Changes to the 2017 National Electrical Code®

Chapter 7

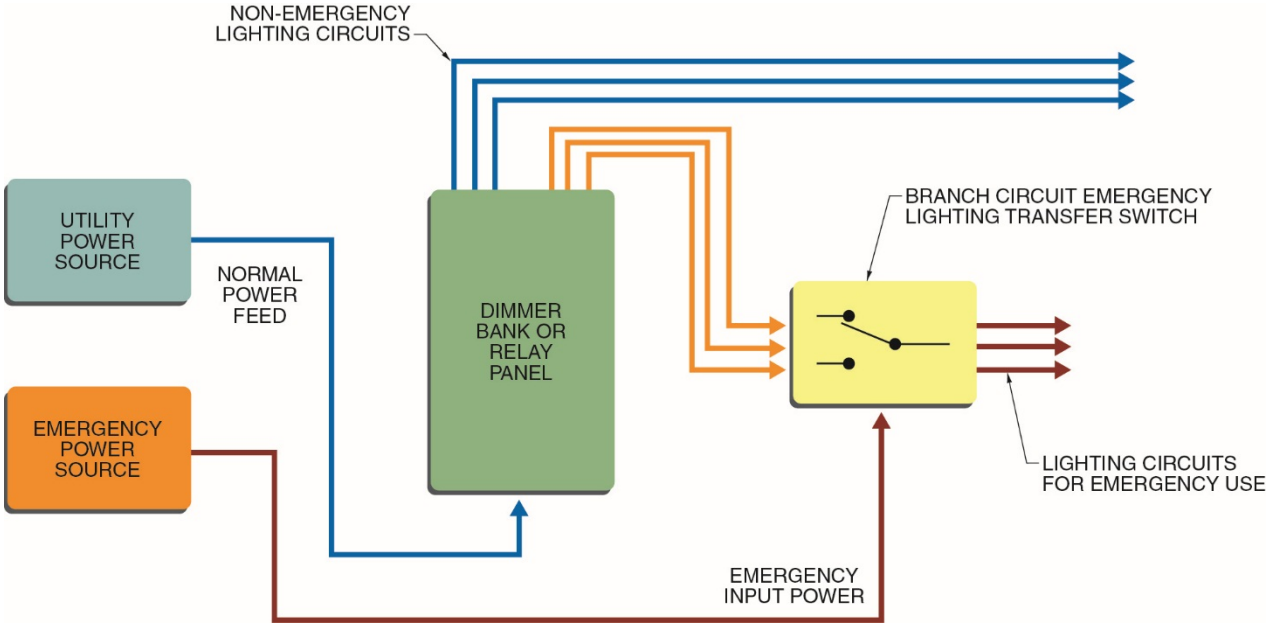
Special Conditions

700.2 and 700.25 Branch Circuit Emergency Lighting Transfer Switch

- For the 2017 NEC a new definition for “Branch Circuit Emergency Lighting Transfer Switch” has been added.
- In many cases there are only a few emergency lighting branch circuits. These transfer switches will allow the transfer from normal power to emergency power for small 20 amp or less lighting circuits.
- ALCRs are not to be used for general purpose transfer equipment

700.2 and 700.25 Branch Circuit Emergency Lighting Transfer Switch

Branch Circuit Emergency Lighting Transfer Switch now permitted to be used to supply branch circuits that are rated at 20 amperes or less. Transfer is between a normal branch circuit to an emergency branch circuit.



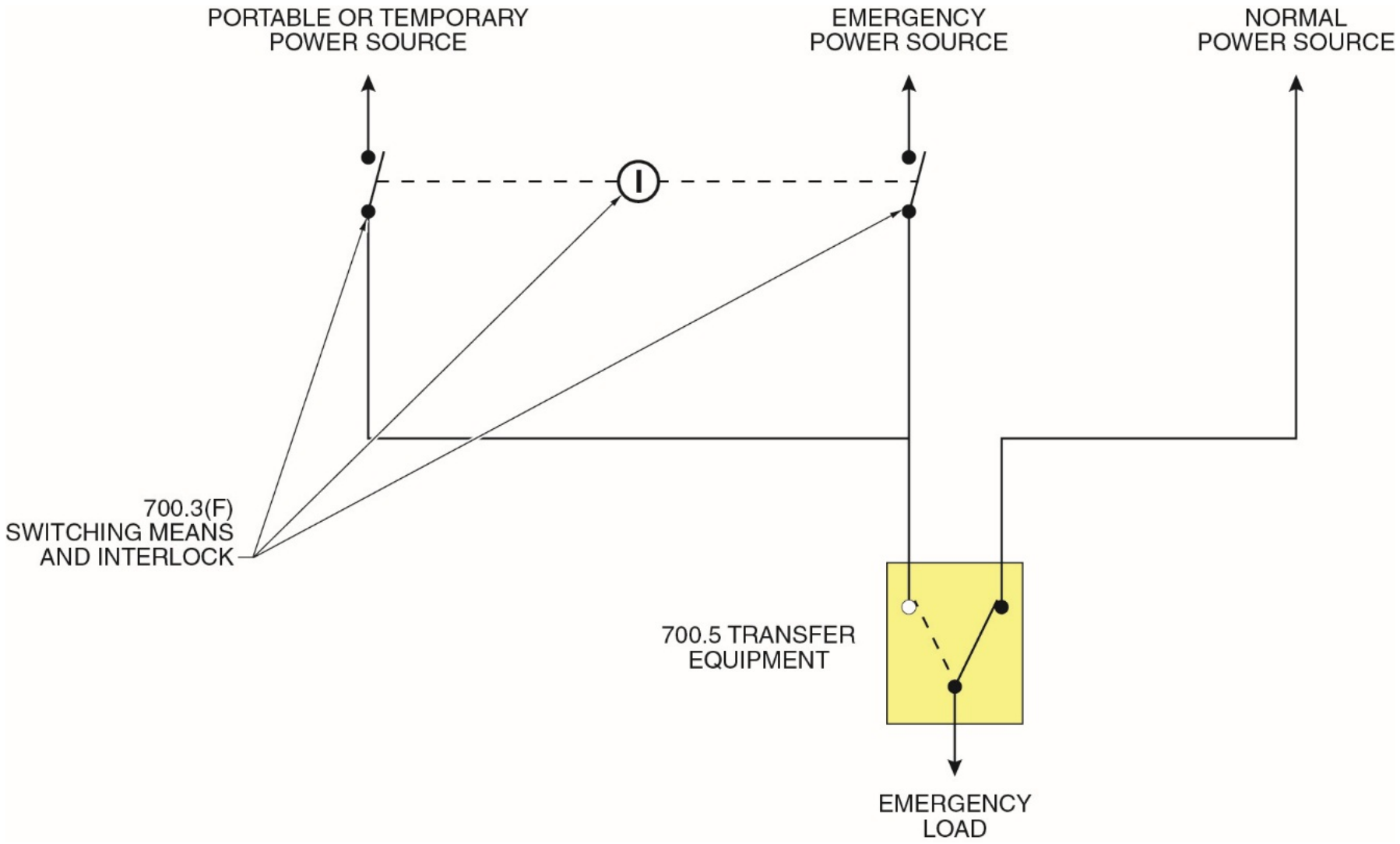
Definition: Branch Circuit Emergency Lighting Transfer Switch. A device connected on the land side of a branch circuit overcurrent protective device that transfers only emergency lighting loads from the normal supply to an emergency supply.


ETC
SC1008
WARNING: More than one live circuit: disconnect all sources before servicing
Attention: Il y a plus d'un circuit sous tension. Veuillez déconnecter toutes les sources avant la maintenance.
CAUTION: This switch will not transfer if the internal fuse (s) open due to a fault
Continuous load current not to exceed 100 percent of the switch rating
Transfer initiates at 80V
Test transfer operation monthly by pressing the "Test" switch or using the laser test function
Use Copper Wire Only, 60/75C conductors
Tighten Terminals to 10 in-lb (1.1 Nm)
For use with Lighting Loads Only including Incandescent, Tungsten and Electric Discharge Lamp.
120-277V, 50/60Hz, 20A Max Load
NEMA Type 1 Enclosure
Suitable for installation in air handling spaces (plenums)
UL2043 LISTED
Patent Pending
LASER TEST
NORMAL POWER
EMERGENCY POWER
PUSH TO TEST
Specific Fuse Manufacturer and Type Listing
Short Circuit Current
Voltage
Manufacturer
Type
Rating
10kA RMS Sym
480
Littelfuse
Class G
20A
LISTED
ETC, Inc. etcconnect.com
Simple Transfer Operation
Dimmer or Switch Control
0-10V Control Wiring

700.3(F) Temporary Source of Power for Maintenance or Repair of the Alternate Source of Power

- New section of code for when a permanent alternate source of power is out of service due to maintenance.
- Some type of switching must be provided while maintenance is being provided on alternate source.
- Concern is with regard to lack of emergency source during maintenance condition.
- Four exceptions to new requirement.
- New Figure 700.3(F) was added to show how this can be accomplished with manual switching.

