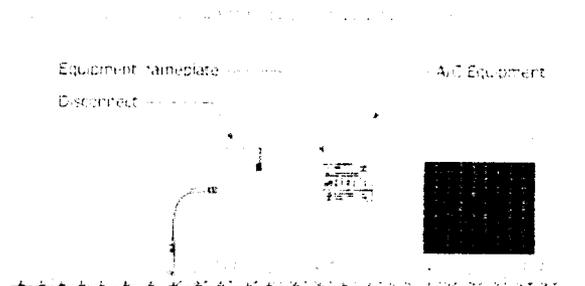
The branch-circuit protective devices are now permitted to provide short-circuit and ground-fault protection for group motor installations as well as a listed manual motor controller marked "Suitable for Tap Conductor Protection in Group Installations"



440.14 Location

Disconnect is required to be installed within sight and readily accessible from air-conditioning and refrigerating equipment

Disconnect is permitted to be installed on or within the equipment



445.19 Generators Supplying Multiple Loads

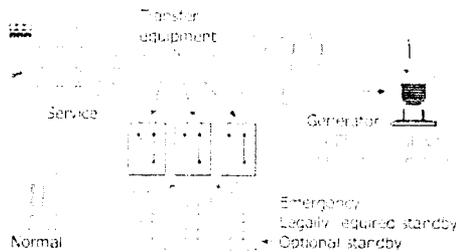
- Revision clarifies the application of tap conductors where multiple enclosures are supplied from a generator
- Generator(s) are now required to have overcurrent protection meeting the requirements of 240.15(A) (*Overcurrent Device Required- Ungrounded Conductors*) allowing the tap conductors to meet the definition of "Tap Conductors" at 240.2
- Feeder taps without overcurrent protection upstream is in conflict with the requirements described in 240.21 (*Overcurrent Protection-Location in Circuit*)
- Modern generators typically employ a listed overcurrent protective device integral with the control function

450.14 Disconnecting Means -Transformers

- New disconnecting means labeling requirements added for transformers (other than Class 2 or Class 3)
- This brings transformers in line with other electrical apparatus with similar disconnecting means requirements such as motors, generators, appliances, air-conditioning equipment, etc.
- Intended to enhance safety for qualified electrical workers when they work with or perform maintenance on transformers

445.19 Generators Supplying Multiple Loads

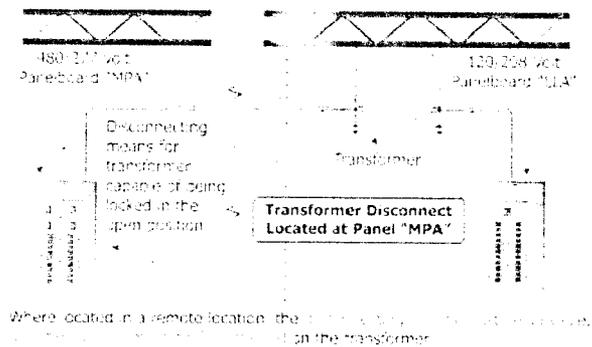
A single generator supplying more than one load, or multiple generators operating in parallel, are permitted to supply either of the following:

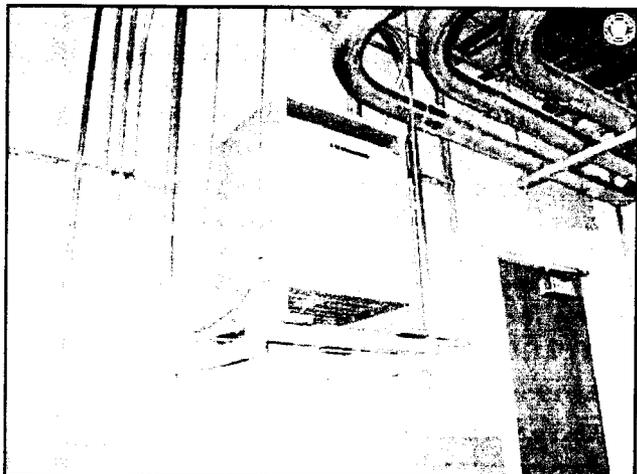


- (1) A vertical switchboard with separate sections
- (2) Individual enclosures with overcurrent protection tapped from a single feeder for load separation and distribution

450.14 Transformers - Disconnecting Means

Transformers (other than Class 2 or Class 3) shall have disconnecting means located either in sight of the transformer or in a remote location.





Articles 500 Through 504 – Scope

- The phrase “flammable gases or vapors, flammable liquids, combustible dusts, or ignitable fibers or flyings” has been revised to “flammable gases, flammable liquid-produced vapors, combustible liquid-produced vapors, combustible dusts, or ignitable fibers/flyings” in multiple sections within Articles 500, 501, 502, 503, 504, and 506.
- Vapors produced from both flammable and combustible liquids are principle factors that prompt requirements for area classification and special consideration for electrical equipment and installations in these locations.

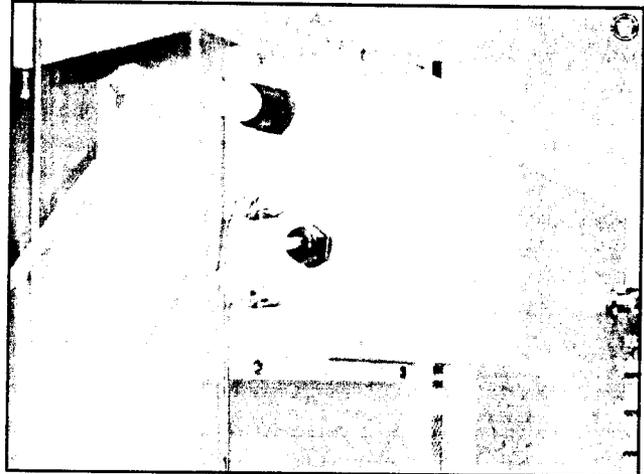


500.2 Definitions: Combustible Dust

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

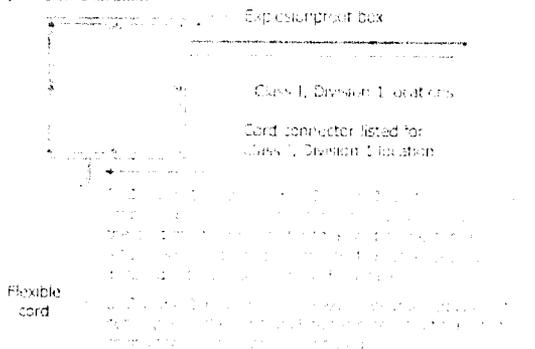
Types of EGCs (Hazardous Locations)

- Flexible metal conduit and liquidtight flexible metal conduit shall include an equipment bonding jumper of the wire type in compliance with 250.102
- This same revision occurred at four other locations in the *NEC*. These common revisions will correlate the equipment grounding conductor requirements in the following locations:
 - 501.30(B) Class I, Divisions 1 and 2 Proposal 14-66
 - 502.30(B) Class II, Divisions 1 and 2 Proposal 14-104
 - 503.30(B) Class III, Divisions 1 and 2 Proposal 14-140
 - 505.25(B) Class I, Zone 0, 1, and 2 Proposal 14-215a
 - 506.25(B) Zone 20, 21, and 22 Locations Proposal 14-245a



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

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



502.130(A)(3) Pendant Luminaires

- Pendant luminaires in Class II, Division 1 classified areas permitted to use flexible cord listed for hard usage as a wiring method when terminated with a cord connector listed for dust-tight ignitionproof protection
- Revision makes it clear that a listed cord-connector must be used with the flexible cord and a suitable seal is still necessary when using a flexible cord
- Reference to 502.10(A)(2)(5) (*Wiring Methods and Flexible Connections in Class II, Division 1 Locations*) has been added (reference to 502.140)
- 502.140 (*Flexible Cords - Class II, Divisions 1 and 2*) to further require the flexible cord to be terminated with dust-tight ignitionproof fittings for sealing of flexible cord

502.130(A)(3) Pendant Luminaires (Class II Division 1 Locations)

Pendant luminaires in Class II, Division 1 classified areas are permitted to employ flexible cord listed for hard usage as a wiring method when terminated with a listed cord connector that maintains the dust-tight ignitionproof protection.

