



31st Annual State Construction Conference

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2011 NEC Electrical Code Update

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2011 NEC– Major changes:

Code Wide Changes:

Grounding Conductor Definitions

Fine Print Notes – Informational Notes

Annexes are not enforceable Code.

New Chapters

399 – Outdoor OH Conductors > 600 V

694 – Small Wind Electric Systems

840 – Premise-Powered Broadband Communications

“Fine Print Notes” have been changed and are now referred to as “Informational Notes” throughout the Code.

90.5(C) Explanatory Material



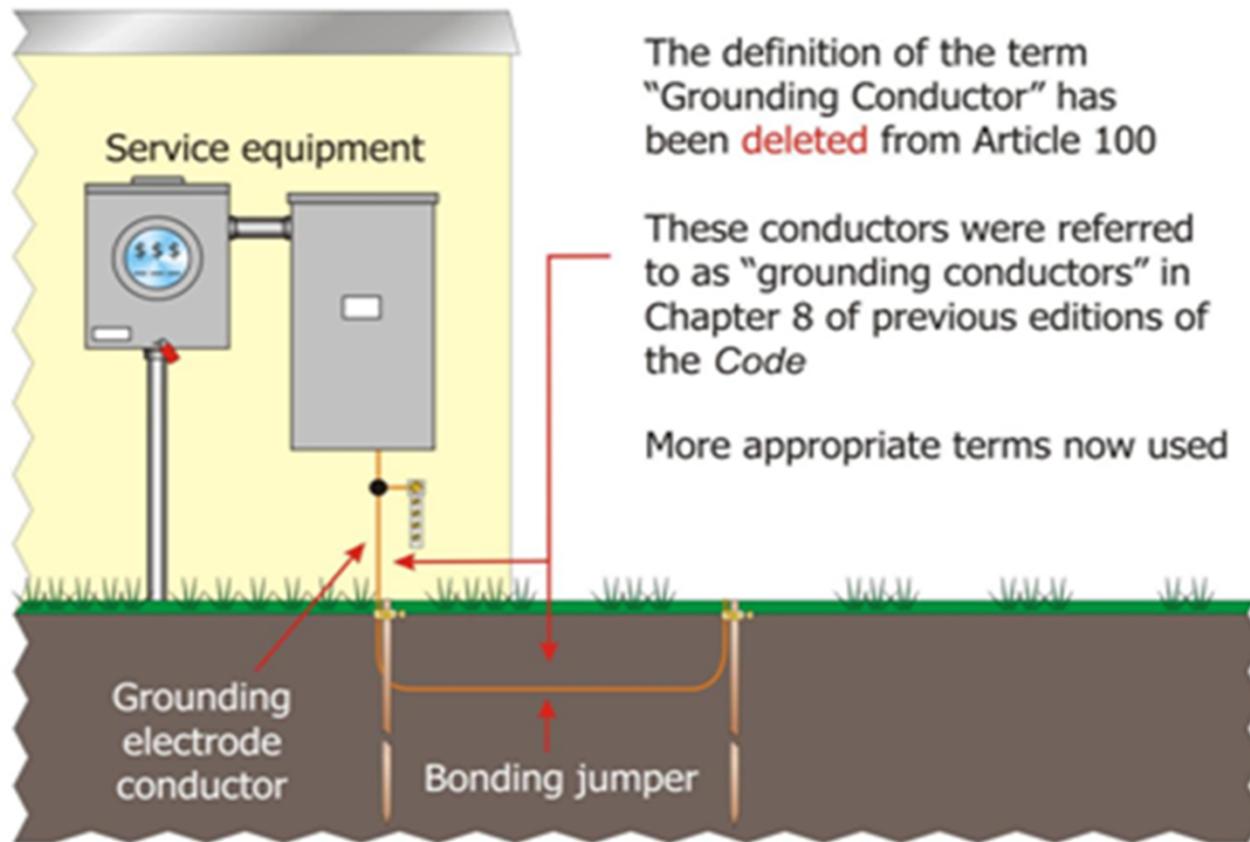
Informational Note:

“Fine Print Notes” are now referred to as “Informational Notes” and a new Item (D) Informative Annexes has been added

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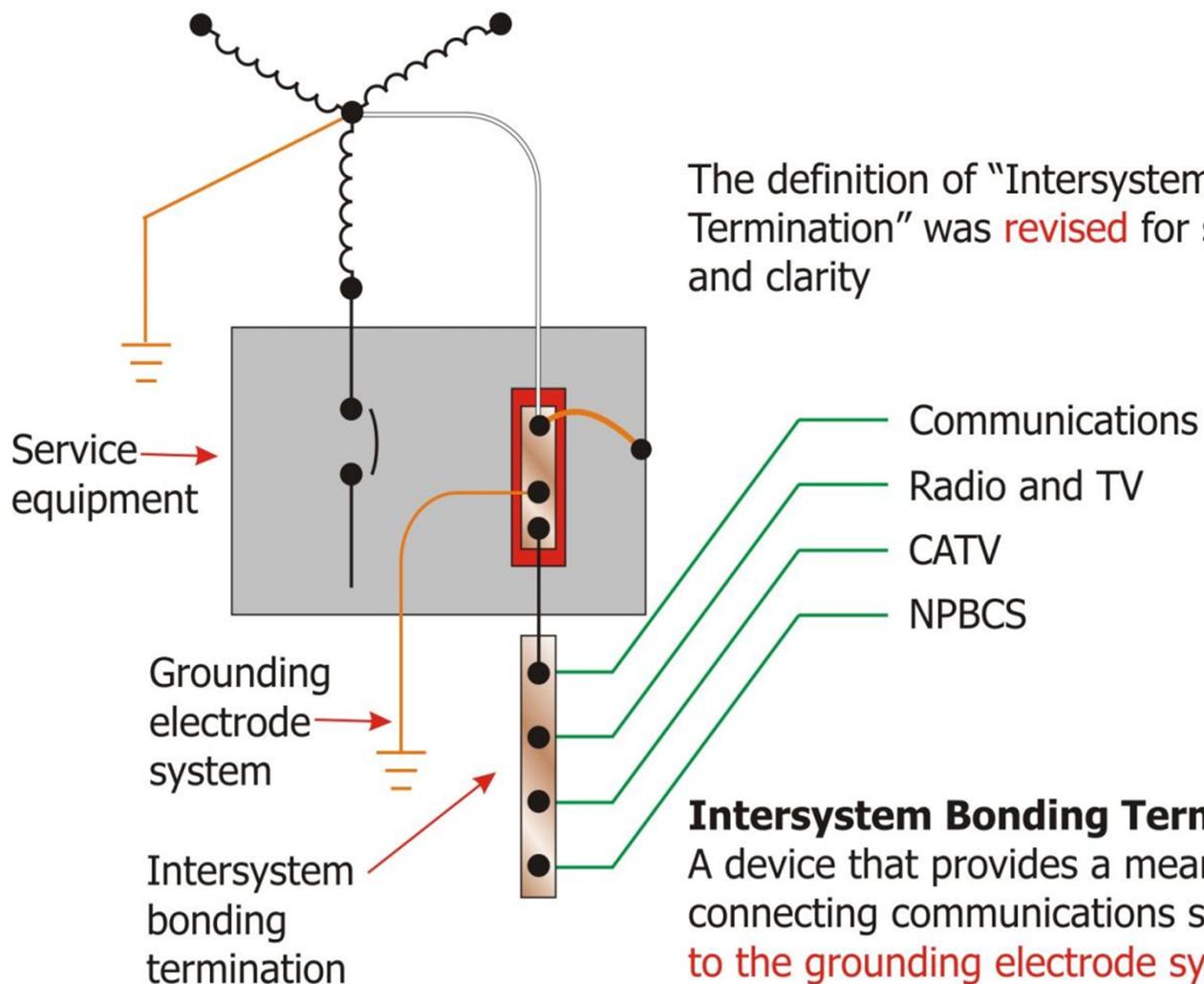
The term “grounding conductor” was replaced with the term “grounding electrode conductor,” “bonding jumper,” or “bonding conductor” in several places throughout the NEC

Article 100: Grounding Conductor (Deleted)



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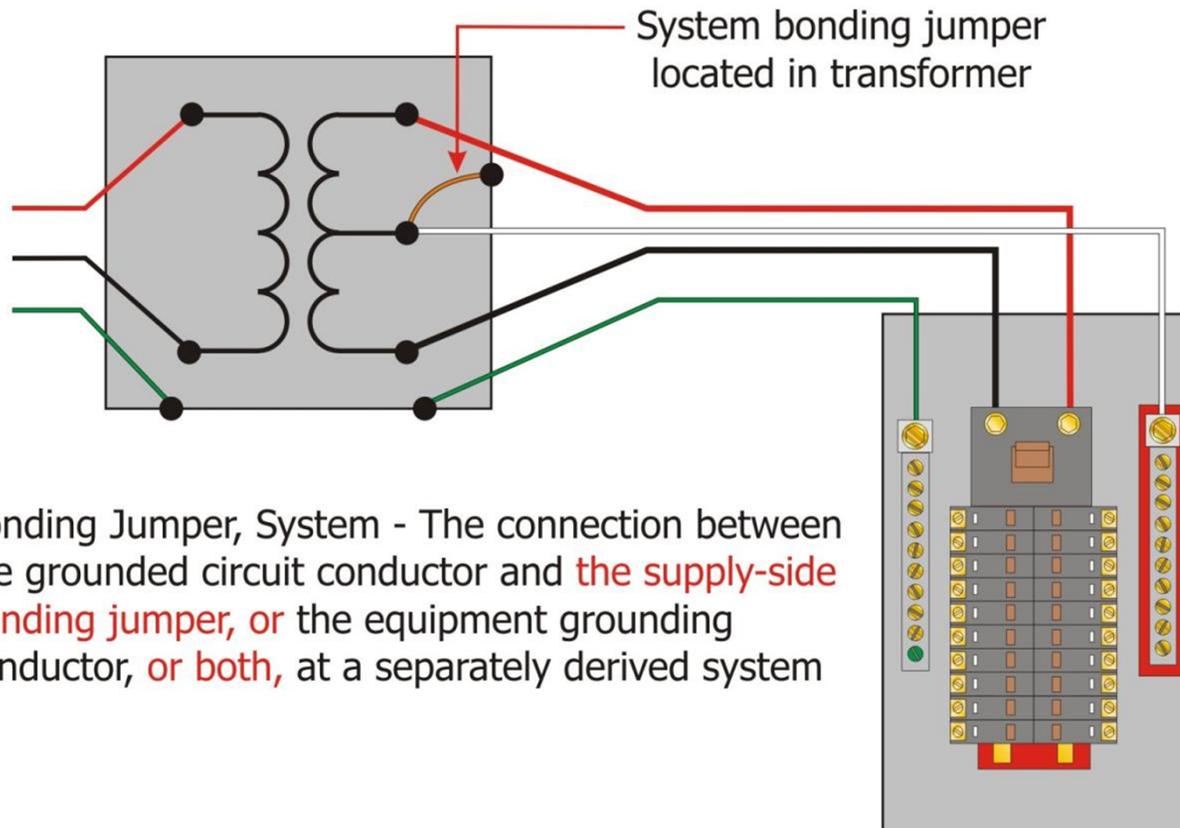
Article 100: Intersystem Bonding Termination



The definition of "Intersystem Bonding Termination" was **revised** for simplicity and clarity

Intersystem Bonding Termination:
A device that provides a means for connecting communications systems to the **grounding electrode system**