700.3(F) and Figure 700.3(F)



700.3(F) Temporary Source of Power

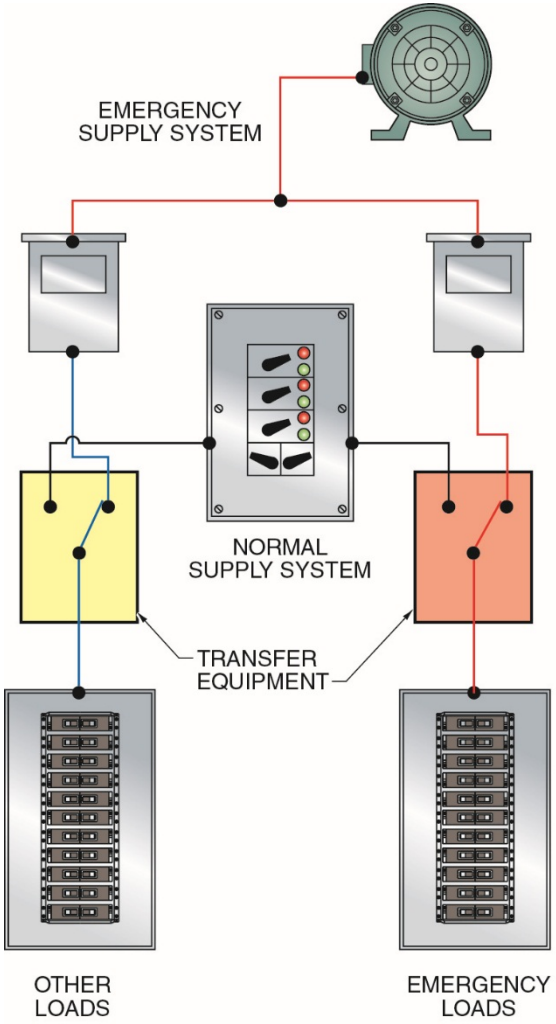
- Previous requirements called for temporary alternate source to be available whenever the emergency generator is out of service for major maintenance or repair
- New text provides additional clarity.
- Exceptions:
  - If building is unoccupied then switching does not need to be provided.
  - If other temporary means can be provided, i.e. portable genset tied to output lugs of permanent generator breakers.
  - If separate utility exists or other permanent alternate source exists, i.e. parallel gensets.
  - All processes that rely on emergency system can be disabled

700.5(E) Emergency Systems Transfer Equipment Documentation

- New requirements added for available short-circuit current rating (SCCR) documentation and field-marking at emergency system transfer equipment
- Literature for transfer switches typically show several short-circuit current ratings depending on specific upstream overcurrent protective device type and settings.
- New requirement will assist authority having jurisdiction.
- New field marking of the SCCR value based on the specific type OCPD, ampere rating, and installed settings, which are known factors by the designer and/or installer

700.5 Documentation

New marking requirement for available short-circuit current rating documentation and field-marking at Emergency ATS



Field marking to take place on exterior of ATS

Short-circuit rating based on upstream device. Manufacturer provides many ratings based on device. Contractor to identify which one applies.

WARNING

MAXIMUM AVAILABLE FAULT CURRENT AT TRANSFER EQUIPMENT: **35.4 kA**

VOLTAGE: **480**

SCCR: **50 kA**

DATE: **Oct 2014**

UL withstand and closing ratings

OTPC transfer switches must be protected by circuit breakers and fuses. Referenced drawings include detailed listings of specific breakers or fuse types that must be used with the respective transfer switches. Consult with your distributor/dealer to obtain the necessary drawings. Withstand and closing ratings (WCR) are stated in symmetrical RMS amperes.

Transfer Switch Ampere	MCCB Protection			Special Circuit Breaker Protection		
	WCR @ Volts Max with Specific Manufacturers MCCBs	Max MCCB Rating	Drawing Reference	With Specific Current Liminting Breakers (CLB)	Max CLB Rating	Drawing Reference
40, 70, 125 3-pole	14,000 at 480 14,000 at 600	225 A	A050J441	200,000 at 480 100,000 at 600	225 A	A048J566
40, 70, 125 4-pole	30,000 at 480 30,000 at 600	400 A	A048E949	200,000 at 480 100,000 at 600	400 A	A051D533
150, 225, 260	30,000 at 480 30,000 at 600	400 A	A048E949	200,000 at 480 100,000 at 600	400 A	A051D533
300, 400, 600	65,000 at 480 65,000 at 600	1200 A	A048E951	200,000 at 480 100,000 at 600	1200 A	A048J564

700.10(A) Identification – Emergency System

- Identification for emergency circuits now includes identification of cables and raceways that are do not have boxes between conduit or cable runs.
- Examples
  - Conduit between panel and emergency light with no box.
  - MC cable between luminaires.
- Permanently marked identification now required on exposed emergency circuit or system cable or raceway systems at intervals not to exceed 7.6 m (25 ft) where boxes or enclosures are not encountered

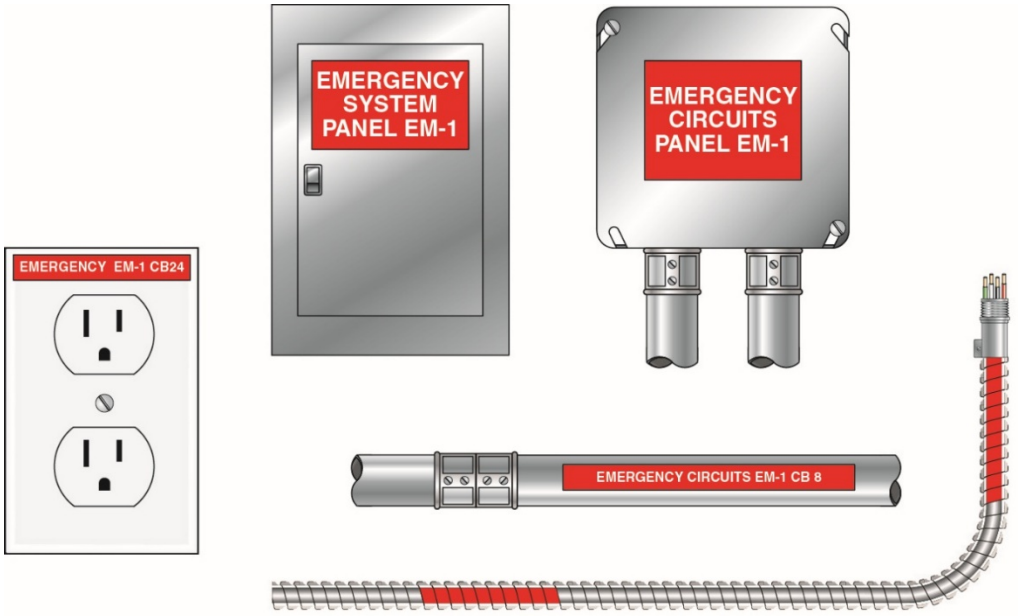
700.10(A) Identification – Emergency Systems

- Emergency system receptacles now require identification with a “distinctive color or marking” on the cover plates or the receptacle
- Not specific as to the method used to mark the receptacle by the “distinctive color or marking” requirements.

700.10(A) Identification of Emergency Systems

Boxes and enclosure that are part of emergency system are required to be readily identified. Now they are to be marked to indicate a part of a emergency system.

Cable and raceways that are exposed and do not have boxes installed (i.e. conduit that is not broken between panel and equipment) are now required to be readily identified "at intervals not exceeding 25 ft".