Class II, Division 1 location

Flexible cord listed for hard usage

Where wiring between an outlet box or fitting and a pendant luminaire is not enclosed in conduit, flexible cord listed for hard usage shall be permitted, and shall be identified for the purpose of minimizing passage of gases, vapors, or dusts.

504.70 Sealing

Intrinsically safe circuit wiring

Conduit or cable seal fitting

Seals are required to be accessible.

- Not required to be explosionproof or flameproof.
- Shall be identified for the purpose of minimizing passage of gases, vapors, or dusts under normal operating conditions.

Conduit and cable seals for intrinsically safe circuits and wiring required to be sealed in accordance with 501.15, 502.15, 505.15, and 506.15 shall be sealed to minimize the passage of gases, vapors, or dusts.

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

In Class III, Division 1 locations where it is necessary to employ flexible connections, the following wiring methods are permitted:

- Dusttight flexible connectors
- Liquidtight flexible metal conduit
- Liquidtight flexible nonmetallic conduit with listed fittings.
- Interlocked armor Type MC cable with listed dusttight terminations, provided the armor is not damaged, and the cable is not used in a location where it is subject to damage.
- Flexible cord in compliance with 503.140

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

511.2 and 511.3 Commercial Garages, Repair and Storage

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

511.2 Major Repair Garage

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

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

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

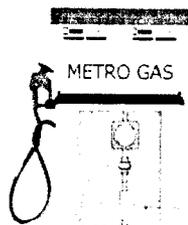
511.2 Minor Repair Garage

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

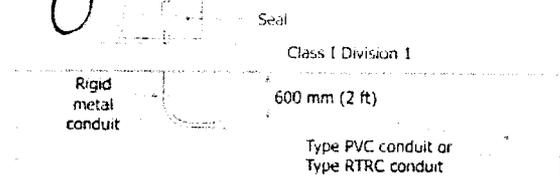
514.8 Ex. No. 2 Underground Wiring (Motor Fuel Dispensing Facilities)

- Revisions to the term "rigid nonmetallic conduit" wiring methods make the Type PVC and Type RTRC conduit terminology consistent with other sections and articles throughout the *NEC*
- The main rule at 514.8 limits acceptable wiring methods under dispensing facilities to threaded rigid metal conduit or threaded steel intermediate metal conduit
- Ex. No. 1 to 514.8 permits Type MI cable
- Previous Ex. No. 2 permitted "rigid nonmetallic conduit" where buried under not less than 600 mm (2 ft) of cover
- Revision limits "rigid nonmetallic conduit" to Type PVC (Rigid Polyvinyl Chloride Conduit) or Type RTRC (Reinforced Thermosetting Resin Conduit) conduit

514.8 Underground Wiring (Motor Fuel Dispensing Facilities)



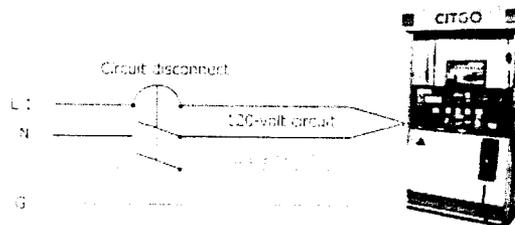
Revisions to the term "fluid-conducting wiring methods" make the "Type RTRC and Type RTRC-EM" terminology consistent with other sections and articles throughout the NEC.



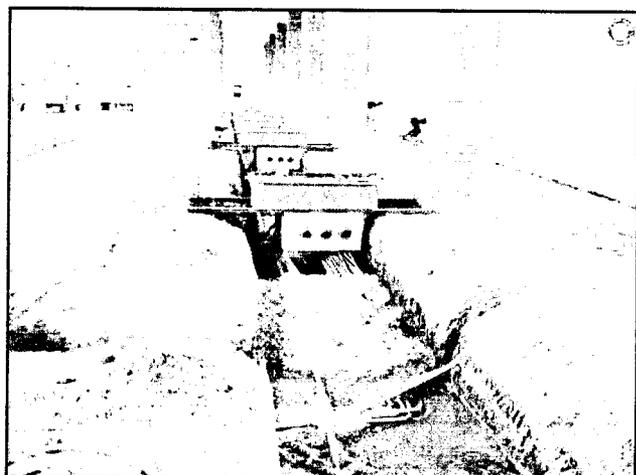
514.11 Circuit Disconnects (Motor Fuel Dispensing Facilities)

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

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

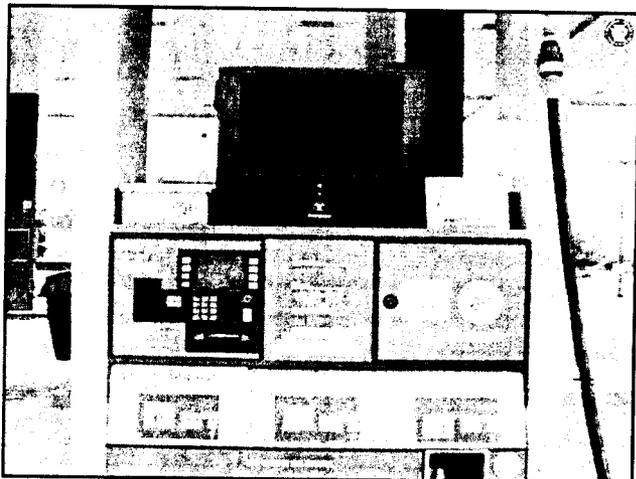


This same basic change of adding communication, data, and video circuits to the disconnecting means requirement also occurred at 514.12 (Provisions for Maintenance and Servicing of Dispensing Equipment).