Article 100: System Bonding Jumper



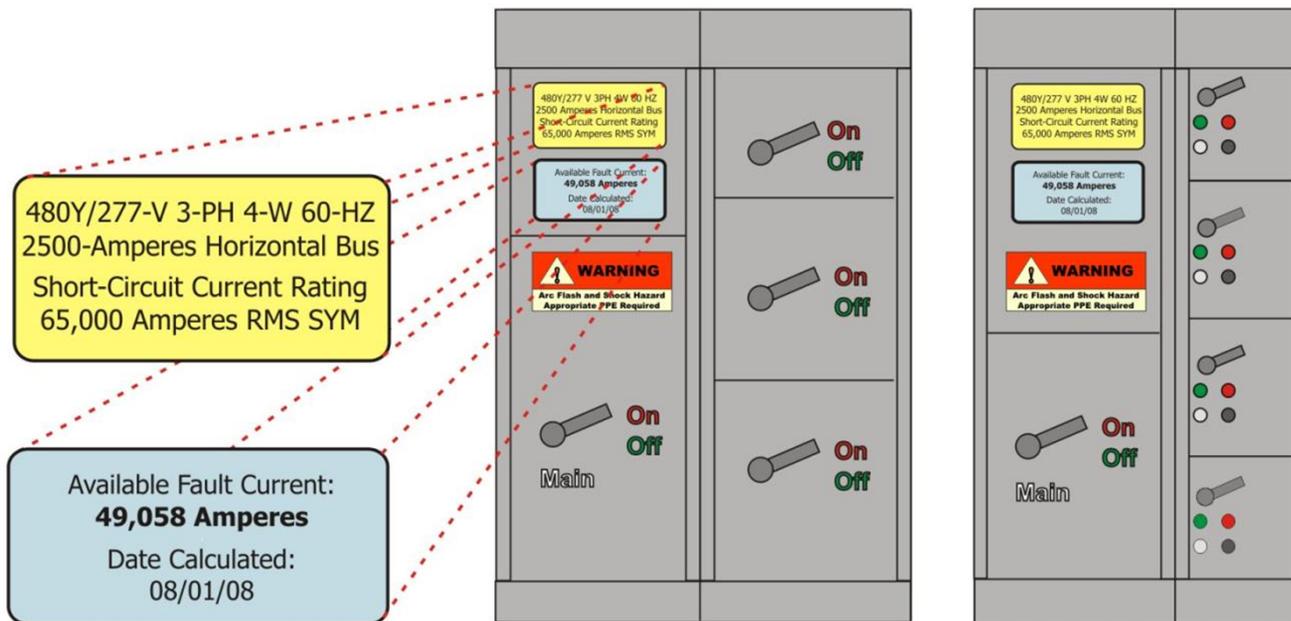
Bonding Jumper, System - The connection between the grounded circuit conductor and **the supply-side bonding jumper, or** the equipment grounding conductor, **or both,** at a separately derived system

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



110.24 Available Fault Current

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



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

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

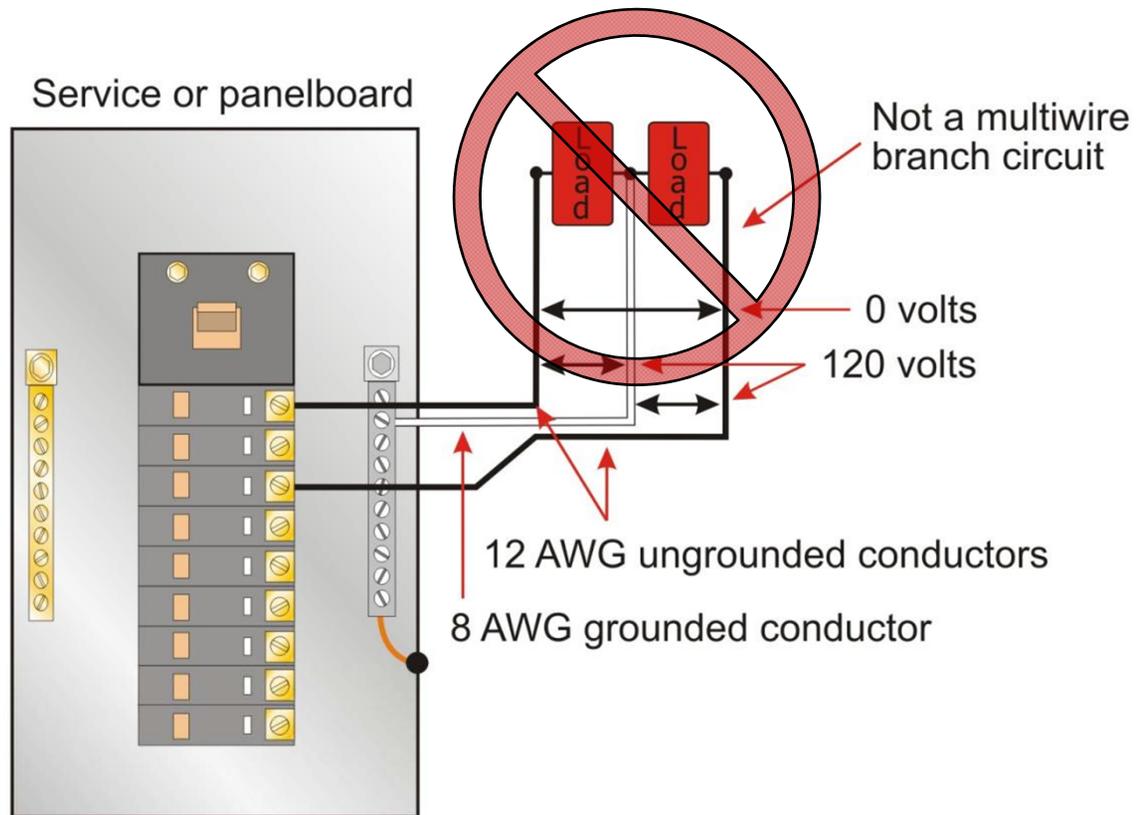
110.26(D) Illumination About Electrical Equipment

- Illumination required
- Additional luminaire not required where space is illuminated by adjacent light source
- **Lighting sources for working spaces about electrical equipment cannot be controlled by automatic means only**



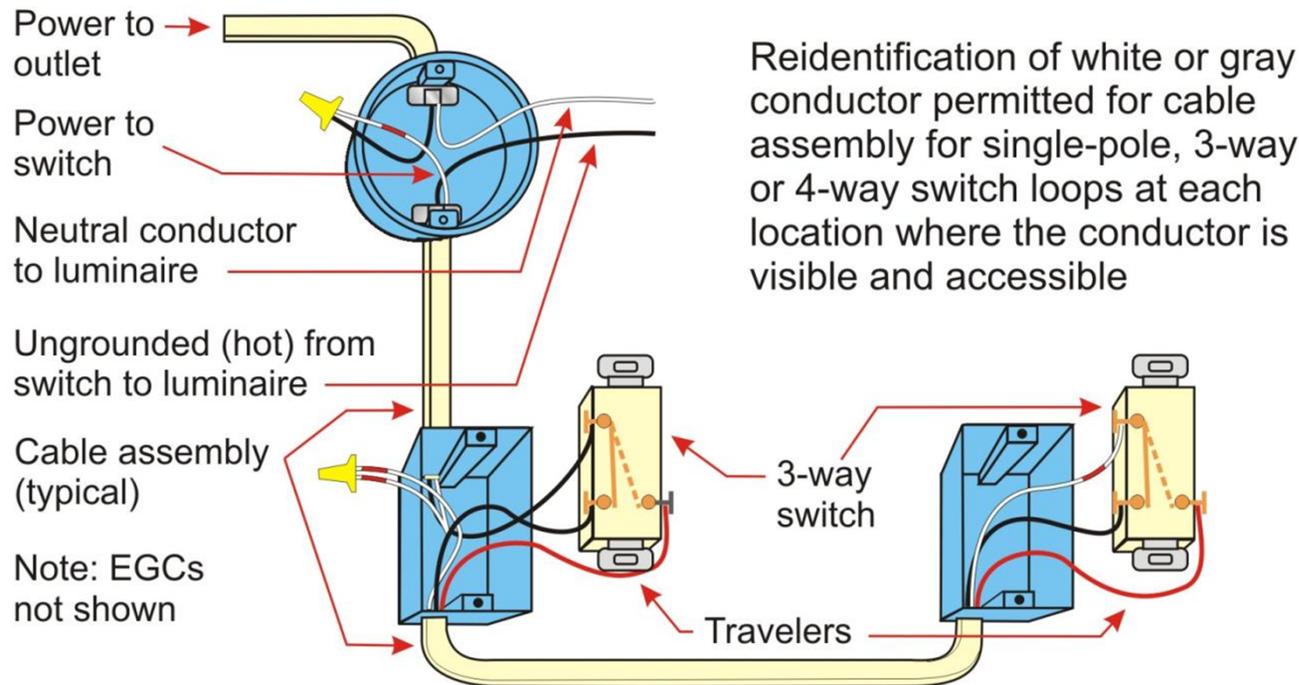
Illumination shall be provided for all working spaces about service equipment, switchboards, panelboards, or motor control centers installed indoors

200.4 Neutral Conductors



Neutral conductors shall not be used for more than one branch circuit, multiwire branch circuit, or for more than one set of ungrounded feeder conductors unless specifically permitted elsewhere in this *Code*.

200.7(C)(1) Reidentifying of White/Gray Conductor



Must be permanently reidentified **by marking tape**, painting, or other effective means to indicate its use at its terminations

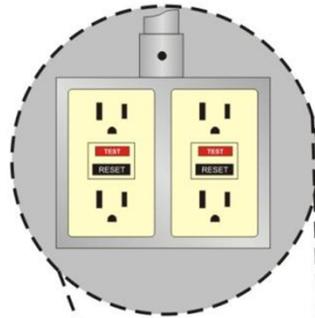
Reidentified white or gray conductors (or three continuous white stripes) must be used only for the supply to the switch - not as a return conductor from the switch to the outlet

210.8 Ground-Fault Circuit-Interrupters

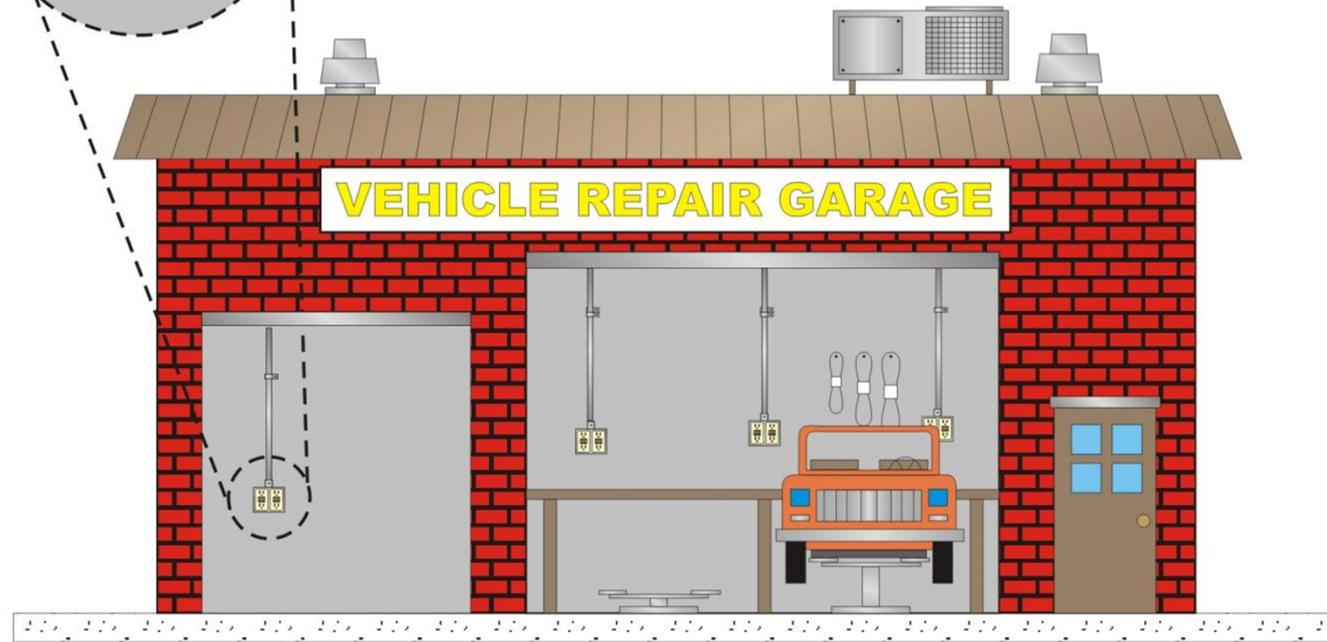


- All GFCIs for personnel must be installed in a readily accessible location
- This applies to 210.8(A), (B), and (C)

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



GFCI protection required at **all types of non-dwelling unit garages** where electrical diagnostic equipment, electrical hand tools, or portable lighting equipment are used, not just those garages under the scope of Article 511