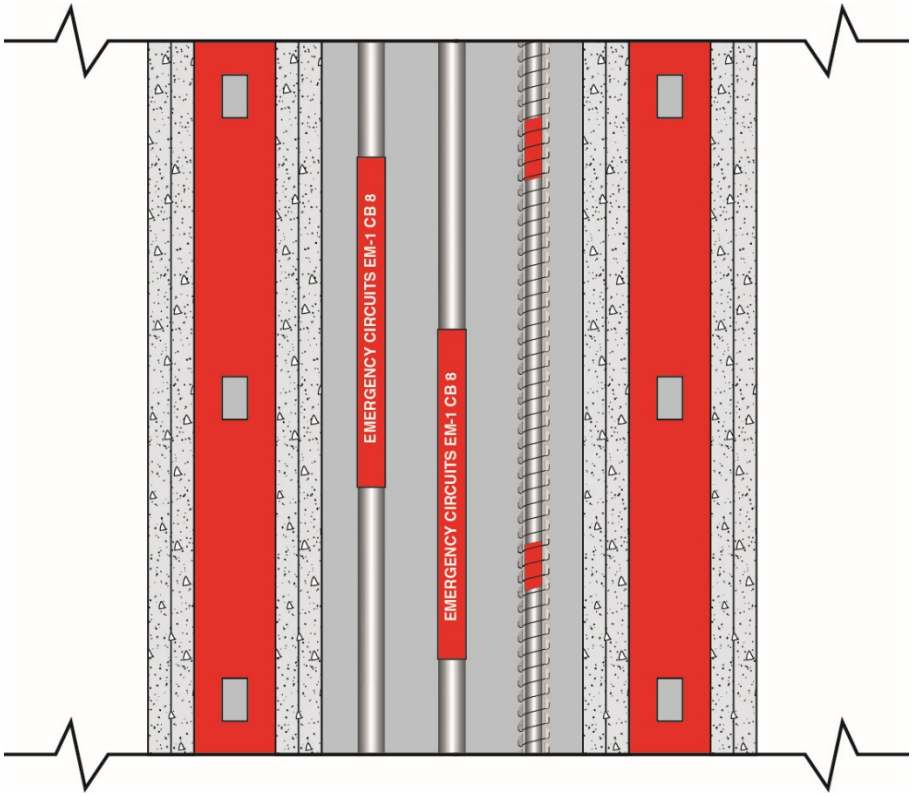
Receptacles that are fed from emergency system required to be identified by a "distinctive color or marking" on the receptacle cover plates or the receptacle.

700.10(D) Fire Protection for Emergency System

- 2014 Requirement was to protect emergency system equipment and feeders with some sort of 2 hour protection.
- 2014 Requirement was simply for large buildings 1000 people or more or high rise buidlings.
- Scope has expanded to require additional protection for the following areas:
    - Health care occupancies where persons are not capable of self-preservation and
    - Educational occupancies with more than 300 occupants

700.10(D)

Occupancy areas requiring 2 hour protection for emergency systems, i.e. equipment and feeders was expanded for the 2017 *NEC*



Fire protection provisions for emergency system feeders required for the following occupancies:

(1) Assembly occupancies for not less than 1000 persons

(2) Buildings above 23 m (75 ft) in height

(3) Health care occupancies where persons are not capable of self preservation

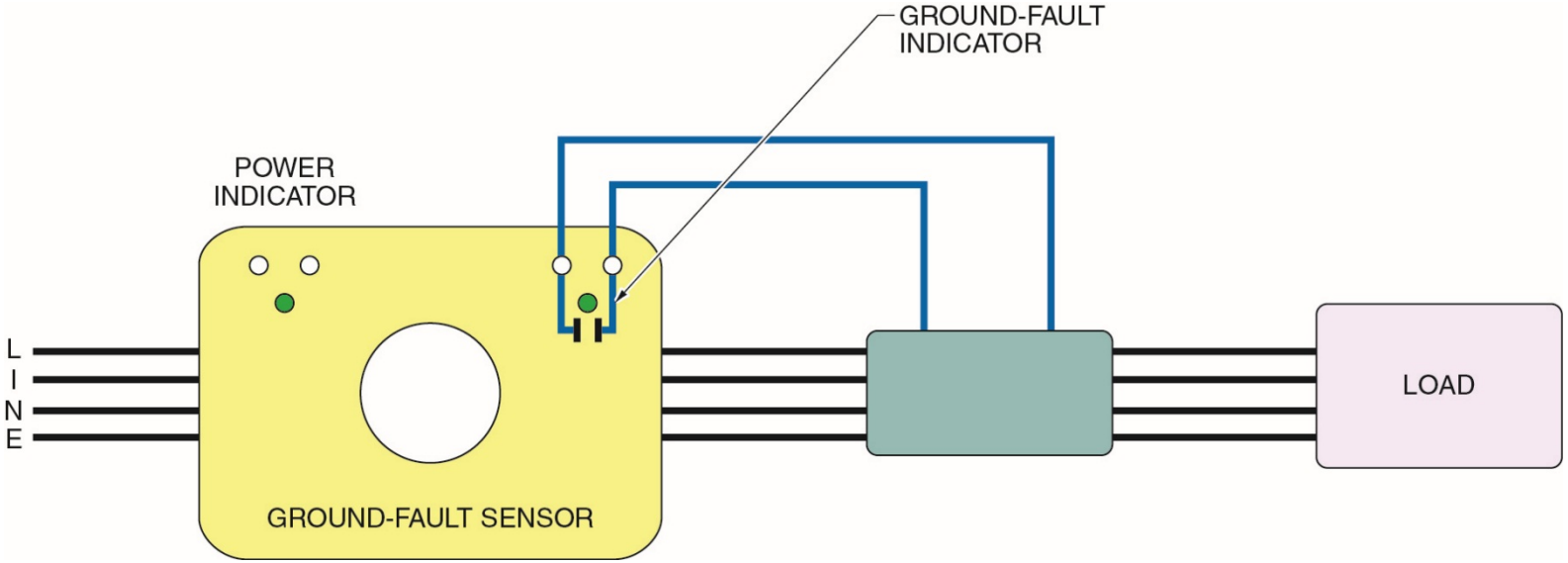
(4) Educational occupancies with more than 300 occupants

701.6(D) GFP Sensors for Legally Required Standby Systems

- For emergency systems ground-fault is required for systems above 150 volts to ground (names 480 volt systems) and at overcurrent protective devices 1000 amp or greater.
- Ground-fault is only required to notify, not trip.
- For parallel generators the ground-fault sensor does not have to be located at the genset breaker since this could lead to nuisance tripping.
- Text was added to clarify that the sensor can be located elsewhere, namely the paralleling switchgear.
- This text normally led to inspectors requiring a sensor at the genset. 2017 Text clarifies the intent.

701.6(D) GFP Sensors

The sensor for ground-fault signal devices is generally required to be located at, or ahead of, the main system disconnecting means or for generators at the main generator breaker.



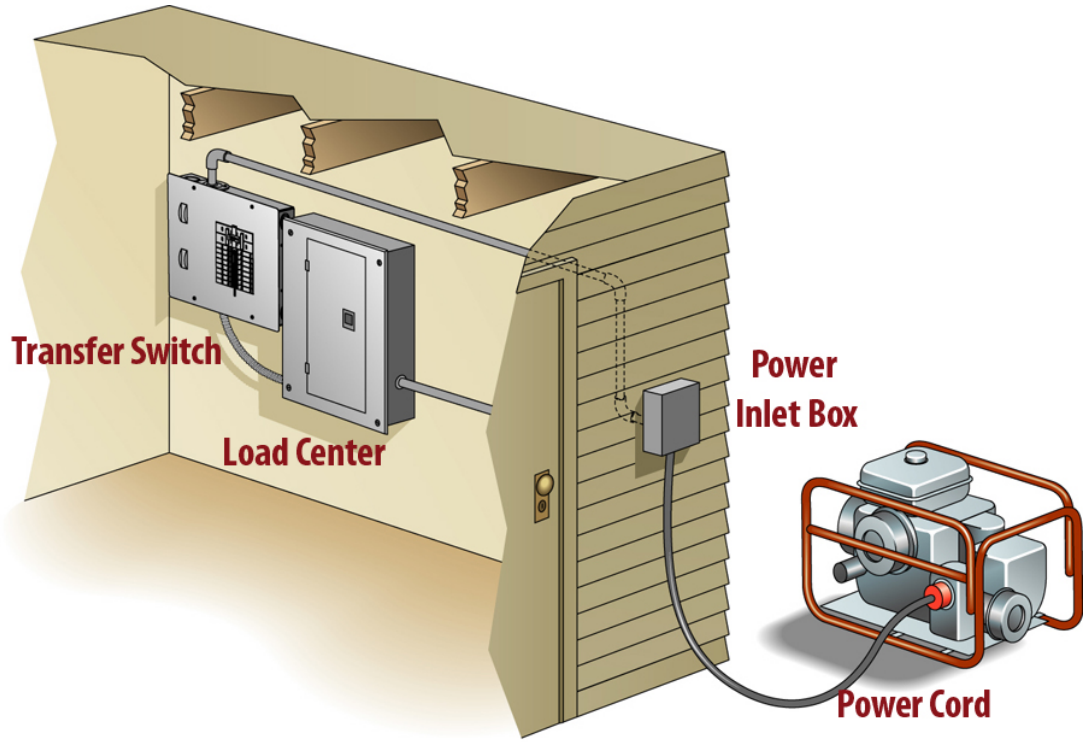
This could lead to nuisance tripping so code language was added at 701.6(D) to clarify that the ground fault sensor can be located at an alternate location for systems with multiple emergency sources connected to a paralleling bus