514.11 Circuit Disconnects (Motor Fuel Dispensing Facilities)

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



517.2 Wet Procedure Location

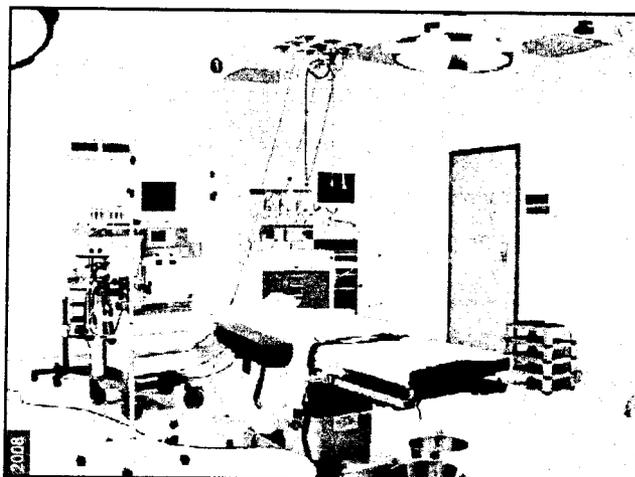
- The word *procedure* has been incorporated into the definition of *wet location* in 517.2 and in Sections 517.20(A) and 517.60 FPN.
- The defined term *wet procedure location* is provided under the general definition of *patient care area*.
- This change assist users with more specific and unique characteristics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

2008

517.2 Patient Care Vicinity

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

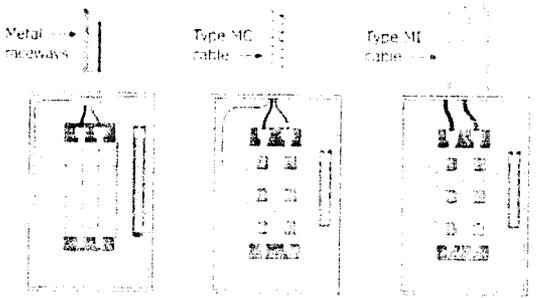
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517.19(D) Panelboard Grounding and Bonding

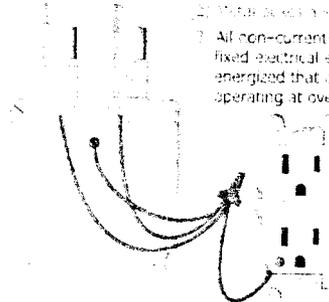
Section 517.19(D) covers grounding and bonding requirements for feeders supplying critical branch switchboards or panelboards. Bonding shall be ensured by any of the means specified in 517.19(D)(1), (2), or (3).



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

The following shall be directly connected to an insulated copper EGC that is grounded to earth ground fault conductors in the wiring methods as provided in 250.146(D).

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



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

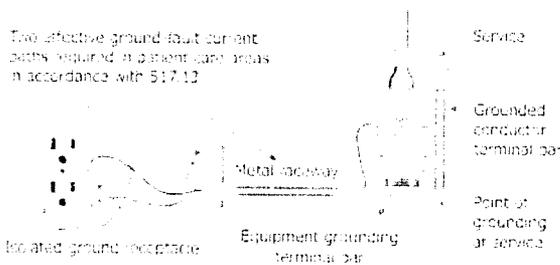
517.32(C)(3) Alarm and Alerting Systems

- Section 517.32(C) has been revised to include a new list item (3) under alarm and alerting systems.
- Mechanical, control, and other accessories, such as dampers and some motors, required for effective life safety shall be permitted to be supplied by the life safety branch.

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

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

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



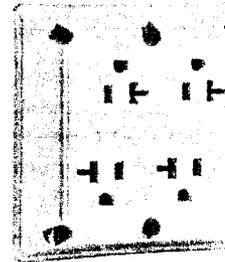
Receptacles with insulated grounding terminals, as permitted in 250.146(D), shall not be installed.

517.18(B) Patient Bed Location Receptacles

- A quadruplex configuration of receptacles has been added to the acceptable configuration of receptacles required at patient bed locations of health care facilities
- Each patient bed location of a general care area must be provided with at least four hospital grade receptacles (duplex receptacle considered as two receptacles)
- Previous language only allowed "single or duplex types or a combination of both" for this minimum receptacle requirement
- This same basic quadruplex configuration of receptacles has been added to the acceptable configuration of receptacles required by 517.19(B)(2) for patient bed locations in critical care areas of health care facilities

517.18(B) Patient Bed Location Receptacles

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



Quadruplex Receptacle

517.18(B) Patient Bed Location Receptacles

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

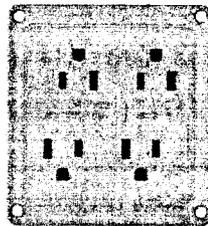
Single



Duplex



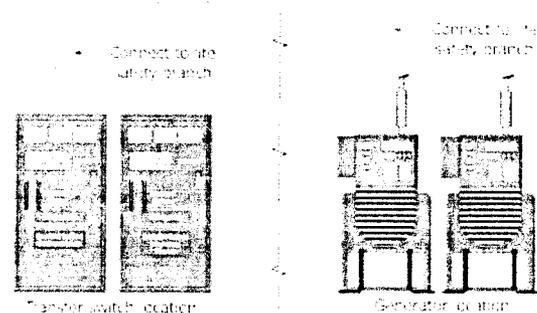
Quadruplex



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

517.32(E) Generator Set and Transfer Switch Location

Transfer switch location, battery charger for battery-powered lighting unit(s) and fire bed receptacles required at the generator set location.

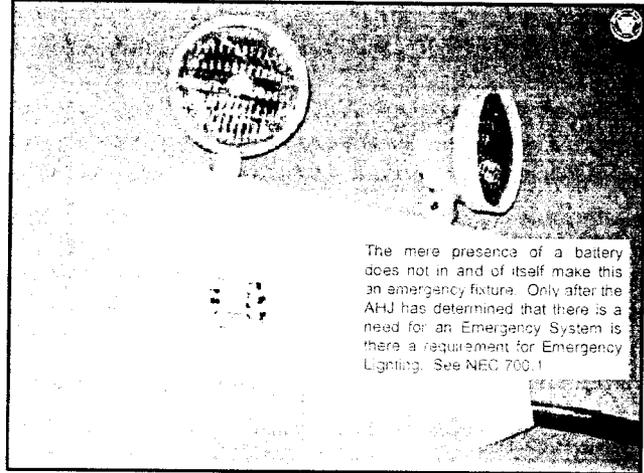


Note: Emergency lighting is often necessary for trouble-shooting generators and transfer switches under emergency conditions.

517.32(F) Life Safety Branch

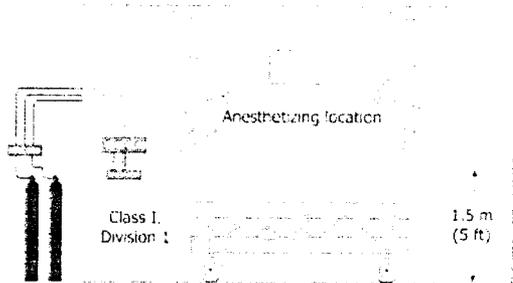
- A new list item (F) covering generator accessories has been added to 517.32.
- (F) Generator set accessories as required for generator performance.
- Generator set accessories such as crankcase heaters, coolant heaters, lights, receptacles, and so forth, are permitted to be connected to the life safety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

2009 5/15/2012



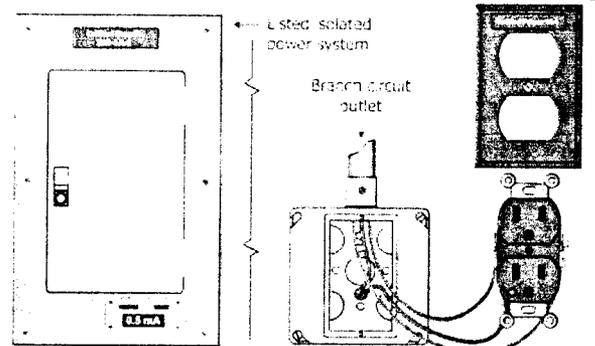
517.63(A) Battery-Powered Lighting Units

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



Battery-Powered Emergency Lighting Units - One or more battery-powered emergency lighting units to be provided and permitted to be connected to critical lighting circuits in the area and connected branch circuit conductors

517.160(A)(5) Conductor Identification



Isolated power system circuit conductors required to be identified by colors specified in 517.160(A)(5) and include at least one distinctive colored stripe (other than white, green, or gray) every 100 mm (4 in.) length of the conductor.