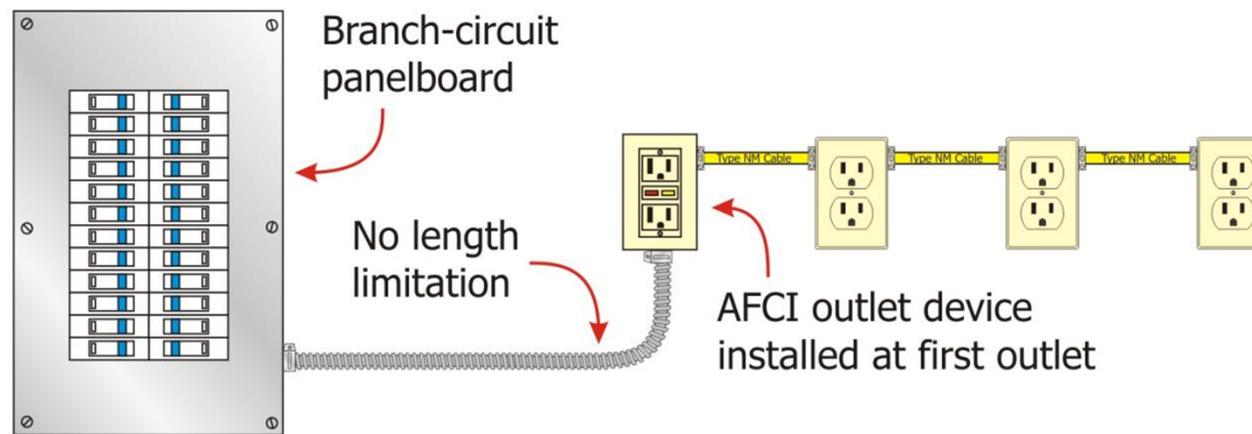


125-volt, 15- and 20-ampere receptacles required to be GFCI-protected

210.12(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

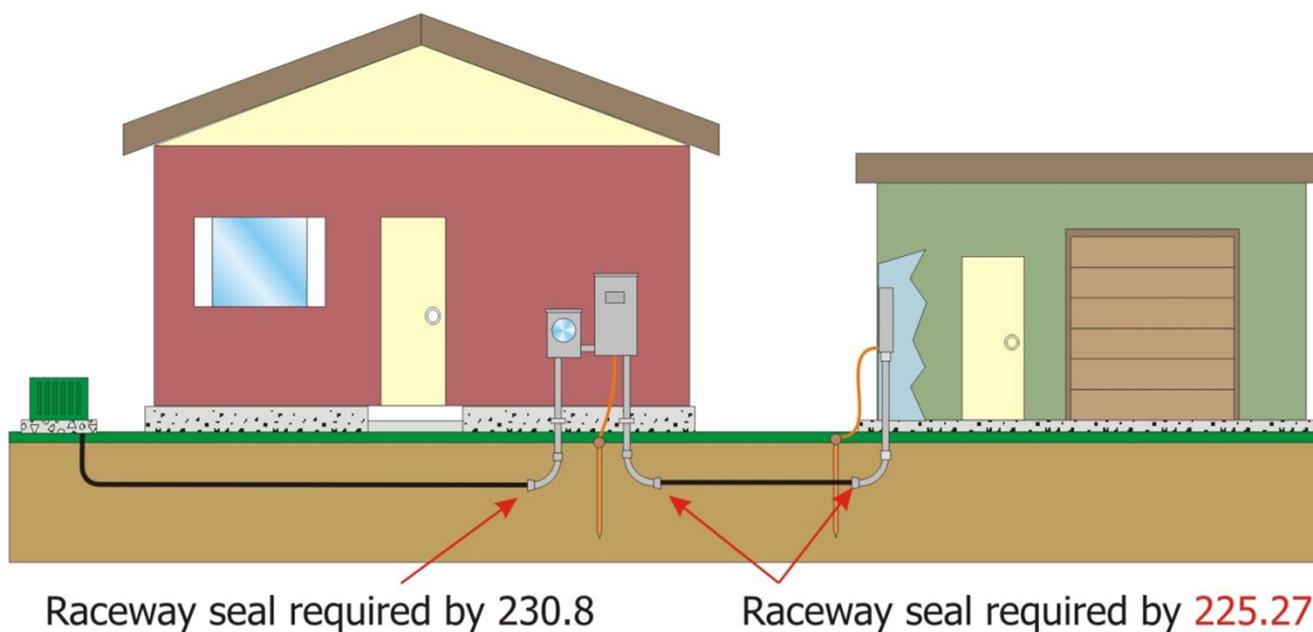


Ex. No. 1: If RMC, IMC, EMT, **Type MC** or steel armored Type AC cables meeting the requirements of 250.118 and metal outlet and junction boxes are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a **outlet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

225.27 Raceway Seal



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



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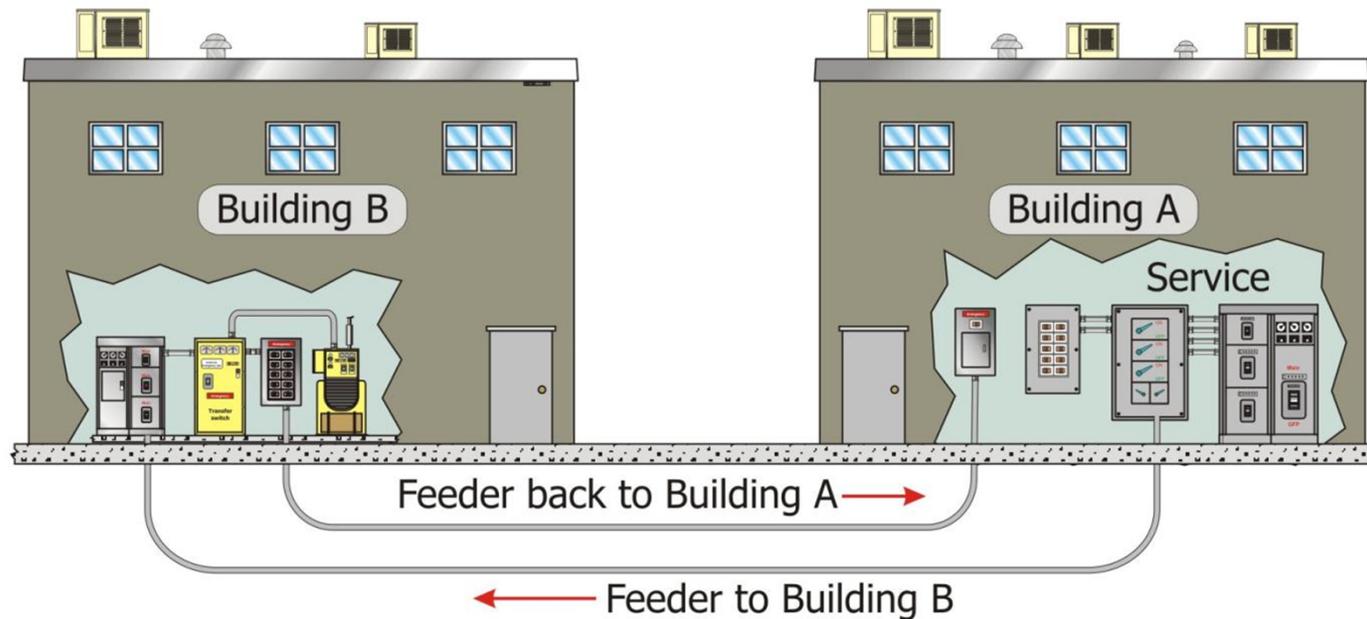


225.30 Number of Supplies

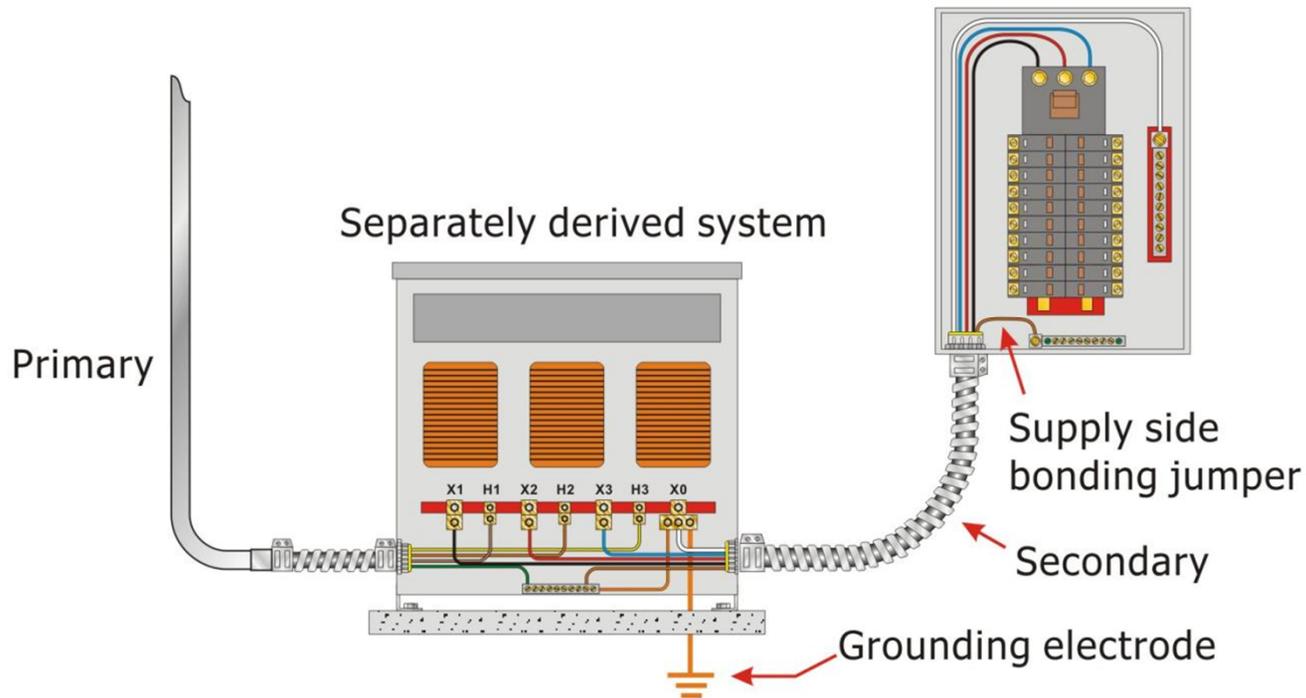
Where more than one building (same property, under single management) exist, each additional building shall be supplied by only one feeder or branch circuit

Where a branch circuit or feeder originates in the additional buildings, only one feeder or branch circuit is permitted to supply power back to the original building

(See 225.30(A) through (E) for additional provisions)

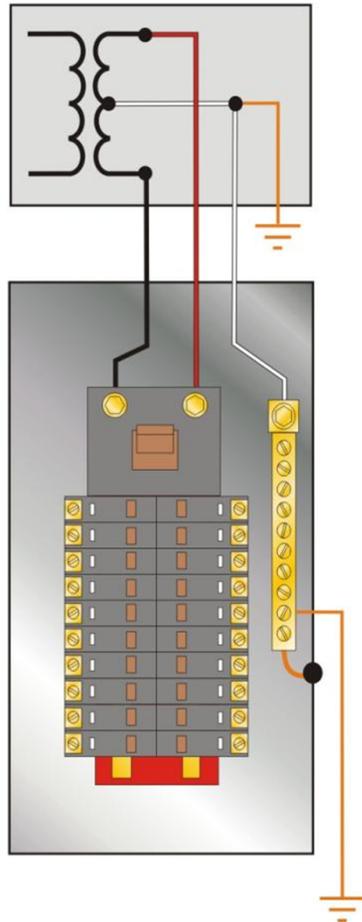


250.2 Definition: Supply Side Bonding Jumper



Bonding Jumper, Supply Side - 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.