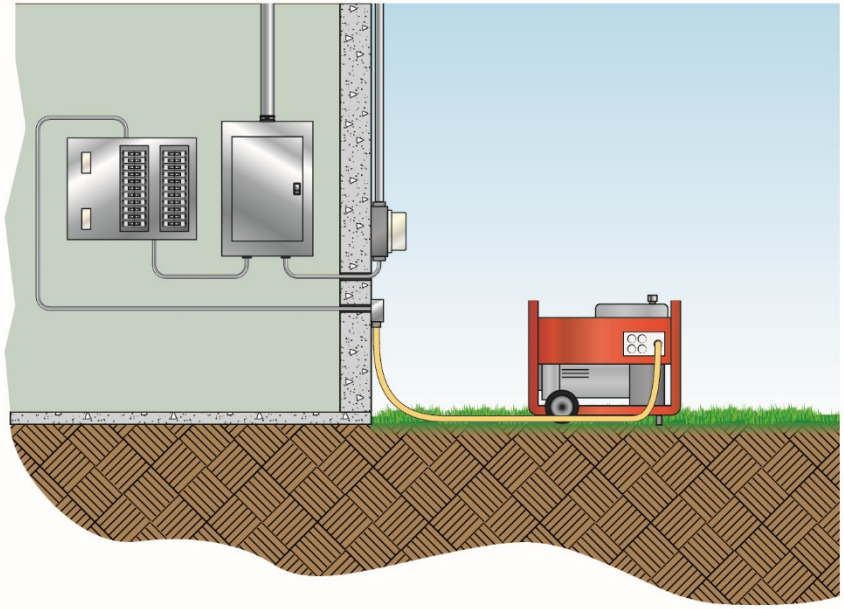
702.12(C) Power Inlets for Portable Generators at Optional Standby Systems

- New requirement to require power inlet devices 100 amp or greater to be listed.
- Also requires a disconnecting means with a power inlet to make sure that power is disconnected prior to removing power connection from outlet, which would create a hazard if under load.

702.12(C) Power Inlets for Portable Generators at Optional Standby Systems

- Two new exceptions :
  - If the power inlet is rated to be safely disconnect under load then a disconnecting means is not required.
  - Second exception allows supervised industrial installations where permanent space is identified for the portable generator to be located within line of sight of the power inlets


Transfer Switch
Load Center
Power
Inlet Box
Power Cord

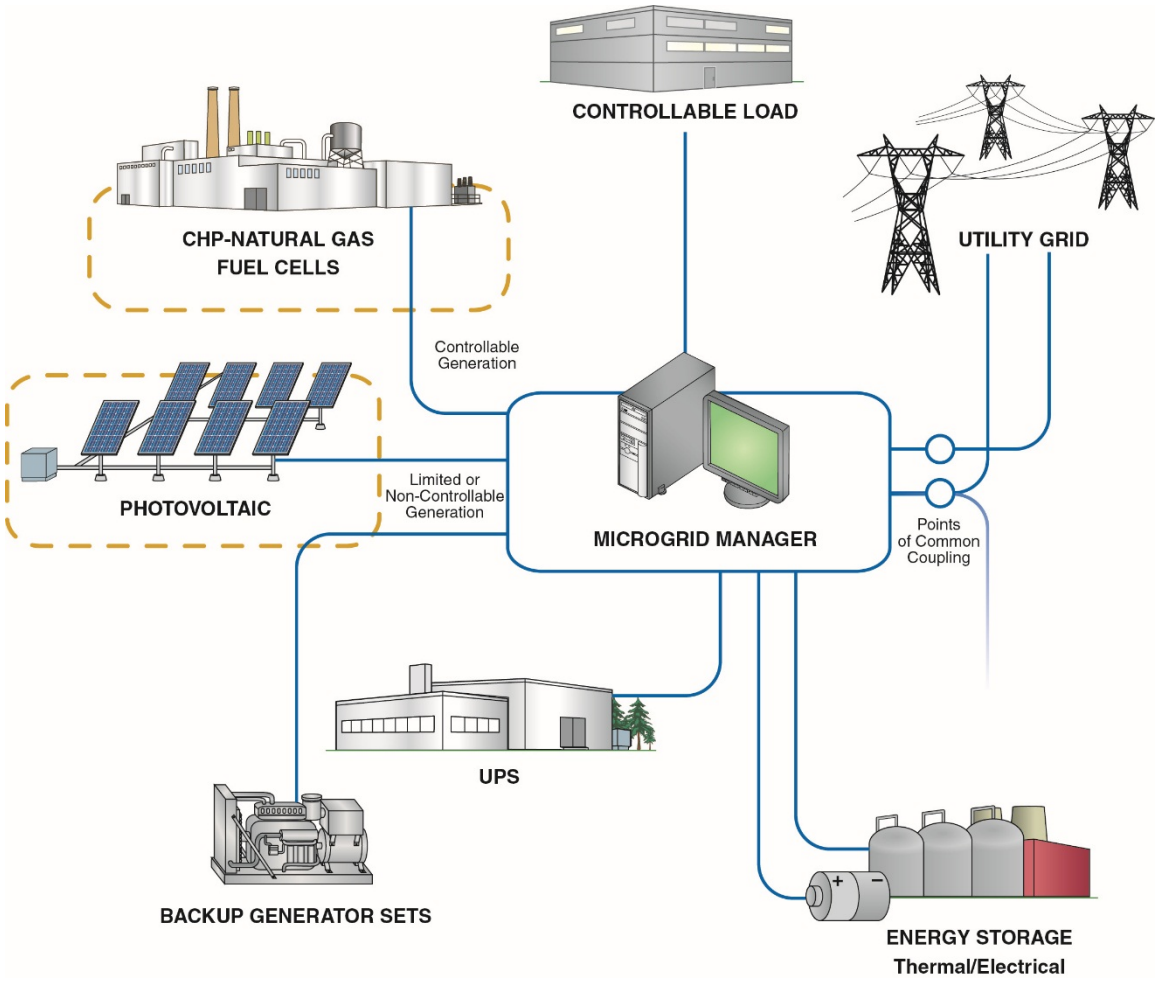


Article 705 Part IV Microgrid Systems (Interconnected Electric Power Production Sources)

- New Part IV added to Article 705 recognizing microgrid systems as an interconnected electric power production source
- Microgrids are an example of one or more interconnected electric power production source operating in parallel with a primary source(s) of electricity
- Microgrid systems are modern, localized, small-scale grids, contrary to the traditional, centralized electricity grid
- Microgrids are a way to add resiliency against loss of power in premises wiring systems
- Microgrid systems are sometimes referred to as “intentionally islanded systems” and “stand-alone systems”

Article 705 Part IV. Microgrid Systems Interconnected Electric Power Production Sources

A Part IV covering "Microgrid Systems" was added to article 705.



Adding this section recognizes that Microgrid are production sources that can be interconnected to other systems that we are familiar with.

Article 706 Energy Storage Systems

- “Energy Storage Systems” does not only apply to DC systems but applies to all permanently installed systems (ESS) operating at over 50 volts ac or 60 volts dc
- Could be stand-alone or interactive with other electric power production sources
- An ESS typically is located on the line side of the service disconnect however systems are being made for load side installation, which would then be governed by NEC.