547.5(G) GFCI - Agricultural Buildings

The amount of GFCI protection for accessible receptacles in agricultural buildings shall be as follows:



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

- (1) Areas having an equipotential plane
- (2) Damp or wet locations
- (3) Dirt confinement areas for livestock
- (4) Outdoors



547.5(G) GFCI (Agricultural Buildings)

(G) Receptacles. All 125-volt, single-phase, 15- and 20-ampere general-purpose receptacles installed in the locations listed in (1) through (4) shall have ground-fault circuit-interrupter protection:

- (1) Areas having an equipotential plane
- (2) Outdoors
- (3) Damp or wet locations
- (4) Dirt confinement areas for livestock

GFCI protection shall not be required for an accessible receptacle supplying a dedicated load where a GFCI-protected receptacle is located within 900 mm (3-ft) of the non-GFCI-protected receptacle.

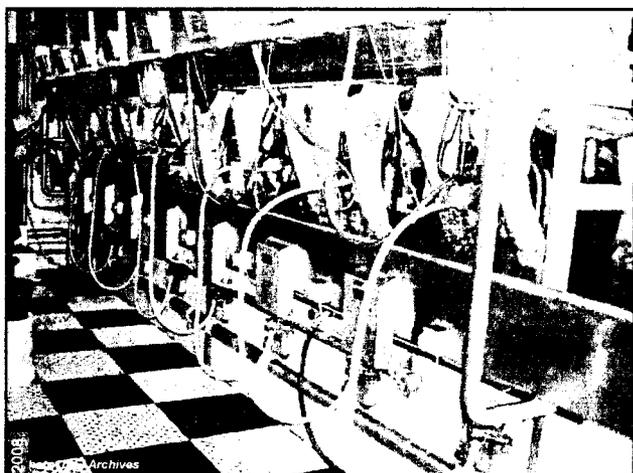
547.10 FPN No. 2 and 547.10(A)

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

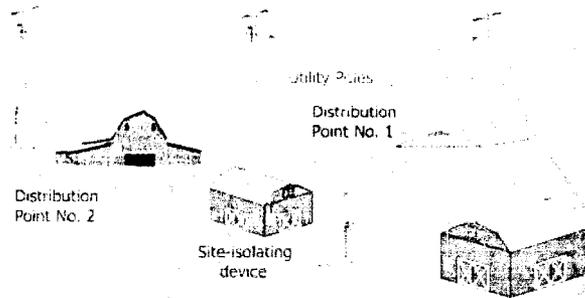


547.9(D) ID of Distribution Point(s)

- Where an agricultural site is supplied by more than one distribution point, a permanent plaque or directory is required to be installed at each distribution point *(regardless of the distance between distribution points)*
- The word "service" has been replaced with the term "distribution point" at this section
- Previously, if the site was supplied by more than one distribution point, with any two distribution points located a distance of 150 m (500 ft) or less apart, the permanent plaque requirement became applicable
- Permanent plaque identification requirements should apply whether or not the distribution points are within 150 m (500 ft) of each other or not



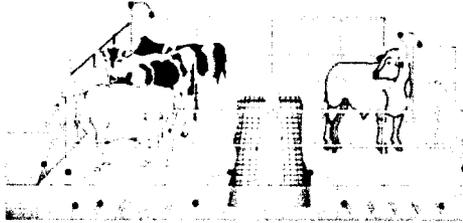
547.9(D) Identification of Distribution Point(s)



Where an agricultural site is supplied by more than one distribution point, a permanent plaque or directory is required to be installed at each distribution point.

547.10(B) Equipotential Planes - Bonding (Agricultural Buildings)

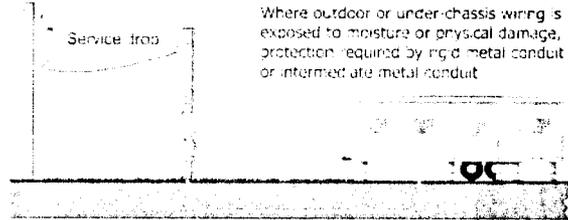
Equipotential planes must be installed in confinement areas with concrete floors (indoors) and areas with concrete slabs (outdoors) where metallic equipment is located that may become energized and accessible to livestock.



The bonding conductor for the equipotential bonding plane at agricultural buildings is required to be a copper, aluminum, insulated, covered or bare conductor, not smaller than 3 AWG.

550.15(H) Under-Chassis Wiring

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



(1) Where closely routed against frames and equipment enclosures, a minimum of 1/2 inch of rigid metal conduit (RMC), intermediate metal conduit, Type MI cable, electrical metallic tubing or rigid polyvinyl chloride conduit (PVC) shall be permitted.

(2) Where the length of the protection is less than 10 feet, the protection shall be permitted to be made of rigid polyvinyl chloride conduit (PVC) or electrical metallic tubing (EMT) with a minimum of 1/2 inch of protection.



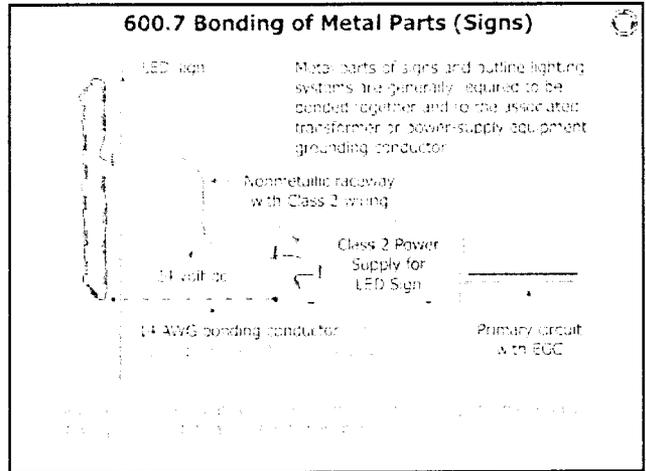
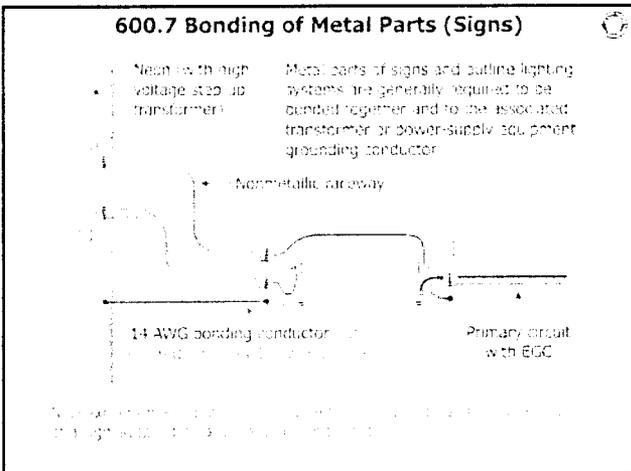
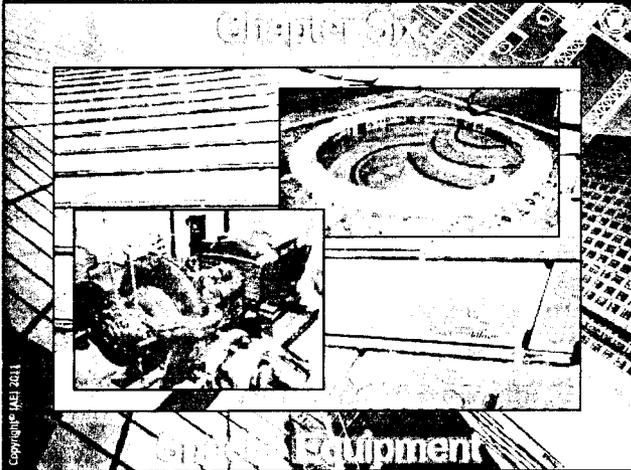
550.25 AFCIs (Mobile and Manufactured Homes)