250.24(C) Grounded Conductor Brought to Service



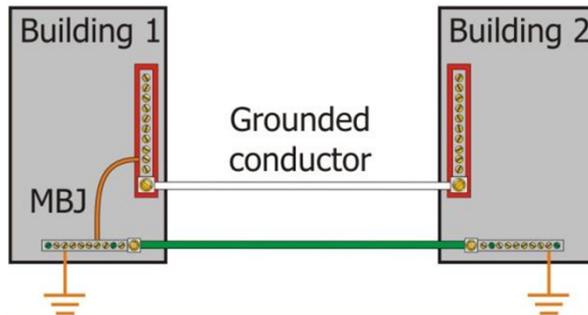
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Grounded service conductor must be:

1. Routed with phase conductors
2. Run to each service disconnecting means
3. Connected to the grounded conductor terminal and bonded to service disconnecting means enclosure through the main bonding jumper
4. Sized no smaller than grounding electrode conductor
5. Sized at least 12½ percent of area of conductors where larger than given in Table 250.66
6. Based on equivalent area of ungrounded parallel service-entrance conductors
7. **Installed in parallel** where service is installed in parallel **in two or more raceways**
8. **Must not have an ampacity rating less than the ungrounded conductor of a 3-phase, 3-wire delta service**
9. Sized in accordance with minimum requirements of 220.61

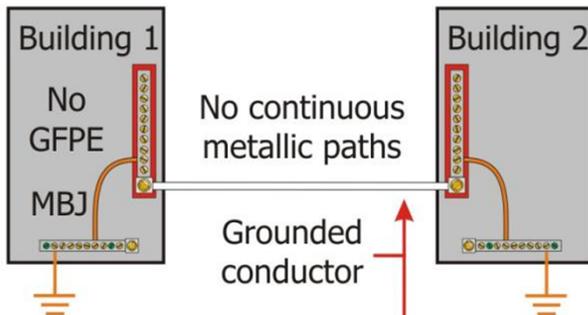


250.32(B) Grounding Separate Buildings



250.32(B)(1)

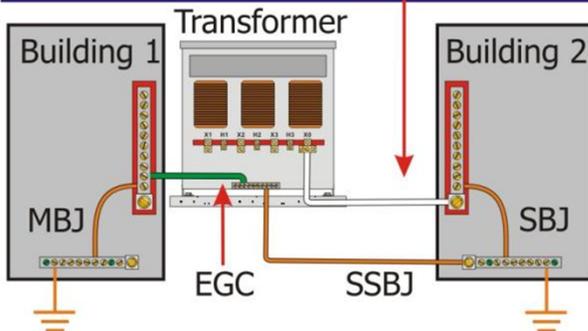
- ← Grounding at separate building or structure using the required EGC EGC in accordance with 250.118



250.32(B)(1) Exception

- ← Grounding at separate building using grounded conductor as follows:

Existing installations only under previous Codes, No EGC, No continuous metallic paths, No supply-side GFPE



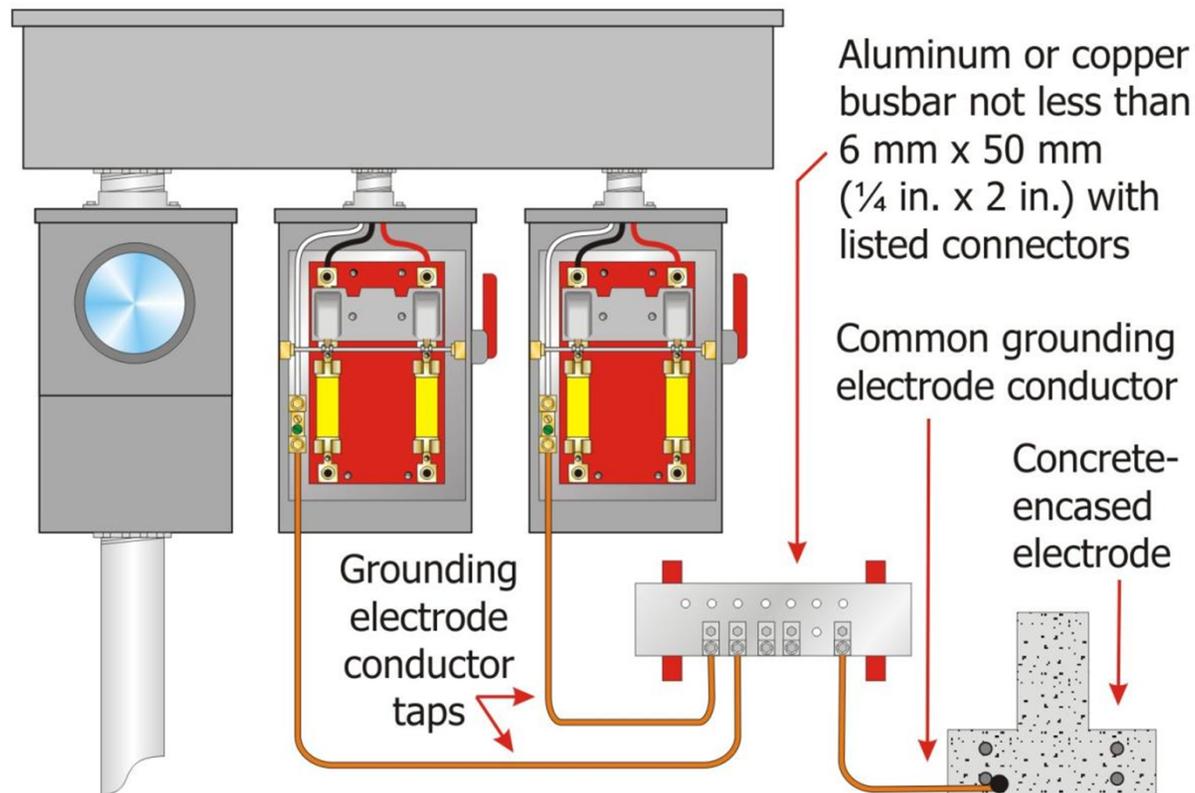
250.32(B)(2)

- ← Where a building or structure is supplied from a separately derived system, the separate equipment or bonding conductor shall be in accordance with 250.30(B)

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 busbar**



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250.190 Grounding of Equipment

1 kV and Over (Medium Voltage)

250.190 Grounding of Equipment

- (A) Equipment Grounding
- (B) Grounding Electrode Conductor
- (C) Equipment Grounding Conductor

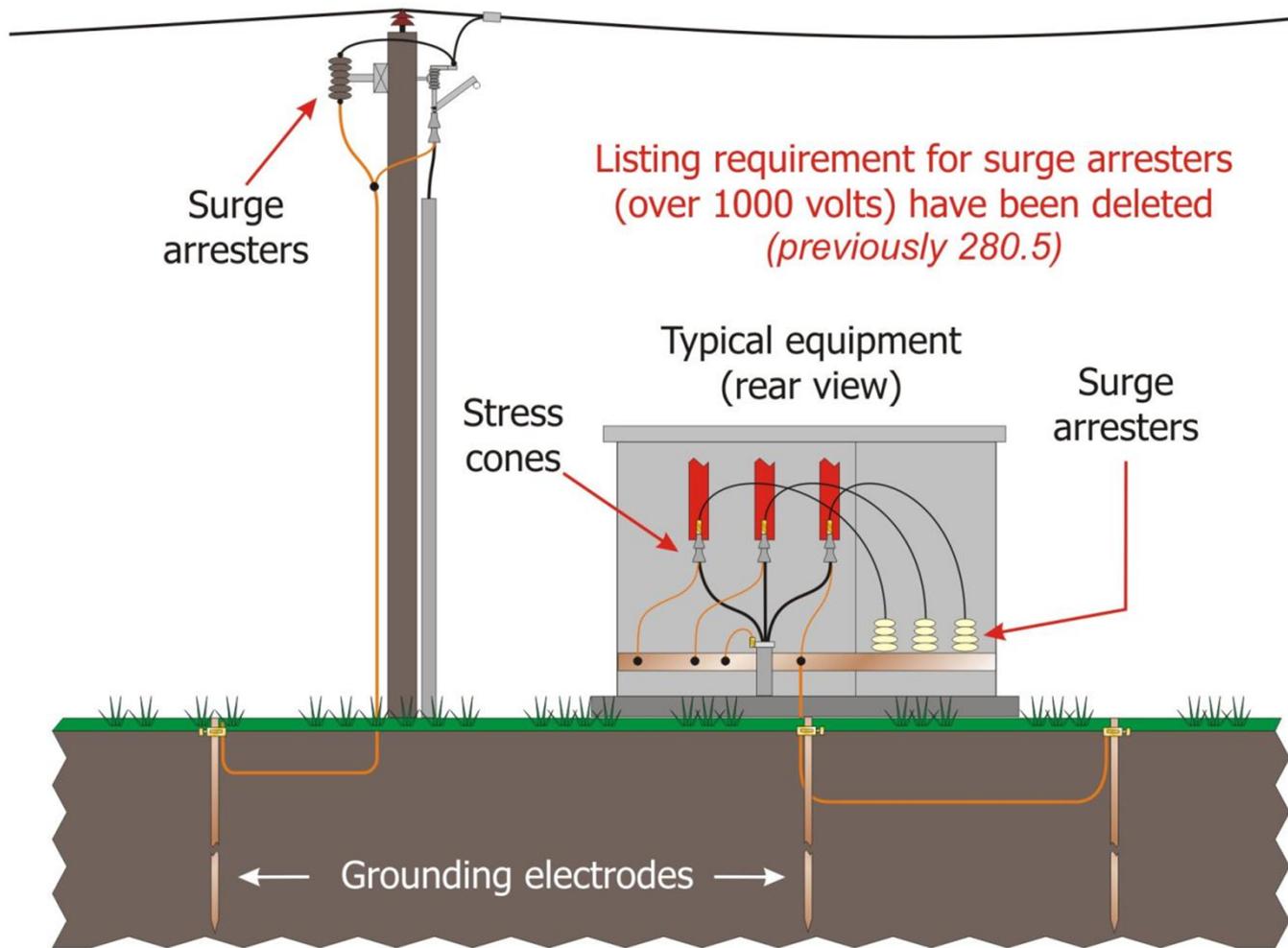
Shielded Cable

Concentric Neutral OK (if sized to 250.122)

Ribbon Shielding Conductor NEVER OK

“Drain-Wire” shielding NEVER OK

Article 280 Surge Arresters - Over 1 kV



Listing requirement for surge arresters (over 1000 volts) have been deleted (previously 280.5)

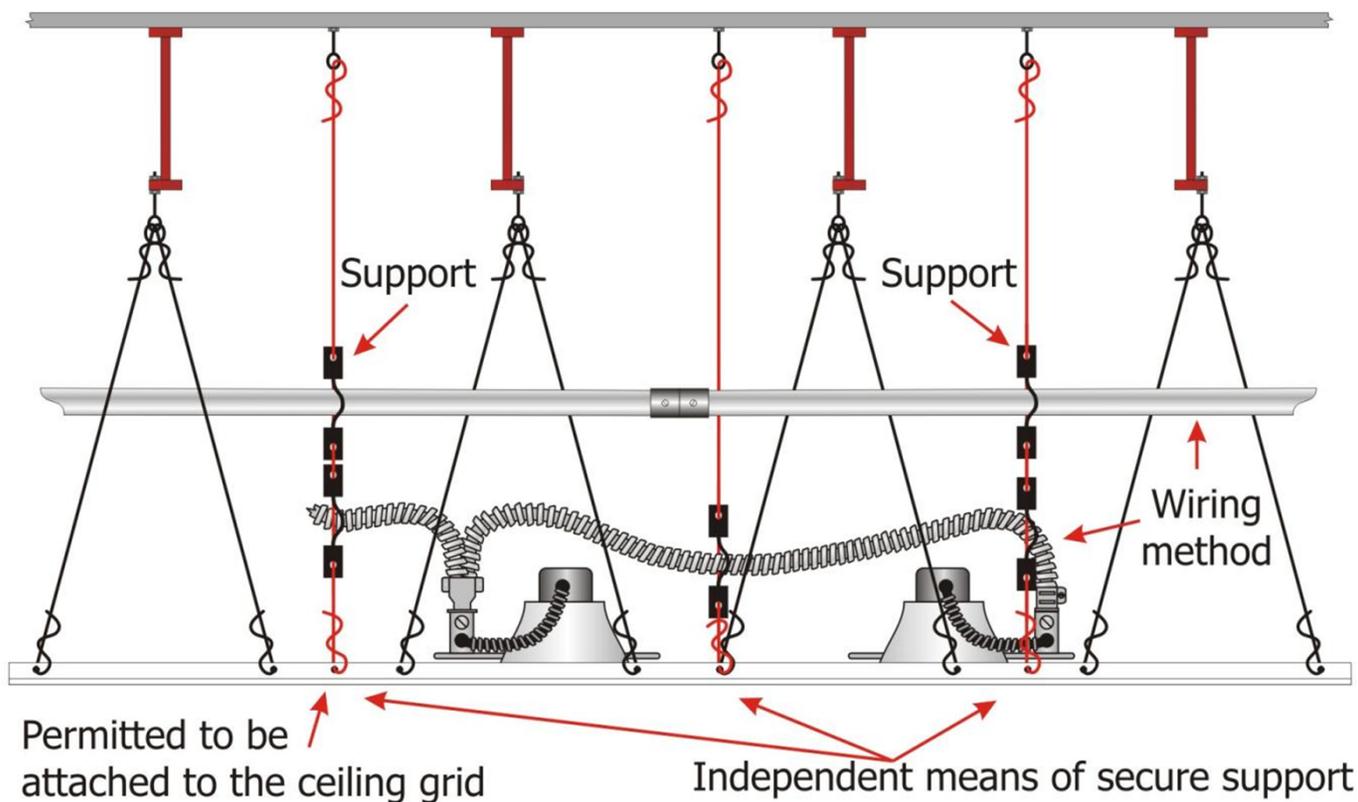
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300.11(A)(2) Non-Fire-Rated Assemblies