New Article 706 Energy Storage Systems

- Energy storage systems (ESS) can consist of the following:
  - Batteries, capacitors, and/or kinetic energy devices (e.g., flywheels and compressed air)
  - ac or dc output for utilization
  - Inverters and/or converters to change stored energy into electrical energy
- Energy storage is the capture of energy and storage of energy that can be used at the same time.
- This article is not referring to UPS equipment or batteries that use energy when normal power is lost.

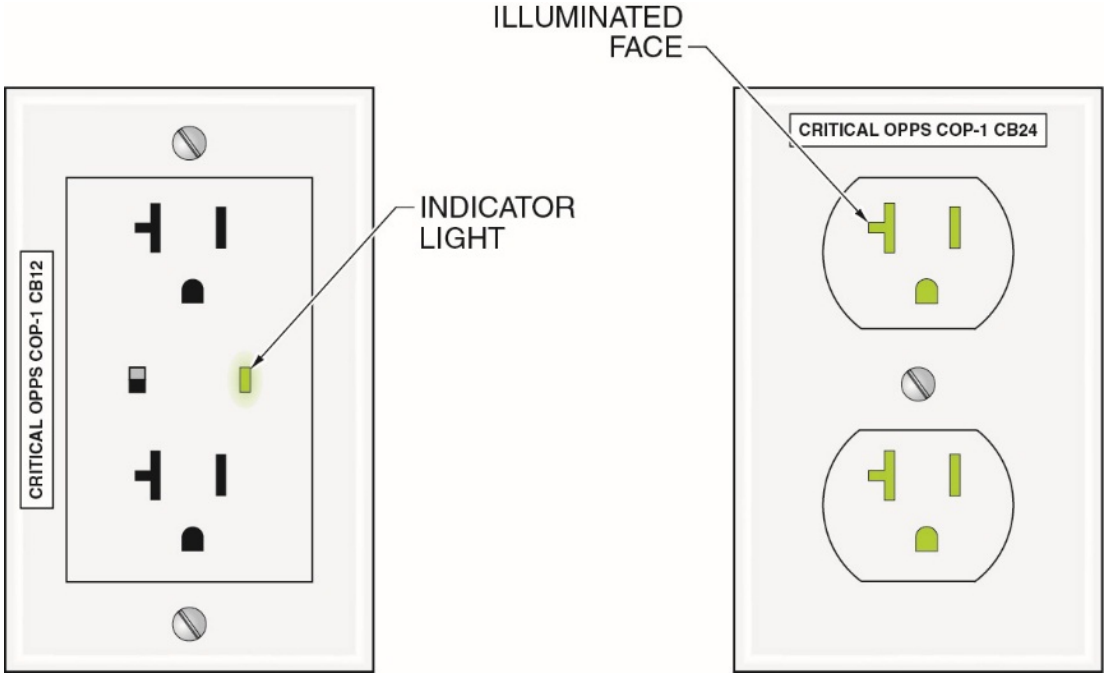
708.10(A)(2) Receptacle Identification for Critical Operations Power Systems (COPS)

- New code requirement for COPS facilities. This requirement is where critical power is also provided with other power systems.
- All nonlocking-type, 125-volt, 15- and 20-ampere receptacles supplied by the Critical Operation Power System (COPS) are required to have an illuminated face or an indicator light to indicate
- Indicator light or illuminated face is necessary to show that there is power to the receptacle
- This is in addition to the existing requirement for a distinctive color or marking so as to be readily identifiable

708.10(A)(2) Receptacle Identification

This requirement is valid where COPS exist with other types of power systems:

2014 requirement that receptacle cover plates or the receptacles themselves supplied from the COPS shall have a distinctive color or marking



2017 requirement for nonlocking-type, 125-volt, 15- and 20-ampere receptacles supplied from the COPS to have a illuminated face or an indicator light to indicate that power is supplied to the receptacle

Article 710 Stand-Alone Systems

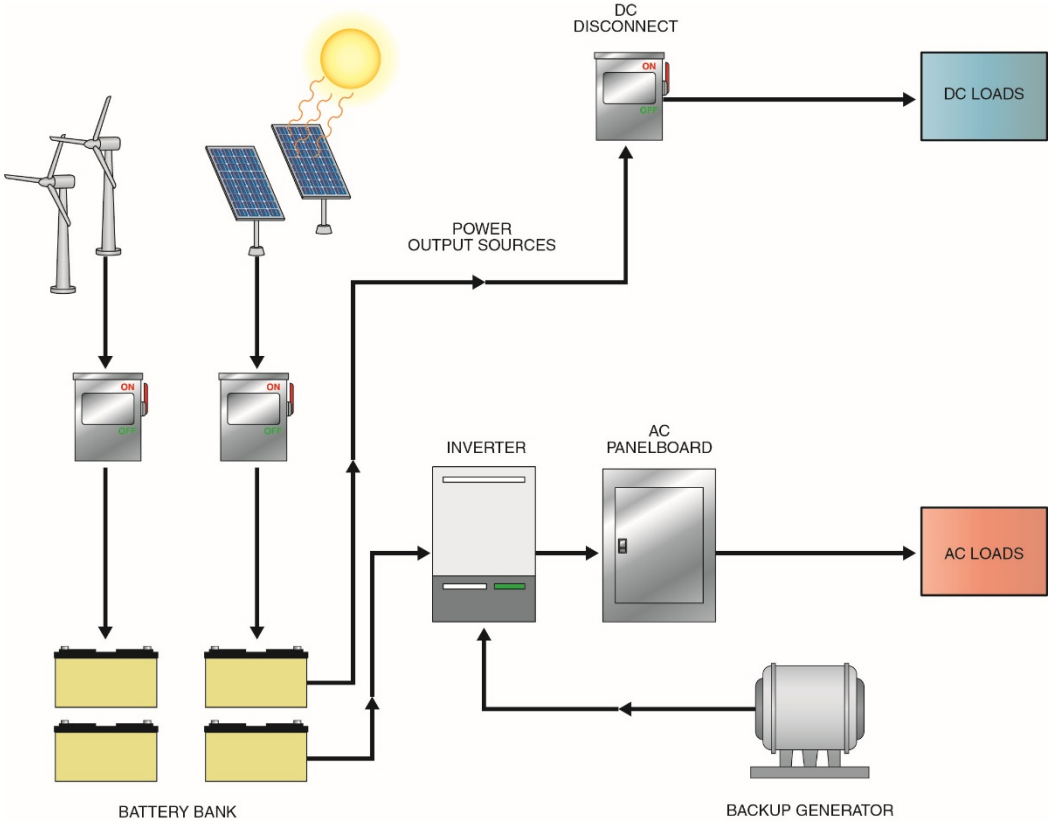
- Stand-alone systems or stand-alone power production facilities were a part of article 690 in the 2014 NEC.
- They are now relocated to a new Article 710.
- Stand-alone power system is normally an off-the-grid electricity system such as a solar system not tied to premises wiring.
- Stand-alone power systems will includes normally one or more methods of
  - electricity generation,
  - energy storage,
  - and regulation

Article 710 Stand-Alone Systems

- While these requirements for stand alone were in 690, 692 and 694, a stand alone system could be a engine generator.
- Stand-alone systems are expected to become more prevalent due to emerging technology in energy storage and local generation

Article 710 Stand-Alone Systems

A new article for “Stand-Alone Systems” was added and information from article 690, 692, and 694 were relocated to article 710 to address the code rules for electric power production sources in a stand-alone mode