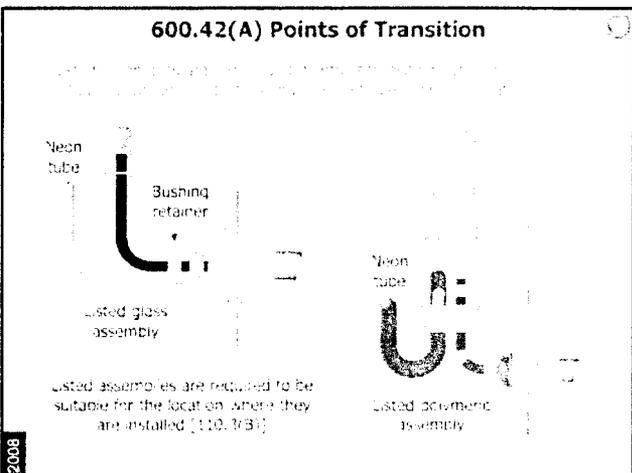
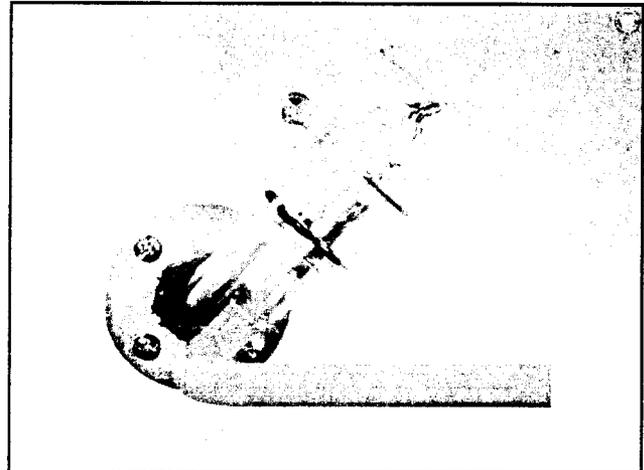
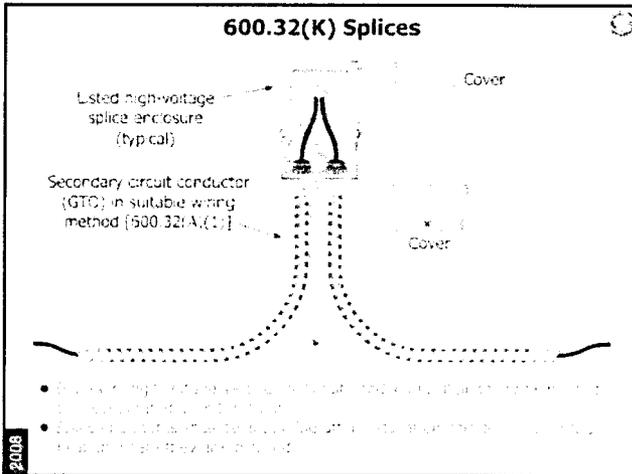
All 120-volt branch circuits that supply 15- and 20-ampere outlets installed in bedrooms, living areas, dining areas, and kitchen areas of mobile homes and manufactured homes shall comply with 210.12 (AFCI).



Overhead floor-plan view of mobile home or manufactured home

S = Outlets requiring AFCI-protected branch circuits



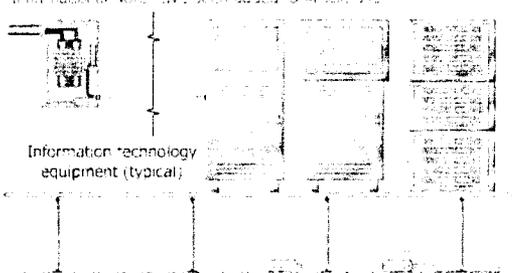


600.33 LED Signs

- New provisions governing the wiring method and materials for light-emitting diode (LED) type sign systems have been added to Article 600
- Clear and concise requirements for Class 2 LED circuits are needed for electric signs and outline lighting
- LED lighting systems have become an increasingly popular light source over the past decade or so
- This new section is designed to consolidate the majority of the rules for Class 2 power-limited wiring used in signs and outline lighting into Article 600

645.2 Definitions: IT Equipment (ITE)

A new Definition for "Information Technology Equipment" and a new Informational Note have been added to Article 645.

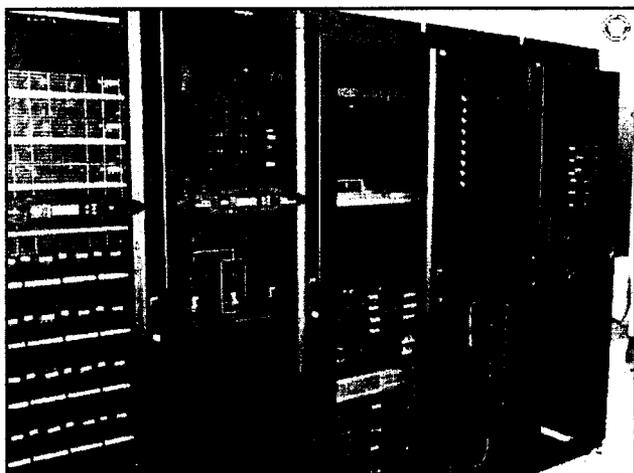


Information technology equipment (typical)

Equipment and systems rated 600V or less, normally found in offices or other business establishments and similar environments classified as ordinary locations, which are used for creation, and manipulation of data, voice, video and similar signals that are not communications equipment as defined in Part I of Article 100 and do not process communications circuits as defined in 300.2

645.4 Special Requirements for Information Technology Equipment Room

- Revisions to 645.4 were made to help clarify that Article 645 is an optional article
- A new Item (6) was added to prohibit the installation of equipment and wiring not associated with an ITE room for the purposes of utilizing Article 645 as a design option
- Main text at 645.4 was changed from "This article shall apply" to "This article shall be permitted to provide alternate wiring methods to the provisions of Chapters 1 through 4 for power wiring, 725.154 for signaling wiring, and 770.113(C) and Table 770.154(A) for optical fiber cabling, when all of the following conditions are met"
- See 645.4 for IT Equipment Room conditions