An independent means of secure support to be provided for wiring methods

Where independent support wires are used, they shall be distinguishable by color, tagging, or other effective means



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Article 310 Tables Comparison Chart



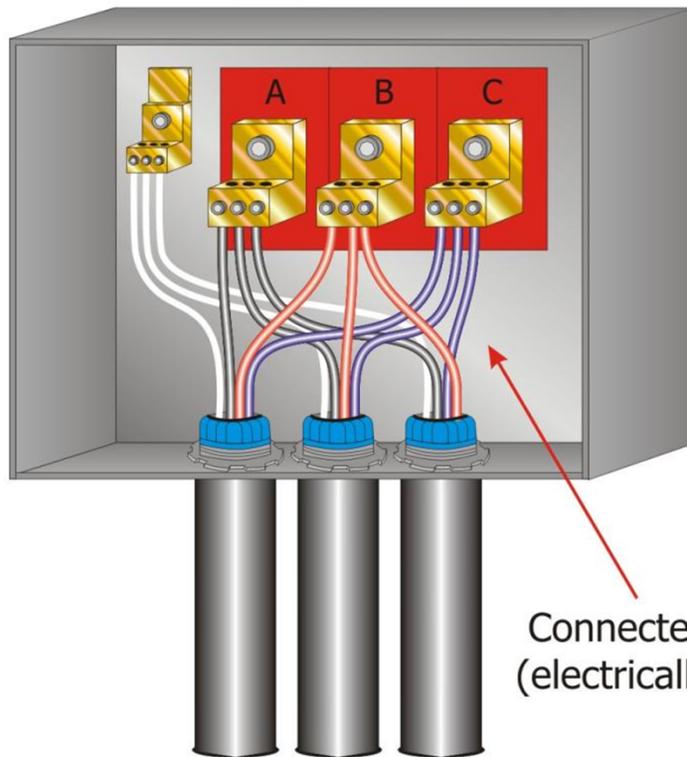
2008 NEC	Table Title	2011 NEC
310.15(B)(2)(a)	Adjustment Factors for More Than Three Current-Conductor in a Raceway or Cable	310.15(B)(3)(a)
310.15(B)(2)(c)	Ambient Temperature Adjustment for Conduits Exposed to Sunlight On or Above Rooftops	310.15(B)(3)(c)
310.15(B)(6)	Conductor Types and Sizes for 120/240-Volt, 3-Wire , Single-Phase Dwelling Services and Feeders	310.15(B)(7)
310.16	Allowable Ampacities of Insulated Conductors Rated Up to and Including 2000 Volts, 60°C Through 90°C (140°F Through 194°F), Not More Than Three Current-Carrying Conductors in Raceway, Cable, or Earth (Directly Buried), Based on Ambient Temperature of 30°C (86°F)	310.15(B)(16)
310.16 (bottom of Table)	Ambient Temperature Correction Factors Based on 30°C (86°F)	310.15(B)(2)(a)
(Not in '08 NEC)	Ambient Temperature Correction Factors	310.60(C)(4)
310.68	Ampacities of Insulated Single Aluminum Conductor Cables Triplexed in Air Based on Conductor Temperatures of 90°C (194°F) and 105°C (221°F) and Ambient Air Temperature of 40°C (104°F)	310.60(C)(68)

Article 310 Table Comparison Chart (in part)

310.10(H)(1) Conductors in Parallel



Only conductors in sizes 1/0 AWG and larger, comprising each phase, polarity, neutral, or grounded circuit conductor shall be connected in parallel

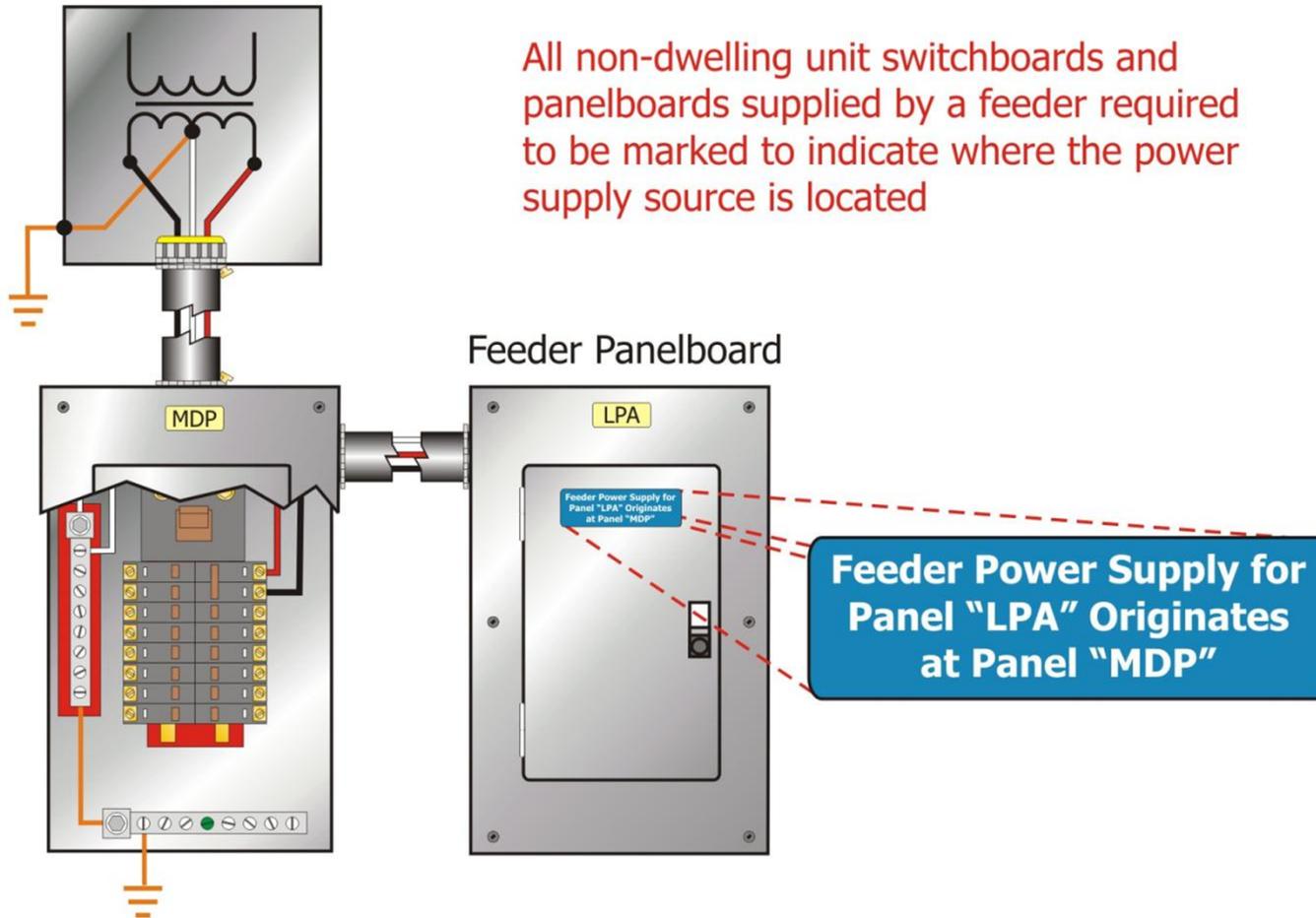


Where conductors of size 1/0 and larger are installed in parallel, must be installed as follows:

- (1) Same length
- (2) Consist 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)

408.4(B) Identification - Source of Supply

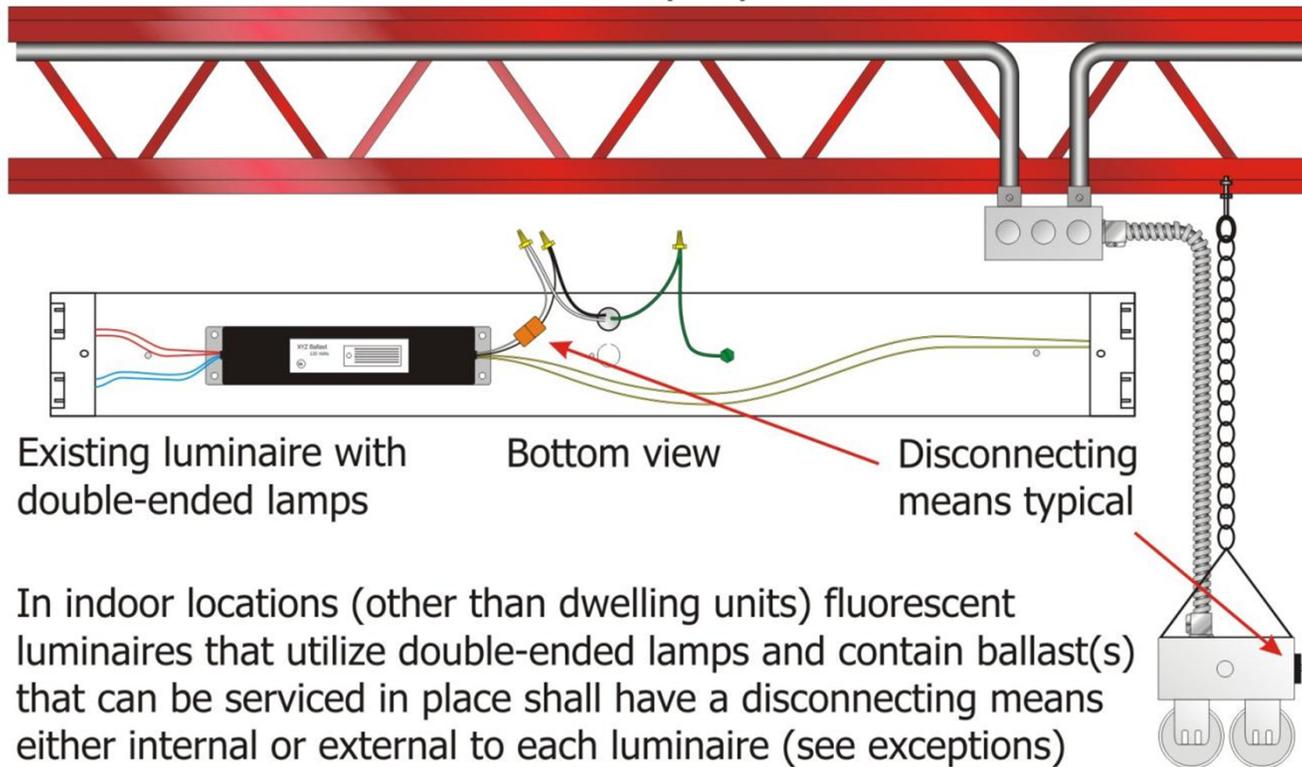


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410.130(G)(1) Disconnecting Means



Elevation (end) view



Existing luminaire with double-ended lamps

Bottom view

Disconnecting means typical

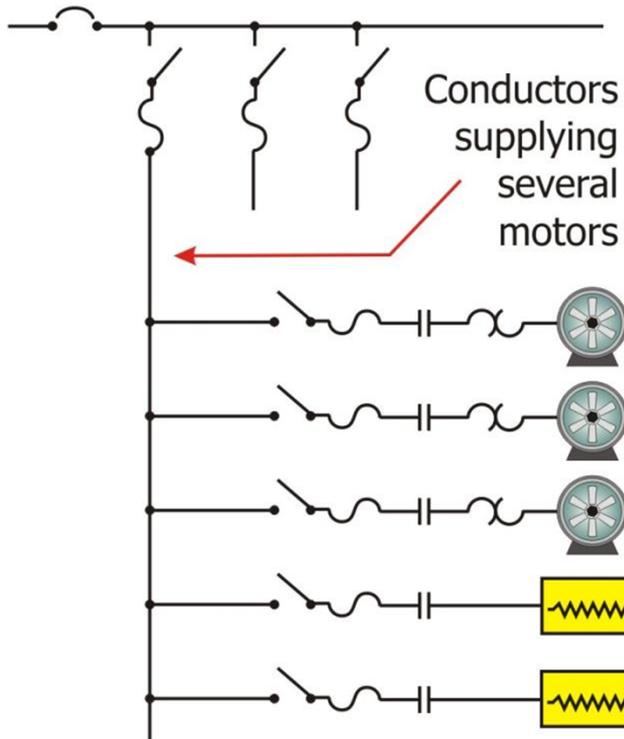
In indoor locations (other than dwelling units) fluorescent luminaires that utilize double-ended lamps and contain ballast(s) that can be serviced in place shall have a disconnecting means either internal or external to each luminaire (see exceptions)

Disconnecting means required for existing installed luminaires without disconnecting means, at the time a ballast is replaced