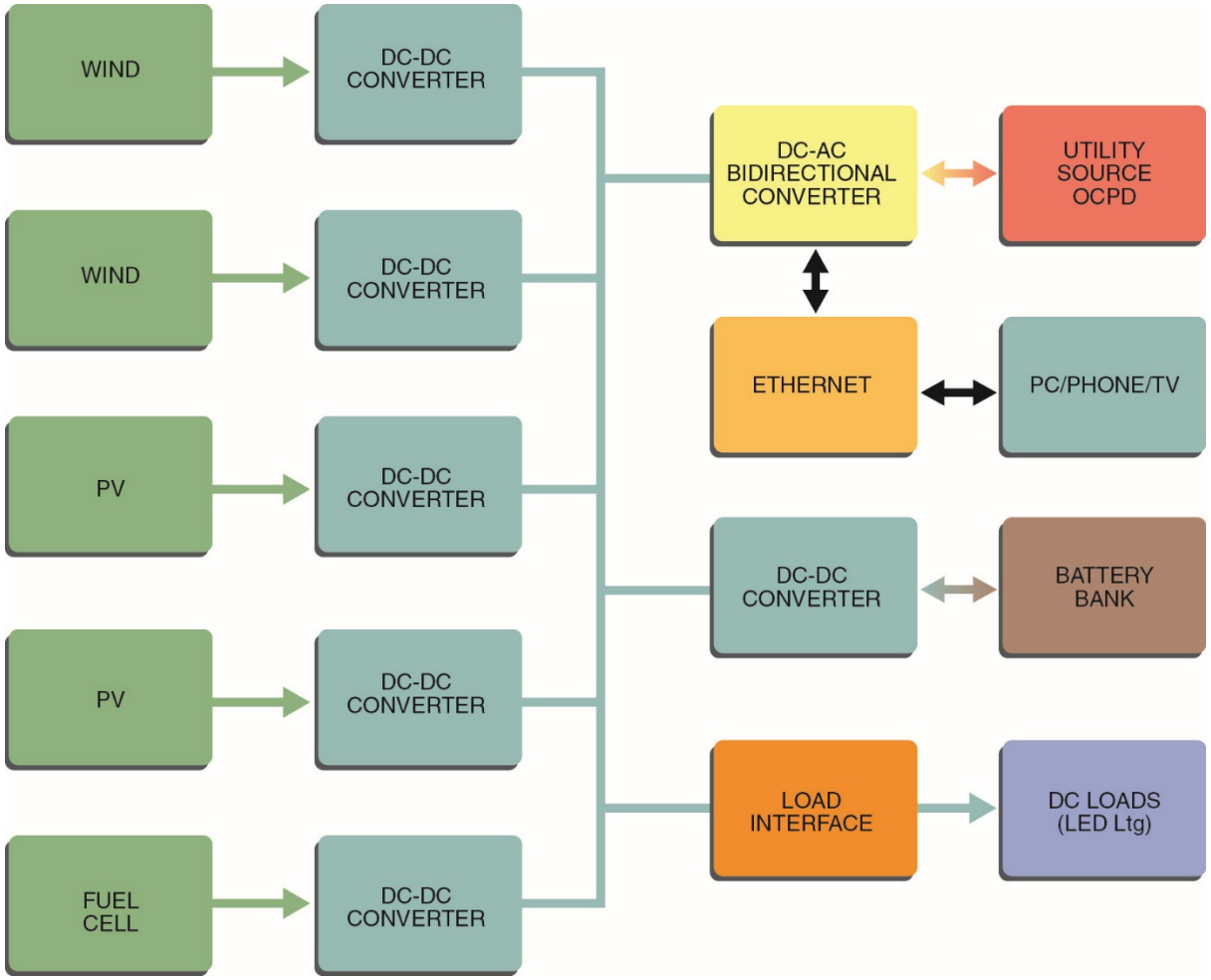


Article 712 Direct Current Microgrids

- New article dealing with DC microgrids
- DC microgrids take alternate energy sources such as wind, solar, etc. put a converter at the output of the alternative energy source and tie it into a larger grid network.
- Many devices are strictly using DC instead of AC in today's electrical infrastructure.
- Overcurrent protection and grounding are specified in other articles such as articles 240 and 250 of the *NEC.*
- Many future technology changes will probably come from the use of DC systems.

New Article 712 DC Microgrids

Definition: DC Microgrid – A power distribution system consisting of more than one interconnected dc power sources, supplying dc-dc converter(s), dc load(s), and/or ac load(s) powered by dc-ac inverter(s).



725.3(M) Cable Routing Assemblies and 725.3(N) Communication Raceways

- New requirements added to 725.3 for cable routing assemblies and communications raceways
- 725.3(M) provides consistency for cable routing assemblies as since Chapter 8 is a stand alone article. Cables that are referenced in Table 800.154(c), 800.182, 800.110(C) and 800.113 are added to this section to understand they can be installed in these types of assemblies.
- Originally cable routing assemblies were just used for optical fiber.
- (N) identifies that Class 2, Class 3 and PLTC cables can now be installed in communication raceways.


BA19105

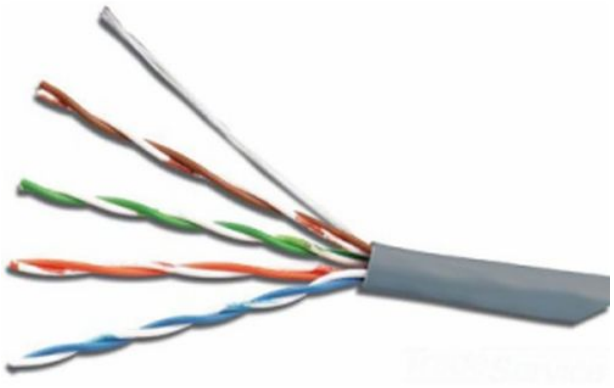
725.135(K), (L), and (M) Installation of Type CMUC

- Type CMUC undercarpet communication wiring and cables
  - Now permitted to be installed under modular flooring, and planks as well as under carpet
  - Type CMUC now applies to one- and two-family dwellings, multifamily dwellings, and other building locations
- Used in areas that are not easily accessible by traditional cabling methods
- Building owners are rapidly adopting alternate flooring covering other than carpet squares, such as modular vinyl planks and tile, laminate and hard wood.

725.135(K), (L), and (M) Installation of Type CMUC

- Type FCC (flat conductor cable) addressed in Article 324 is similar to Type CMUC wire.
- Type FCC cables carry more power than Type CMUC.

Type CMUC under carpet communication wiring and cables is permitted to be installed under modular flooring, and planks as well as under carpet



CMUC can be used for CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC cables as well as Type CMUC undercarpet communications wires and cables

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

- New 725.144 was added to address power over ethernet or POE.
- Table 725.144 added to introduce new cable Type “LP” (Limited Power) that provides the current limitation due to cable bundling.
- The “-LP” cable designation indicates cable has been evaluated to carry marked current under reasonable worst-case installation scenarios without exceeding the temperature rating of the cable
- With POE and more systems that can use this technology electricians need to know that CAT 5 type cables can only handle certain ampacities.

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

- Systems rated at 60W or less are typically okay.
- Newer 100 W POE systems are more of a concern.
- UL Fact Finding Report on Power over Local Area Network Type Cables shows heating concern when bundling cables
- No conductor (or cable) should be used in such a manner that its operating temperature exceeds its rated maximum temperature

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

TABLE 725.144																				
AWG	1			2–7			8–19			20–37			38–61			62–91			92–192		
	Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating		
	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C
26	1	1	1	1	1	1	0.7	0.8	1	0.5	0.6	0.7	0.4	0.5	0.6	0.4	0.5	0.5	NA	NA	NA
24	2	2	2	1	1.4	1.6	0.8	1	1.1	0.6	0.7	0.9	0.5	0.6	0.7	0.4	0.5	0.6	0.3	0.4	0.5
23	2.5	2.5	2.5	1.2	1.5	1.7	0.8	1.1	1.2	0.6	0.8	0.9	0.5	0.7	0.8	0.5	0.7	0.8	0.4	0.5	0.6
22	3	3	3	1.4	1.8	2.1	1	1.2	1.4	0.7	0.9	1.1	0.6	0.8	0.9	0.6	0.8	0.9	0.5	0.6	0.7

Note 1: For bundle sizes over 192 cables, or for conductor sizes smaller than 26 AWG, ampacities shall be permitted to be determined by qualified personnel under engineering supervision.

Note 2: Where only half od the conductors in each cable are carrying current, the values in the table shall be permitted to be increased by a factor of 1.4.

Informational Note: The conductor sizes in data cables in wide-spread use are typically 22–26 AWG

727.4(5) Ex. to (5)
Uses Permitted for Type ITC-ER Cable

- ITC Cable is only permitted to be installed in Cable Trays, in raceways or a few other locations mentioned in 727.4.
- A new code section allows Type ITC-ER cable to be installed between a cable tray and a utilization equipment or devicee for a distance not to exceed 1.8 m (6 ft) without continuous support and the cable is not subject to physical damage.
- This code section requirement is similar to article 336 that covers power and control tray cable (Type TC-ER) at 336.10(7)
- Cable must be mechanically supported where exiting the cable tray.