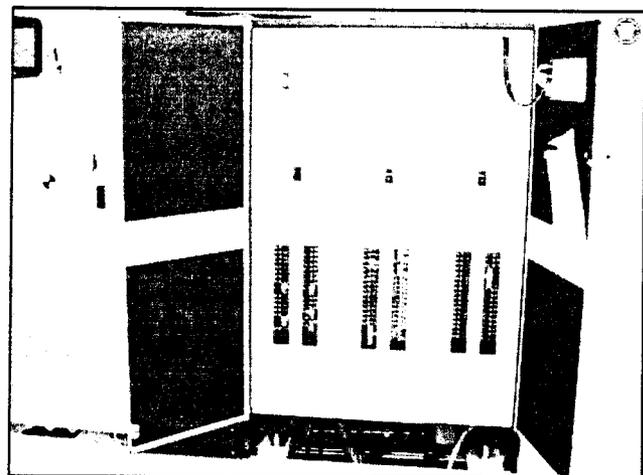
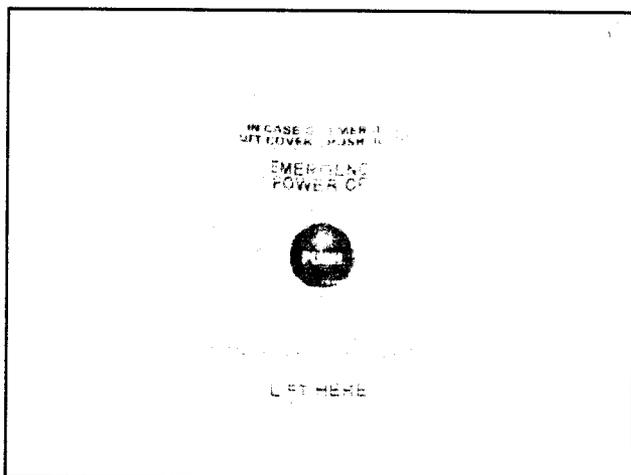


645.10 Disconnecting Means

- Disconnecting means requirements for IT equipment rooms has been revised
- Single disconnecting means actuator permitted to be located at an approved alternative location
- 645.10 has been completely restructured by creating two new Items (A) and (B)
- New 645.10(A) (*Remote Disconnect Controls*) has nearly the same requirements as the 2008 *NEC*, except the placement of the Emergency Power Off (EPO) actuator can be located in any approved alternative location, as opposed to limiting the location at the principal exit doors per prior language
- New 645.10(B) is the highest level of criticality for the operations and is classed as a "Critical Operations Data System" **and remote disconnection is NOT required.**

645.17 Power Distribution Units (Information Technology Equipment)

- Power distribution units that are used for information technology equipment shall be permitted to have multiple panelboards within a single cabinet, provided that each panelboard has no more than 42 overcurrent devices and if the power distribution unit is utilization equipment listed for information technology application
- The 42 overcurrent device limitation was removed
- Quantity of overcurrent devices in a PDU panelboard is determined by the design and listing of the panelboard
- Corresponds with changes that were implemented during the 2008 *NEC* process in Article 408



645.25 Engineering Supervision (IT Equipment)

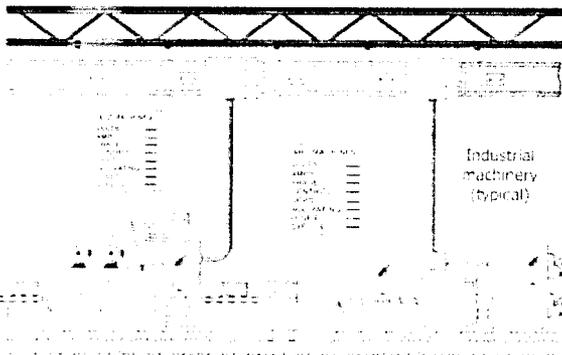
A new section has been added to allow alternative feeder and service load calculations to be done under engineering supervision in an IT equipment room.



As an alternative to the feeder and service load calculations required by Parts II and IV of Article 320, feeder and service load calculations for new or existing loads may be permitted to be used if performed by qualified persons under engineering supervision.

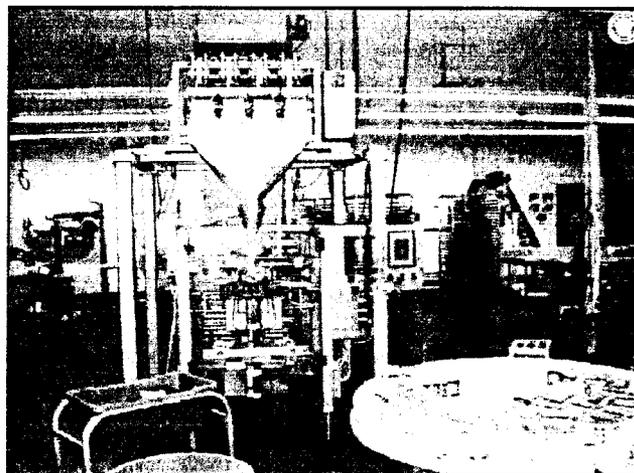
670.5 Short-Circuit Current Rating

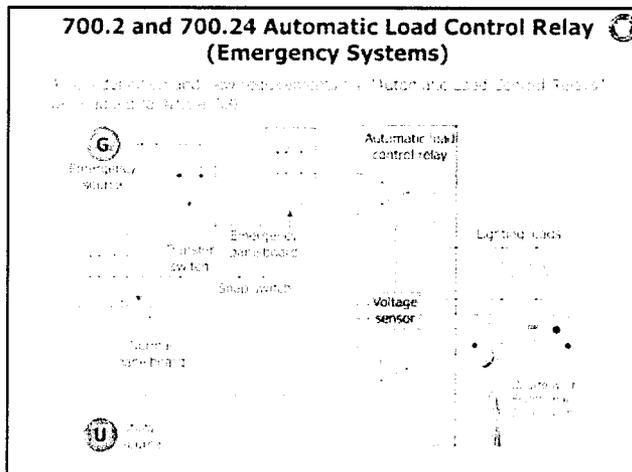
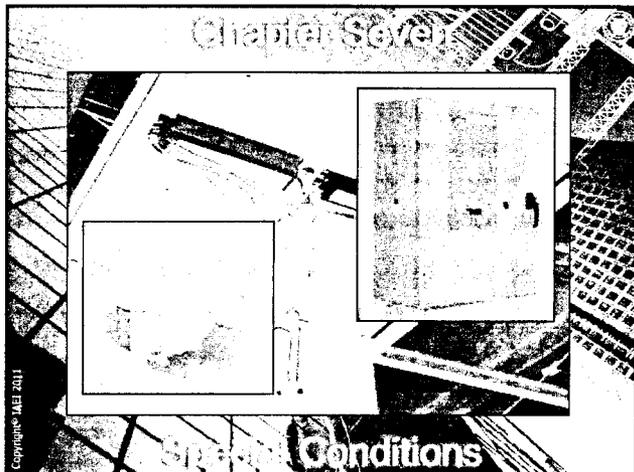
New section added requiring industrial machinery to be installed only where the available fault current does not exceed its marked short-circuit current rating.