430.24 Circuit Conductors for Several Motors



Conductors supplying several motors, or a motor(s) and other load(s), shall have an ampacity not less than **the sum of each of the following:**



- (1) 125 percent of the full-load current rating of the highest rated motor **as determined by 430.6(A)**
- (2) the sum of the full-load current ratings of all the other motors in the group, as determined by 430.6(A)
- (3) **100 percent of the non-continuous non-motor load**
- (4) **125 percent of the continuous non-motor load**

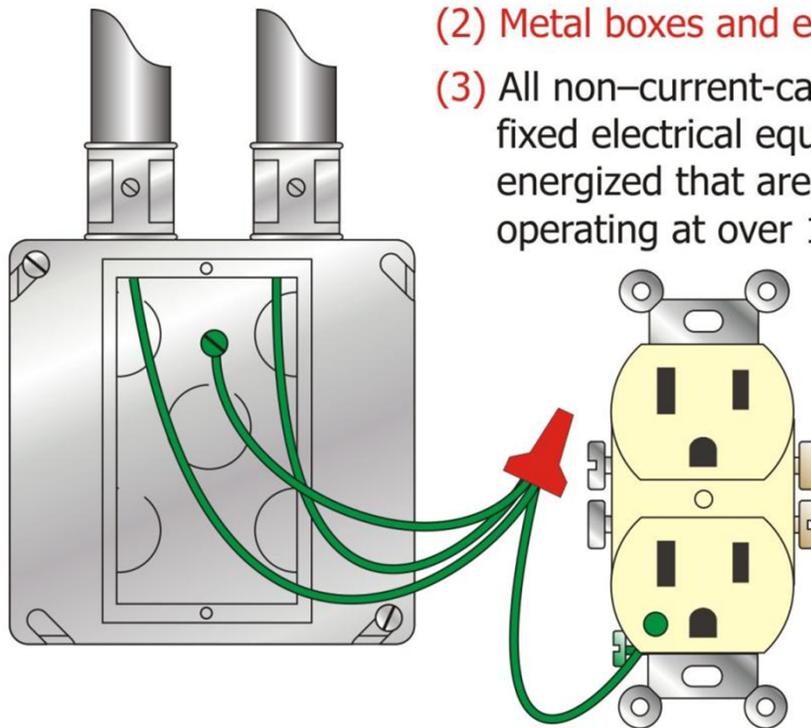
The method of calculating motor-circuit conductors for several motors or motors and other loads was **revised into a list format**



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

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

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



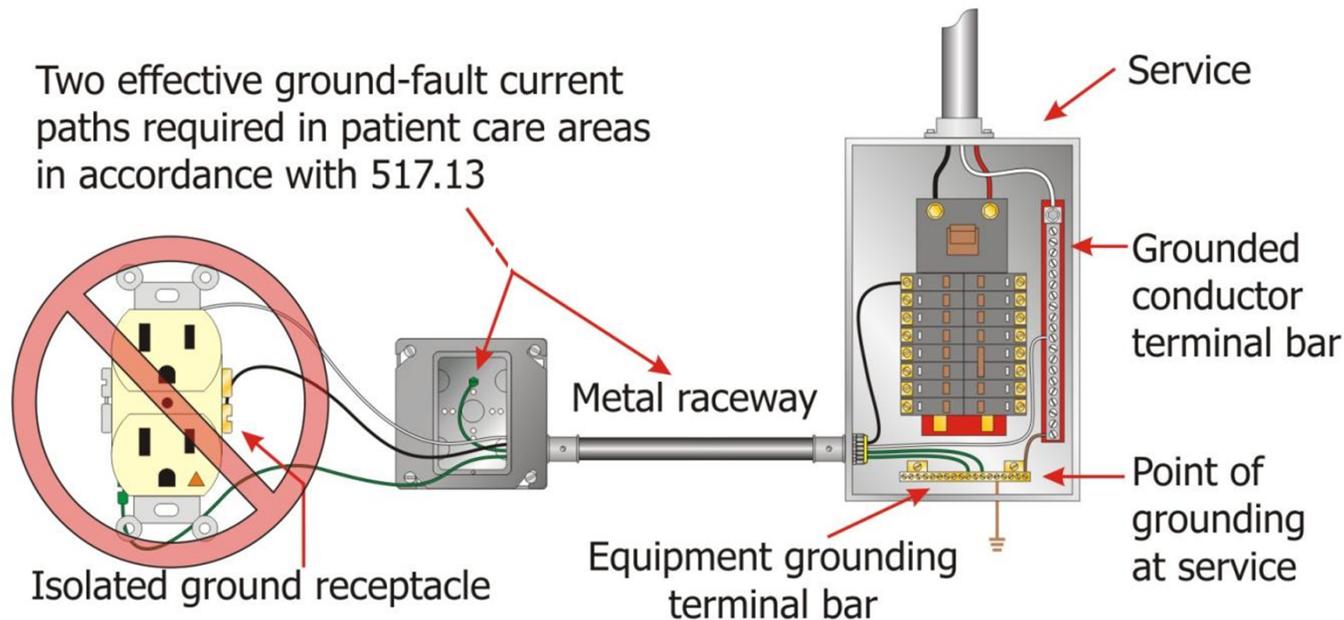
- 517.13(B) rearranged for clarity and usability
- Metal box required to be directly connected to the insulated copper EGC required for grounding at patient care areas

517.16 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 described in 250.146(D), shall **not be permitted**

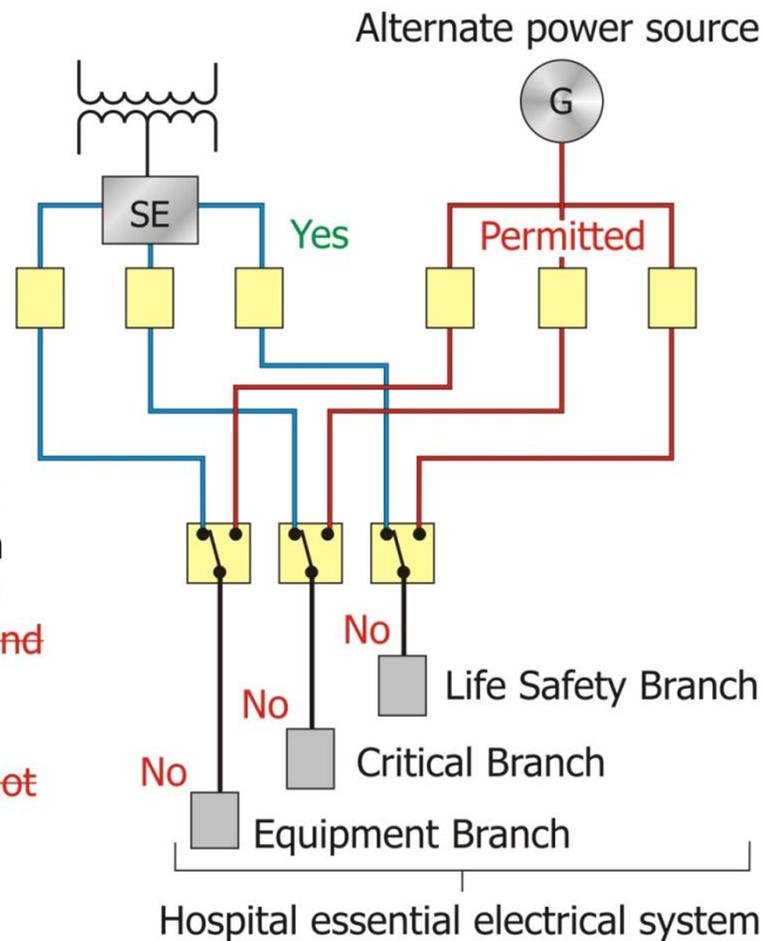
517.17(B) Feeder GFP (Health Care Facilities)



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

Additional levels of GFP shall not be installed as follows:

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

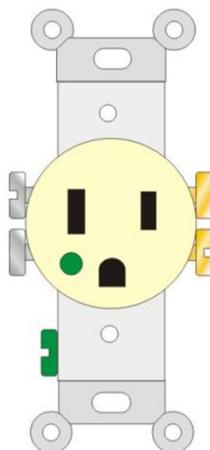


517.18(B) Patient Bed Location Receptacles

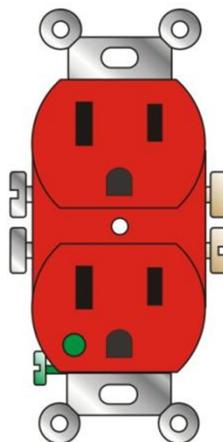


"Quadruplex" has been added to the acceptable configuration of receptacles required at patient bed locations of health care facilities

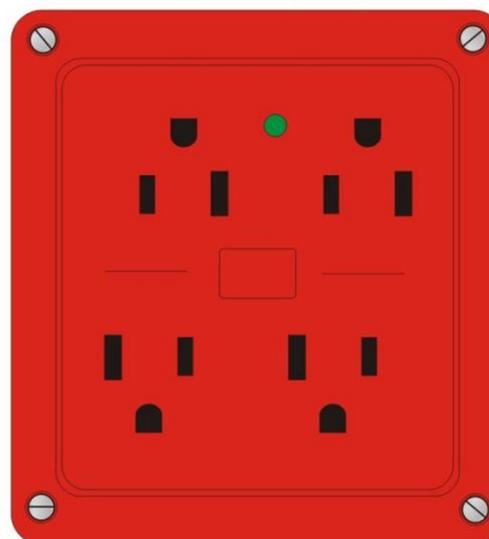
Single



Duplex



Quadruplex



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

645.25 Engineering Supervision (IT Equipment)



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

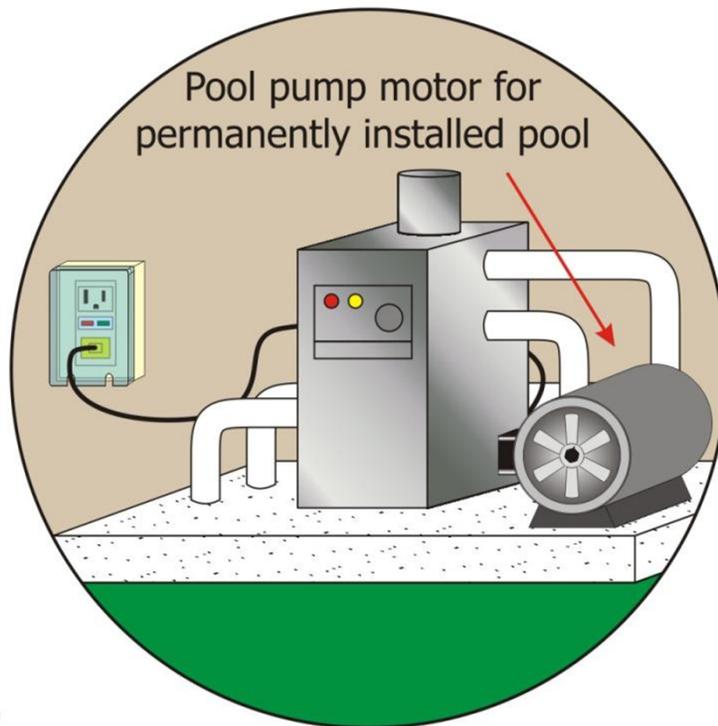


As an alternative to the feeder and service load calculations required by Parts III and IV of Article 220, feeder and service load calculations for new or existing loads shall be permitted to be used if performed by qualified persons under engineering supervision

680.21(A)(5) Motors - Cord-and-Plug Connection



Flexible cords for cord-and-plug-connected pool pump motors for a permanently installed pool must contain a **copper** equipment grounding conductor **not smaller than 12 AWG**



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Pool-associated motors permitted to employ cord-and-plug connections