727.4(5), Ex. To (5) Type ITC-ER Cable

An exception has been added for Type ITC cable (without a metallic sheath or armor) that complies with the crush and impact requirements of Type MC cable and is identified for such use with the marking “ITC-ER”

This cable can be installed exposed if the cable is continuously supported and protected against physical damage using mechanical protection and is secured at intervals not exceeding 1.8 m (6 ft)

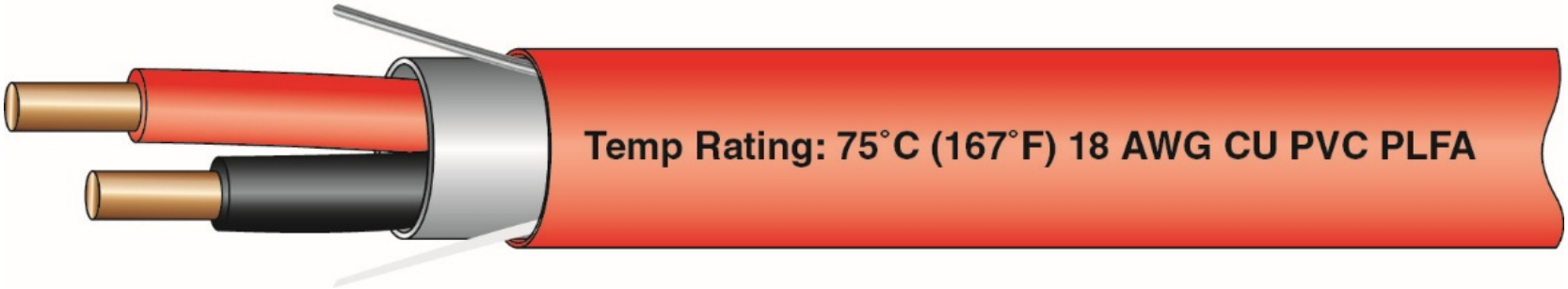
This new exception in 727.4(G) Ex to (5) allows ITC-ER cable to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6 ft) <u>without continuous support</u> where not subject to physical damage

760.176(G) and 760.179(I) Cable Markings for Fire Alarm Systems

- New marking requirements for NPLFA and PLFA cables
- Temperature ratings and conductor size to be marked on the jacket of NPLFA and PLFA cables when a temperature rating exceeding 60° C (140 F°)
- Fire alarm cables must also be marked with conductor size

760.176(G) and 760.179(I) Cable

Listing and marking requirements for fire alarms circuits are addressed by UL standards and by 760.176 for NPLFA circuits and 760.179 for PLFA circuits



New marking requirements were added for fire alarm circuits requiring a temperature rating to be marked on the jacket of NPLFA and PLFA cables that have a temperature rating exceeding 60°C (140°F) and cable jacket must also show conductor size as well

770.44 Overhead (Aerial) Optical Fiber Cables

- Article 770 covers all optical fiber cables. Article 840 covers optical fiber for Broadband communications.
- 2017 NEC will require optical fiber in 770.44 to be governed by rules for optical fiber for broadband communications entering a building from overhead.
- Earlier codes did not have requirements for optical fiber cables installed overhead to a building or structure
- 840.44 requires a relative location of optical fiber to power lines, climbing space and clearances.

770.44 Overhead (Aerial) Optical Fiber Cables

- Some of the new selected requirements for overhead (aerial) optical fiber cables that enter a building are as follows:
  - Generally located below electric light or power conductors
  - Attachment to cross-arm that carries electric light or power conductors not permitted
  - Climbing space to comply with 225.14(D) [typically 750 mm (30 in.)]
  - Minimum separation of 300 mm (12 in.) at any point in the span from service drops and sets of overhead service conductors of 0 to 750 volts
  - Vertical clearance of not less than 2.5 m (8 ft) from all points of roofs above which they pass (with exceptions)

770.48 Optical Fiber Cables and Raceways Entering Buildings

- Unlisted optical fiber is normally installed where telecommunication utilities enter the building at the point of entrance.
- Normally this is only allowed for 50’ (15m).
- Point of entrance for optical fiber cables is now permitted to be extended when optical fiber is enclosed in rigid metal conduit (RMC) or intermediate metal conduit (IMC)
- The 50 ft requirement is then measured from the “Point of emergence” where the optical fiber exits the conduit.

770.48 Optical Fiber Cables and Raceways Entering Buildings

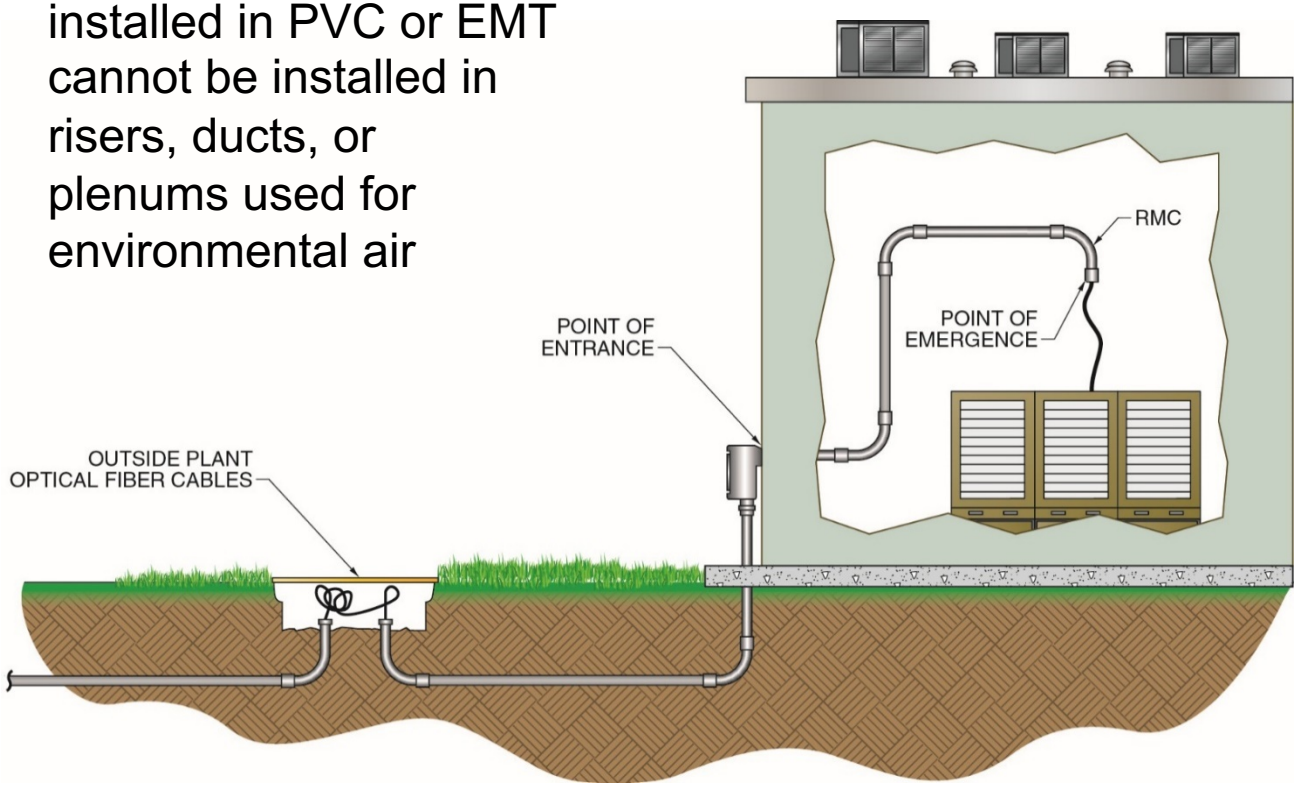
- Outside plant fiber cables installed in PVC or EMT are not permitted to be installed in risers, ducts and plenums for environmental air, and other places used for environmental air.
- This requirement in 770.48(B) is new.
- Provides consistency between requirements of 770.48(A) and (B)
- A similar change occurred in 800.48 and 820.48

770.48 Unlisted Cables Entering Building

Unlisted outside plant optical fiber cables are typically required to be installed in at the point of entrance to the building where the length of the cable within the building *(measured from its point of entrance)* does not exceed 15 m (50 ft) and the cable is terminated in an enclosure

The point of entrance is now permitted to be lengthened if the optical fiber is continuously enclosed in RMC or IMC to the point of exit from the conduit.