670.5 Short-Circuit Current Rating (Industrial Machinery)

- New section (not a new requirement) requires industrial machinery to be installed only where the available fault current does not exceed its marked short-circuit current rating
- New section provides guidance for the industrial machinery marked short-circuit current rating to be in accordance with 670.3(A)(4)
- Provides clear language and direction for the overall short-circuit current rating on the control panel
- 670.3(A)(4) is to be used to evaluate suitability and available fault current ratings
- Please note that this is NOT a new requirement. NEC 110.10 already required equipment to be suitable for the AFC.



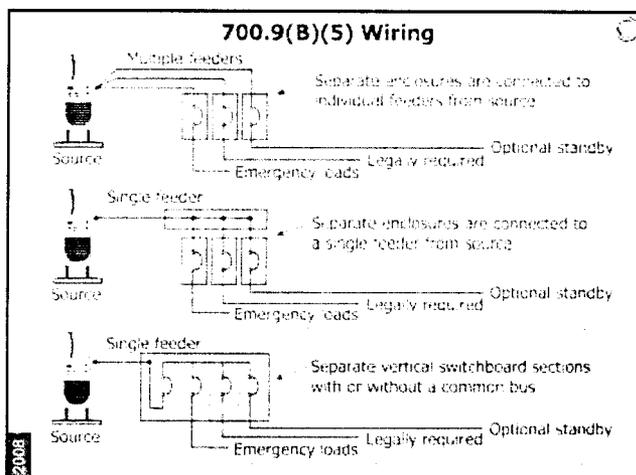
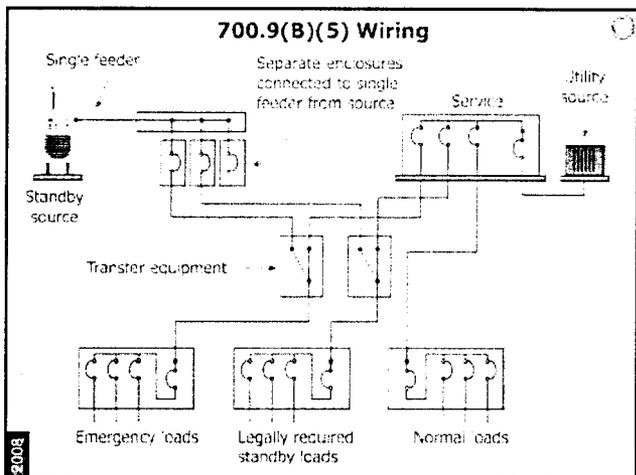
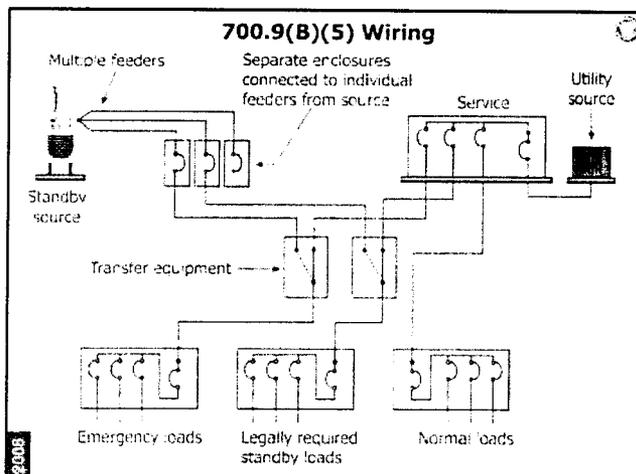
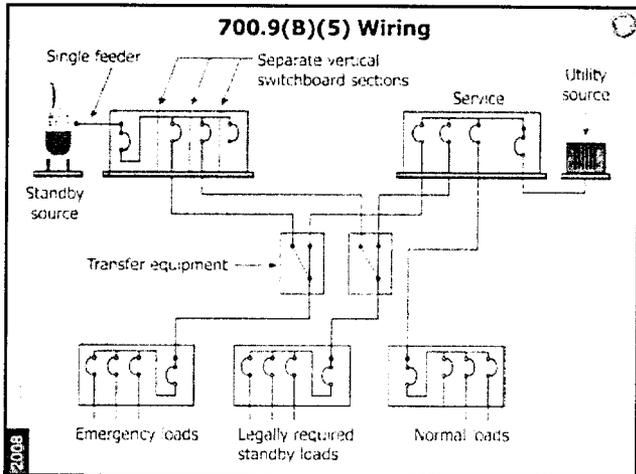


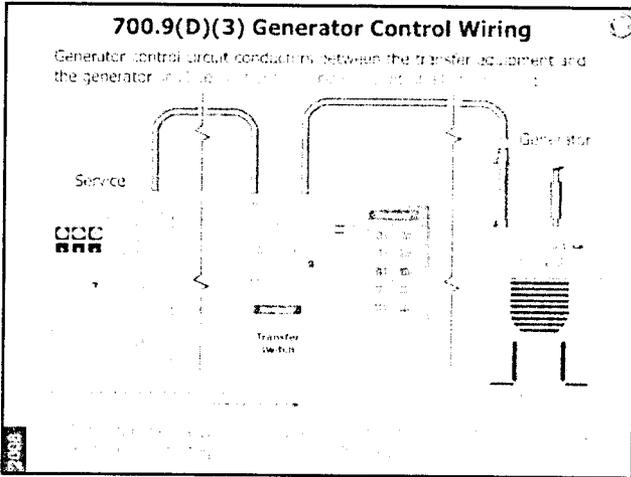
700.2 and 700.24 Automatic Load Control Relay

- A new definition and new requirements for "Automatic Load Control Relays" were added to Article 700
- **Relay, Automatic Load Control.** A device used to energize switched or normally-off lighting equipment from an emergency supply in the event of loss of the normal supply, and to de-energize or return the equipment to normal status when the normal supply is restored.
- **Informational Note:** For requirements covering automatic load control relays, see ANSI/UL 924, Emergency Lighting and Power Equipment.
- **700.24 Automatic Load Control Relay.** If an emergency lighting load is automatically energized upon loss of the normal supply, a listed automatic load control relay shall be permitted to energize the load. The load control relay shall not be used as transfer equipment.