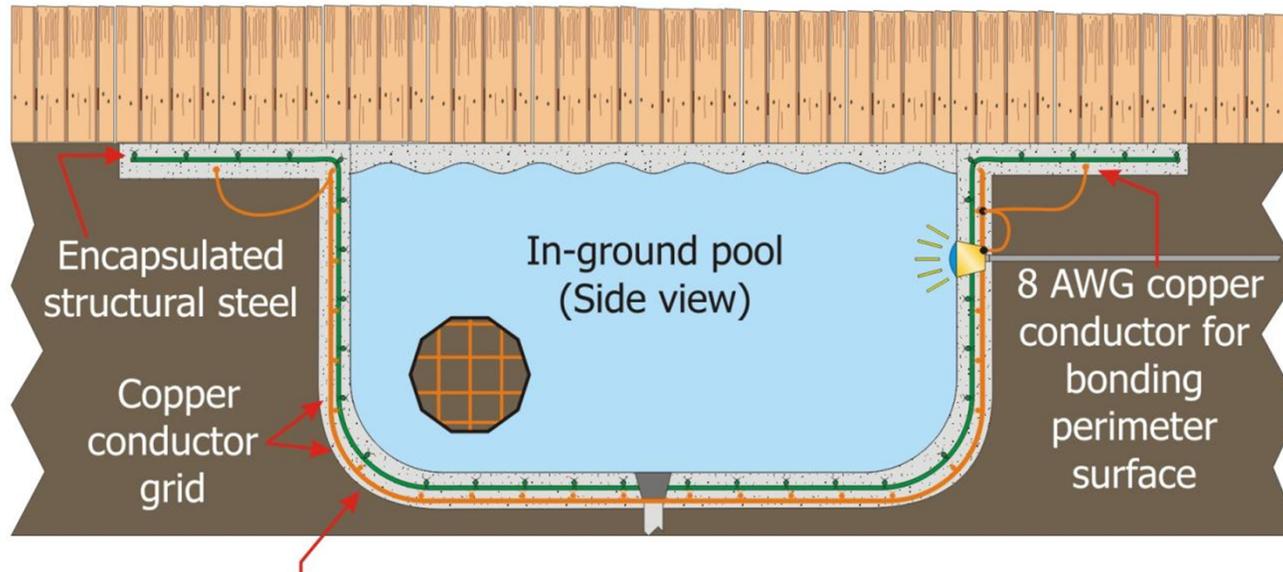
The flexible cord not to exceed 900 mm (3 ft) in length

The flexible cord must include a **copper** equipment grounding conductor sized per 250.122

EGC **not to be smaller than 12 AWG**

The cord to terminate in a grounding-type attachment plug

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

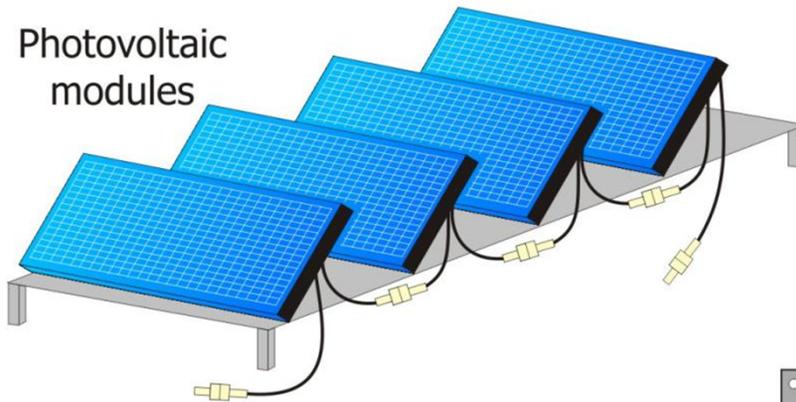


Copper conductor grid for bonding conductive pool shell shall be min. 8 AWG bare solid copper conductors bonded to each other at all points of crossing and conform to the contour of the pool **and the pool deck**

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

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

690.4(B) Conductors of Different Systems

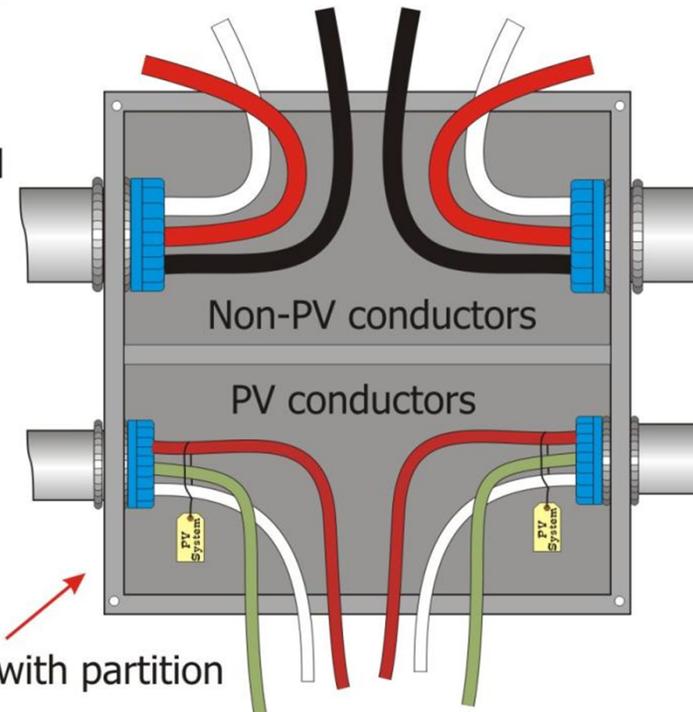


Photovoltaic modules

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

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

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



Junction box with partition

690.4(E) Wiring and Connections

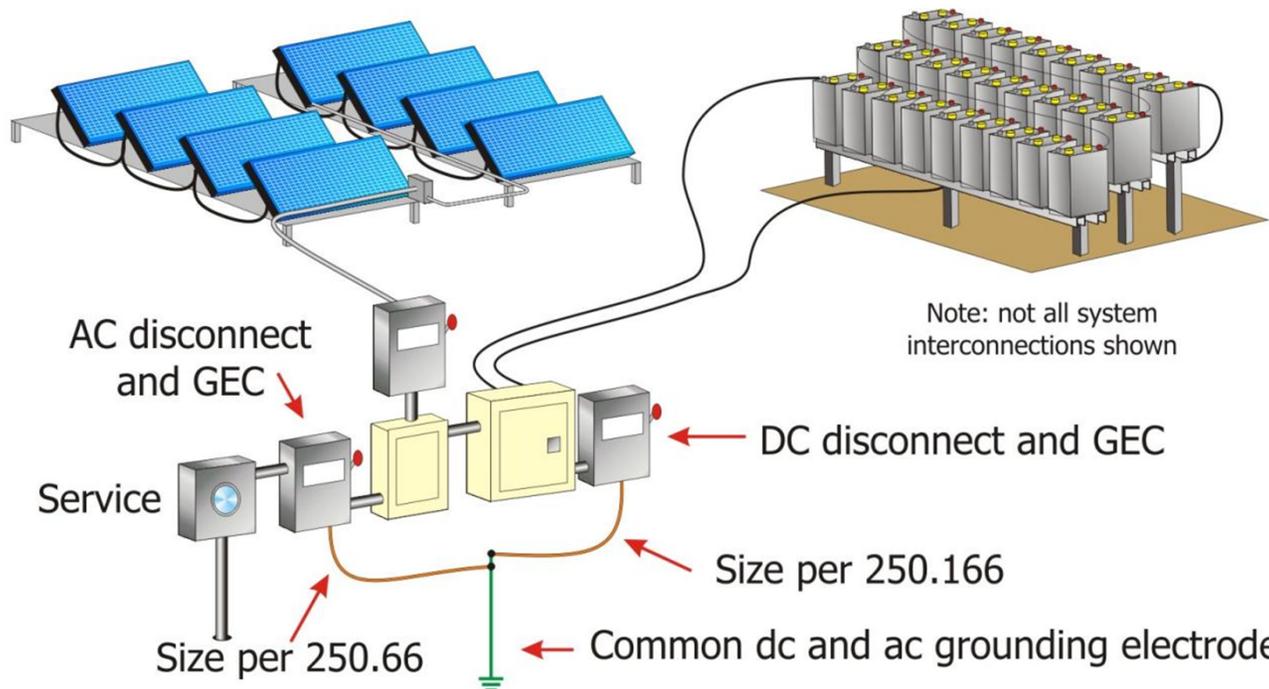


"Qualified persons" required to perform the described work on photovoltaic (PV) systems



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

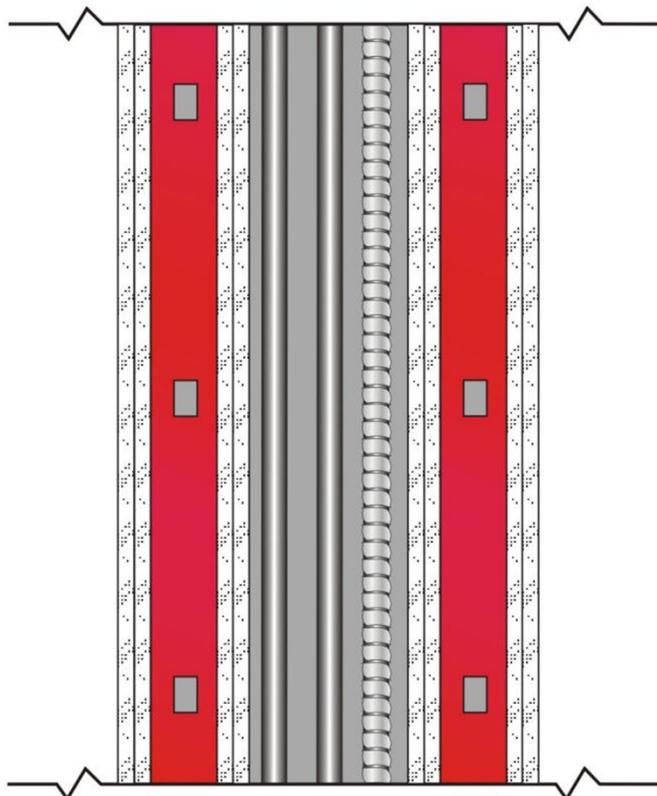
690.47(C) Systems with Alternating Current and Direct-Current Grounding Requirements



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

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

700.10(D)(1) Feeder-Circuit Wiring



Feeder circuit wiring requiring fire protection

Note: Wiring supports are not shown

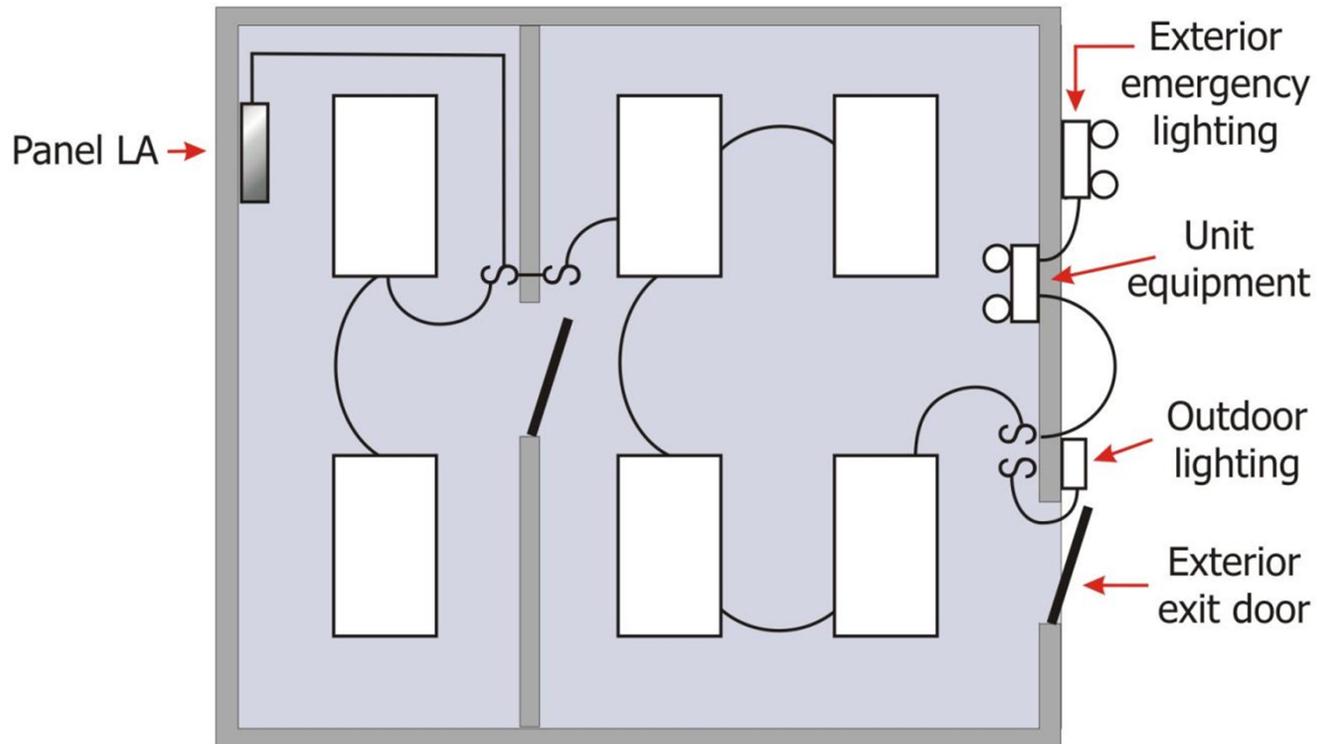
Feeder-circuit wiring shall meet one of the following conditions:

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

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



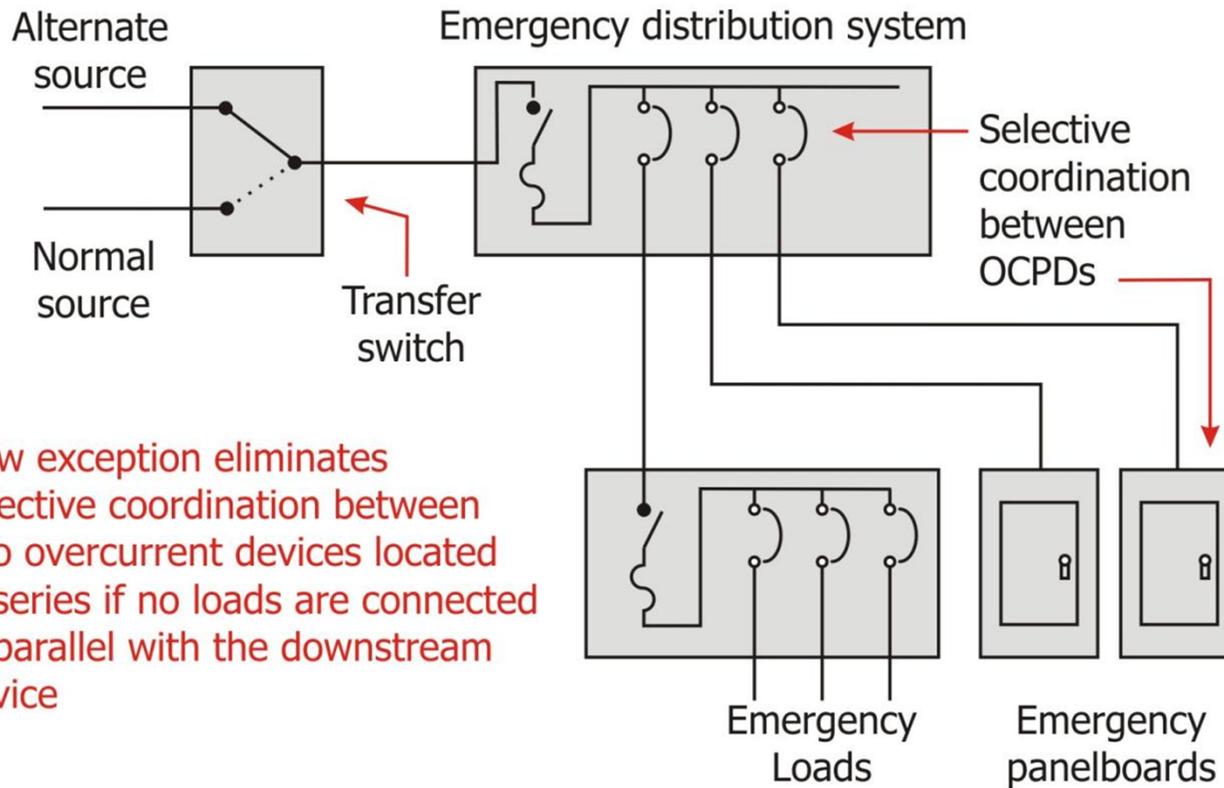
A new exception permits exterior emergency lighting to be supplied by the unit equipment serving the area immediately inside the exit door



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

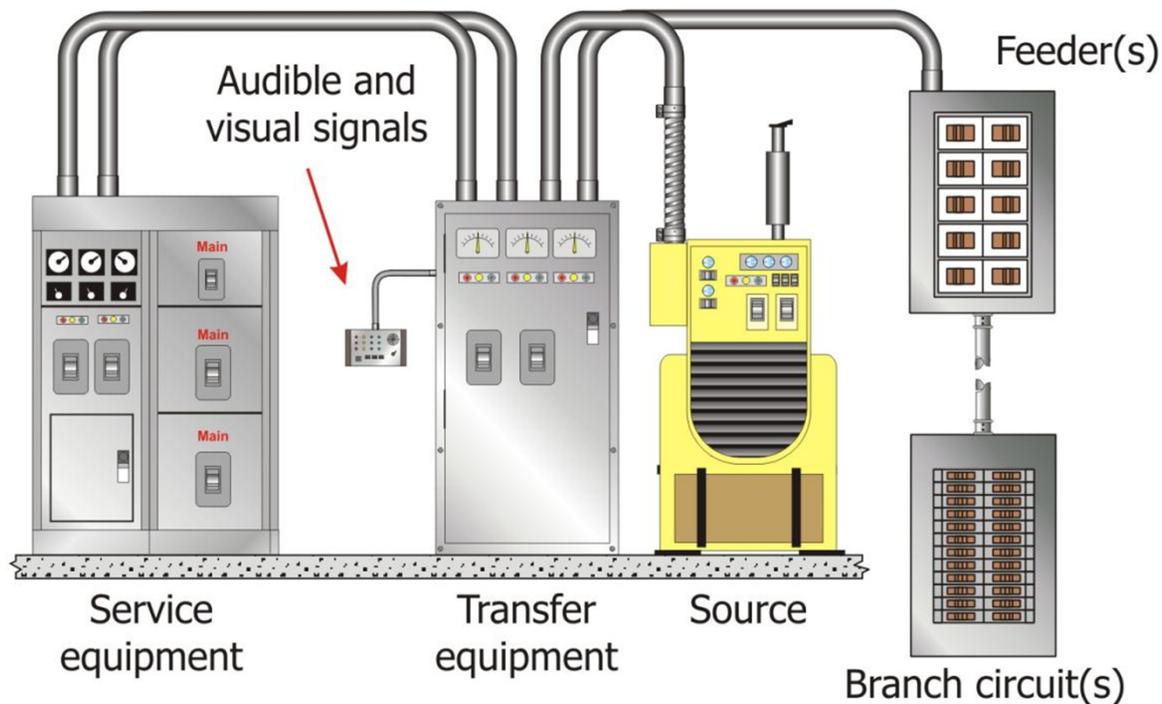


New exception eliminates selective coordination between two overcurrent devices located in series if no loads are connected in parallel with the downstream device

701.6 Signals (Legally Required Standby Systems)



Audible and visual signal devices shall be provided for legally required standby systems to indicate such things as derangement of the standby source, load carrying, battery charger not functioning, and **ground-fault indication**



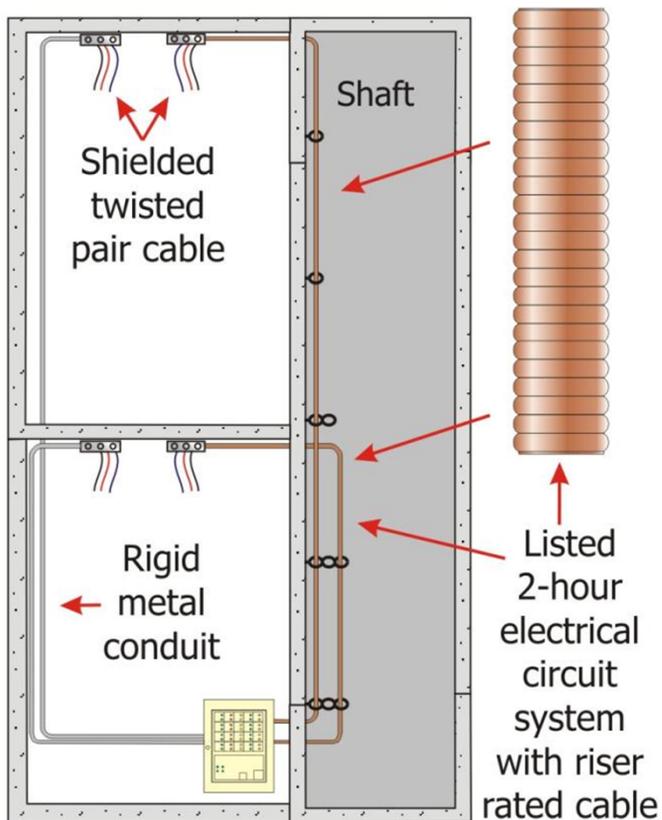
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Ground-fault indication for legally required standby systems is now required by 701.6(D) and 701.26

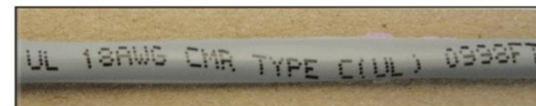
708.14 Wiring of HVAC, Fire Alarm, Security, Emergency Communications, and Signaling Systems



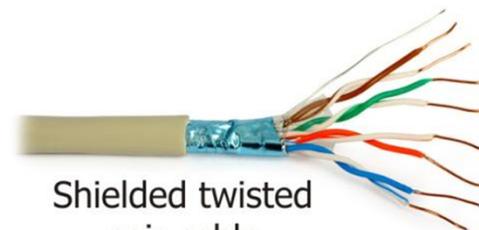
Revisions added to 708.14 to clarify which HVAC, fire alarm, security, emergency communications, and signaling systems cable types at critical operations power system (COPS) facilities require shielded twisted pairs, and which require riser ratings



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



Riser (CMR) rated cable



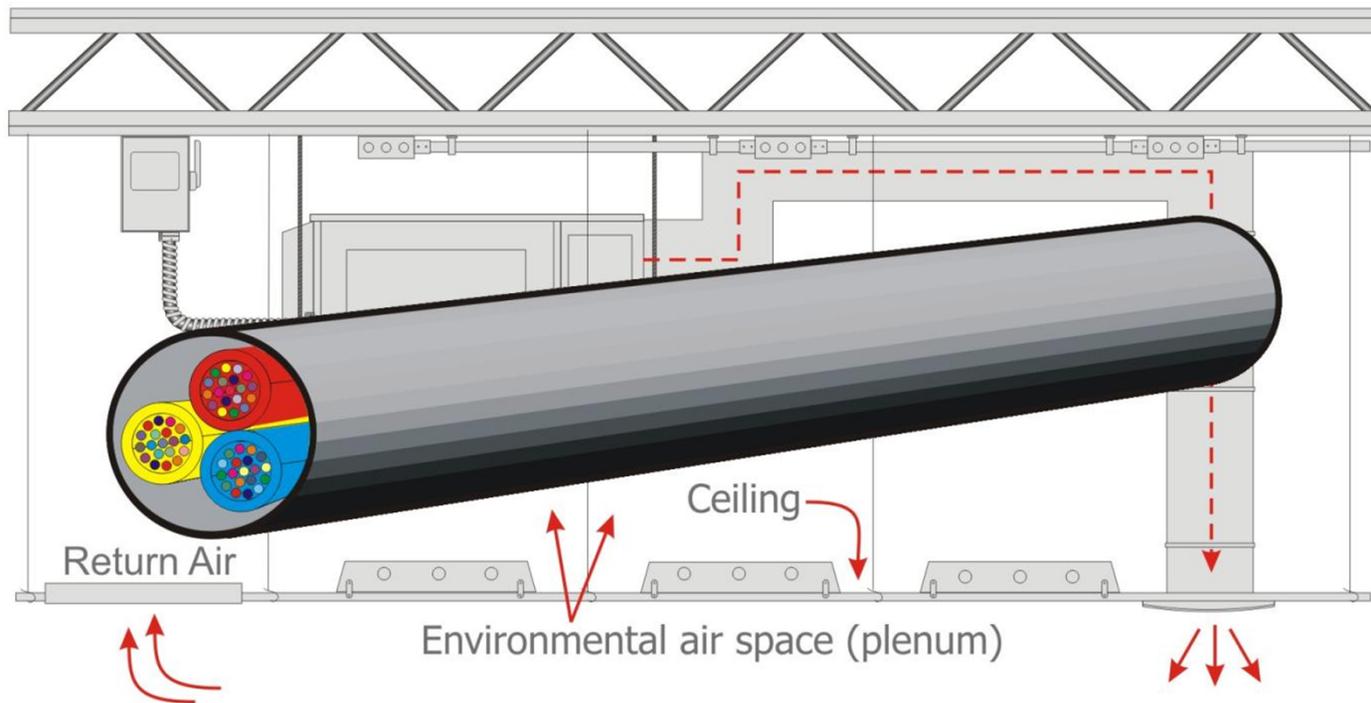
Shielded twisted pair cable

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800.2 Definitions: Communications Raceways



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



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

Thank you!

Questions?

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jim.yancey@doa.nc.gov

howard.beasley@doa.nc.gov

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