Changes to the 2017 National Electrical Code®

Chapter 7
Special Conditions

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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.
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.
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)

PORTABLE OR TEMPORARY POWER SOURCE

EMERGENCY POWER SOURCE

NORMAL POWER SOURCE

700.3(F) SWITCHING MEANS AND INTERLOCK

700.5 TRANSFER EQUIPMENT

EMERGENCY LOAD
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.
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.
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.
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.

<table>
<thead>
<tr>
<th>Transfer Switch Ampere</th>
<th>MCCB Protection</th>
<th>Special Circuit Breaker Protection</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>WCR @ Volts Max with Specific Manufacturers MCCBs</td>
<td>Max MCCB Rating</td>
</tr>
<tr>
<td>40, 70, 125 3-pole</td>
<td>14,000 at 480</td>
<td>225 A</td>
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<tr>
<td></td>
<td>14,000 at 600</td>
<td></td>
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<tr>
<td>40, 70, 125 4-pole</td>
<td>30,000 at 480</td>
<td>400 A</td>
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<td></td>
<td>30,000 at 600</td>
<td></td>
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<tr>
<td>150, 225, 260</td>
<td>30,000 at 480</td>
<td>400 A</td>
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<td></td>
<td>30,000 at 600</td>
<td></td>
</tr>
<tr>
<td>300, 400, 600</td>
<td>65,000 at 480</td>
<td>1200 A</td>
</tr>
<tr>
<td></td>
<td>65,000 at 600</td>
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</table>
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.
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 an 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.
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 buildings.

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
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.
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.
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.
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.
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”

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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.
“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.
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 an 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 include 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 an 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.
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).
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.
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.

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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.
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.
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>
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<th>AWG</th>
<th>1</th>
<th>2–7</th>
<th>8–19</th>
<th>20–37</th>
<th>38–61</th>
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<td>60°C</td>
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<td>26</td>
<td>1</td>
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<td>3</td>
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<td>1.4</td>
<td>1.8</td>
<td>2.1</td>
<td>1</td>
</tr>
</tbody>
</table>

**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 of 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.
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 device 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.
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) without continuous support where not subject to physical damage
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.
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.
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)
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.
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
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.
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.
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
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.
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.