700.9(B)(5) Wiring

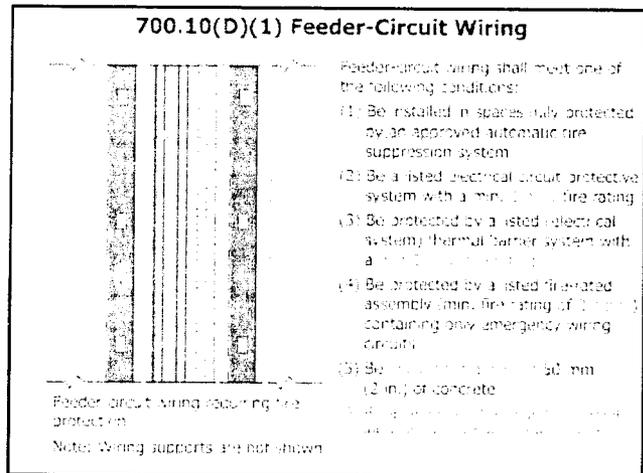
- A new item (5) has been added to Section 700.9(B).
- From the source to the loads or from the source distribution overcurrent protection to the loads, it is required to maintain separation unless modified by any of the provisions in items (1) – (5).
- The revised text clarifies that it is permitted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





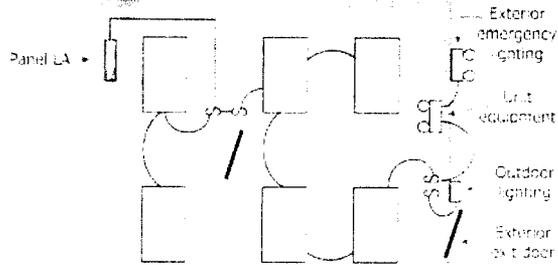
- ### 700.10(D)(1) Feeder-Circuit Wiring (Emergency System)
- Revision increases the fire rating time from 1 hour to 2 hours for emergency system wiring (A occupancies of 1000 or more.)
 - Safe and systematic operation of emergency electrical systems is critical for heavily populated buildings and for high-rise occupancies
 - Fire protection requirements for emergency system feeder circuits help maintain the reliability as well as the performance of the emergency electrical system
 - Revision increases reliability and performance by providing more time to safely evacuate the building in an emergency

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

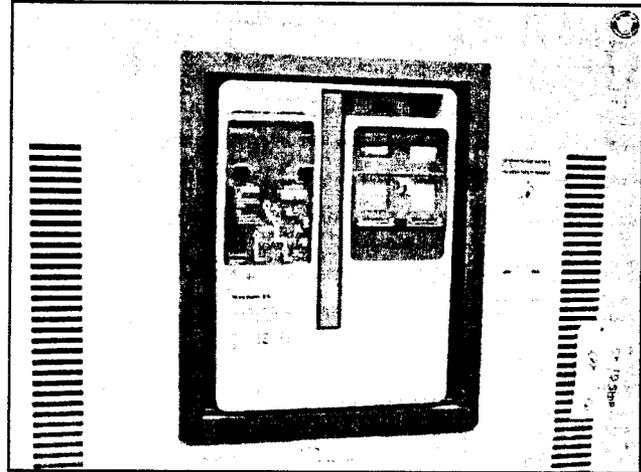


700.12(F) Ex. No. 2 Unit Equipment

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

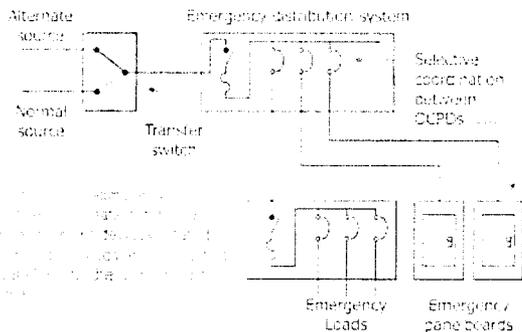


4. Unit equipment shall be connected to the branch circuit serving the normal lighting in the area and connected ahead of any local switches.



700.27 Coordination (Emergency Systems)

Emergency system's overcurrent devices shall be selectively coordinated with all supply side overcurrent protective devices to isolate the fault to the device closest to the fault condition.

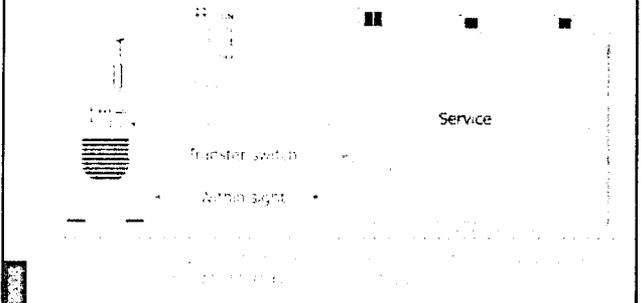


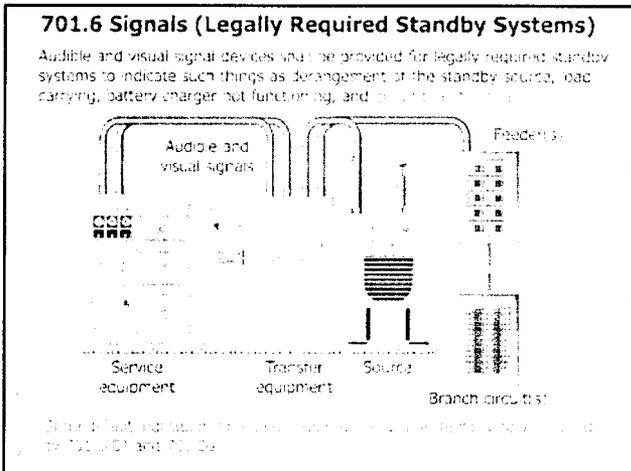
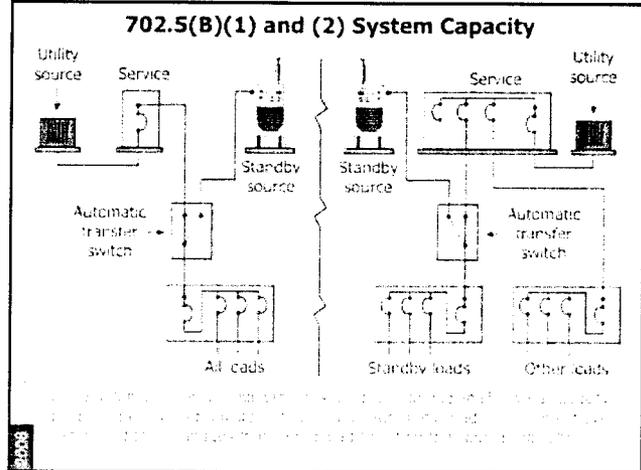
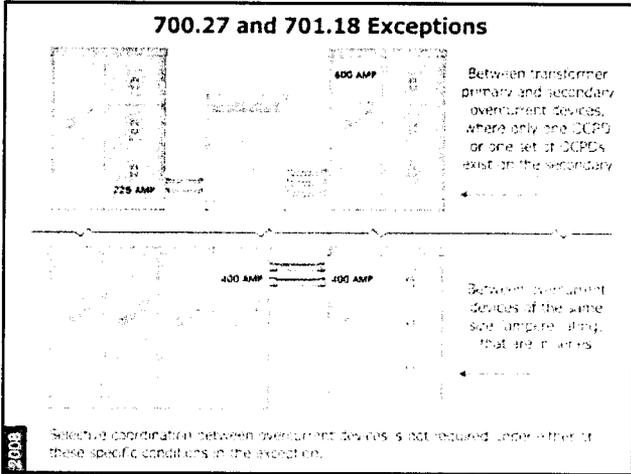
Emergency system's overcurrent devices shall be selectively coordinated with all supply side overcurrent protective devices to isolate the fault to the device closest to the fault condition.

700.12(B)(6) Outdoor Generator Sets

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

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





Article 708 Critical Operations Power Systems (COPS)

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

Scope and Applicability

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

2008

Contributors to this presentation include

- International Association of Electrical Inspectors
- National Electrical Manufacturers Association
- Sandia National Laboratory
- MEP Consulting
- Square D
- Siemens
- Eaton Corporation
- Cooper Industries
- Underwriters Laboratories

**Thank you
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