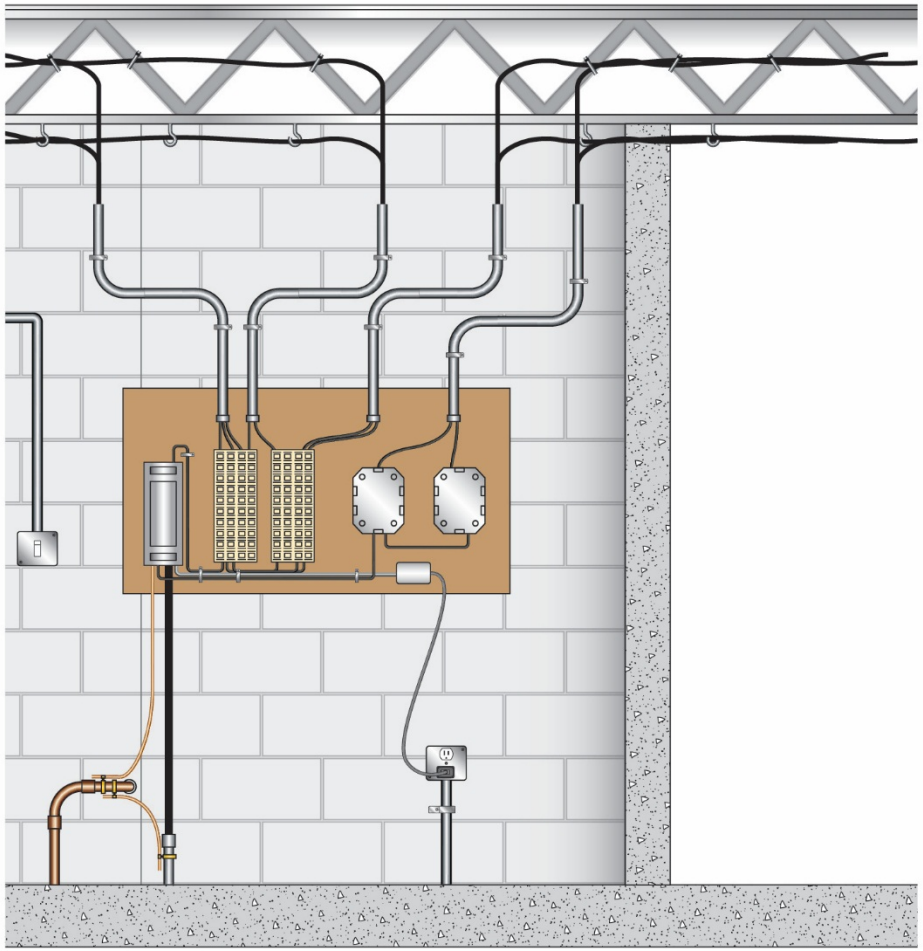
Unlisted outside plant optical fiber cables installed in PVC or EMT cannot be installed in risers, ducts, or plenums used for environmental air



770.49 Metallic Entrance Conduit Grounding for Optical Fiber Cables and Raceways

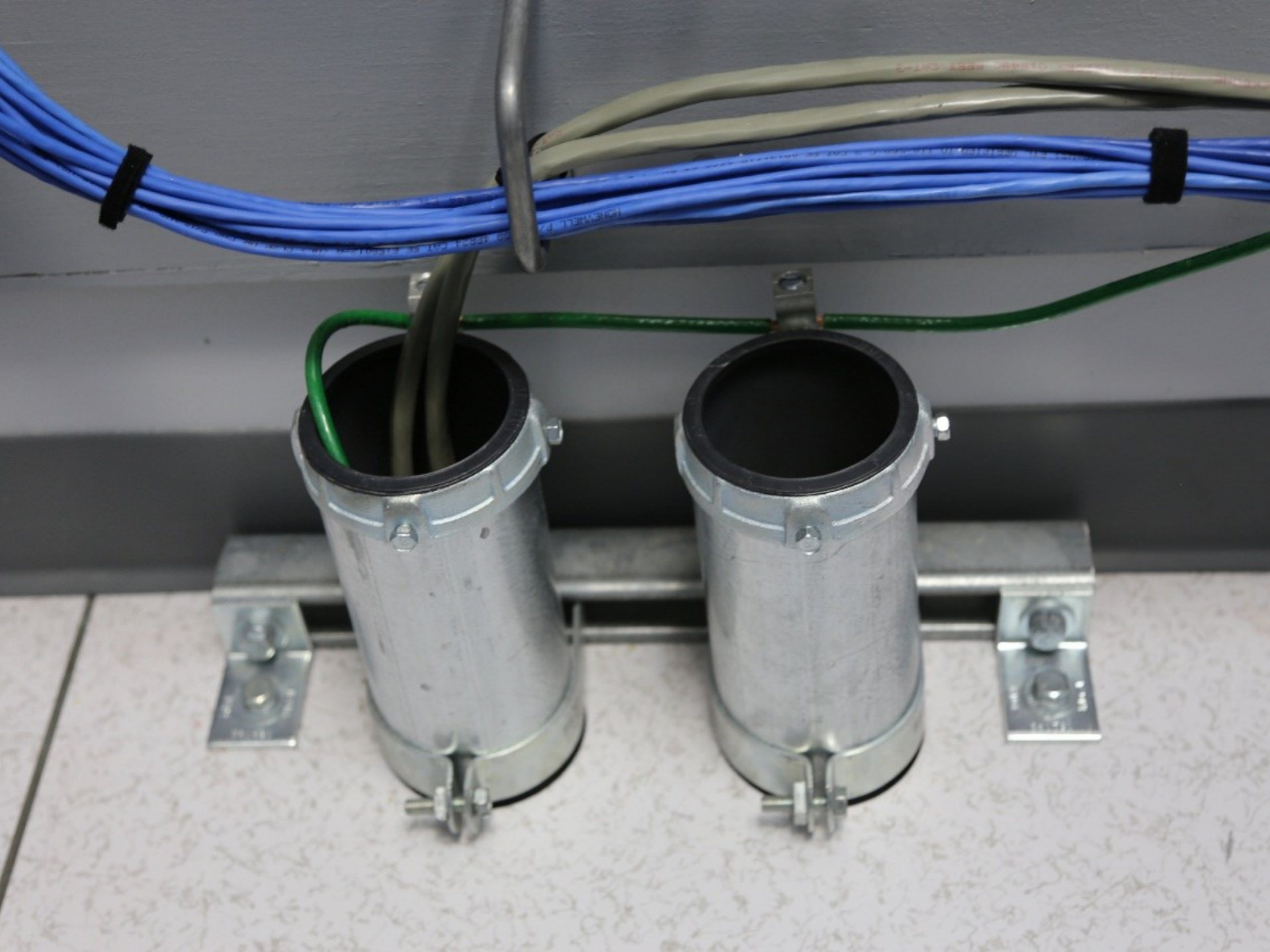
- In 2014 just RMC and IMC enclosing optical fiber entrance cable were required to be connected by a bonding conductor or grounding electrode conductor to a grounding electrode
- In 2017 all metallic conduits enclosing optical fiber entrance cables are required to be bonded to grounding electrode.
- A similar change is now required for for communications circuits in 800.49, for community antenna television and radio distribution systems in 820.49 and for network-powered broadband communications systems in 830.49.

770.49 Metallic Entrance Conduit Grounding



Metallic conduit containing optical fiber entrance cable shall be tied to a grounding electrode by a bonding or grounding electrode conductor per 770.100(B)

In the 2014 NEC section 770.100 only required RMC or IMC to be bonded. In 2017 all "metallic conduit" that contains optical fiber entrance cables will require a bonding connection to a grounding electrode



770.100(B)(3)(2) Entrance Cable Bonding and Grounding of Optical Fiber Cables and Raceways

- Metallic parts of optical fiber cable, where no grounding means are present, are not permitted to be grounded to lightning protection system conductors, (not just air terminal conductors).

- Lightning protection systems are not to be used as part of the grounding electrode or grounding electrode conductors for optical fiber systems or any communication system in buildings or structures if a intersystem bonding termination is not provided.

770.100(B)(3)(2) Entrance Cable Bonding and Grounding of Optical Fiber Cables and Raceways

- A similar change has occurred at 800.100(B)(3)(2) for communications circuits, 820.100(B)(3)(2) for community antenna television and radio distribution systems, and 830.100(B)(3)(2) for network-powered broadband communications systems