

670.5

Short-Circuit Current Rating (Industrial Machinery)

Industrial machinery shall not be installed where the available fault current exceeds its short-circuit current rating as marked in accordance with 670.3(A)(4).

680.2

Definitions (Swimming Pools, Fountains, and Similar Installations)

Low Voltage Contact Limit. A voltage not exceeding the following values:

- (1) 15 volts (RMS) for sinusoidal ac
- (2) 21.2 volts peak for nonsinusoidal ac
- (3) 30 volts for continuous dc
- (4) 12.4 volts peak for dc that is interrupted at a rate of 10 to 200 Hz.

680.10

Underground Wiring Location (Swimming Pools, Fountains, and Similar Installations)

Underground wiring shall not be permitted under the pool or within the area extending 1.5 m (5 ft) horizontally from the inside wall of the pool unless this wiring is necessary to supply pool equipment permitted by this article. Where space limitations prevent wiring from being routed a distance 1.5 m (5 ft) or more from the pool, such wiring shall be permitted where installed in complete raceway systems of rigid metal conduit, intermediate metal conduit, or a nonmetallic raceway system. All metal conduit shall be corrosion resistant and suitable for the location. The minimum cover depth shall be as given in Table 680.10.

680.2

Definitions (Swimming Pools, Fountains, and Similar Installations)

Dry-Niche Luminaire. A luminaire intended for installation in the floor or wall of a pool, spa, or fountain in a niche that is sealed against the entry of pool water.

680.3

Other Articles

Except as modified by this article, wiring and equipment in or adjacent to pools and fountains shall comply with other applicable provisions of this Code, including those provisions identified in Table 680.3.

Table 680.10 Minimum Cover Depths

Wiring Method	Minimum Cover	
	mm	in.
Rigid metal conduit	150	6
Intermediate metal conduit	150	6
Nonmetallic raceways listed for direct burial under minimum of 102 mm (4 in.) thick concrete exterior slab and extending not less than 162 mm (6 in.) beyond the underground installation	150	6
Nonmetallic raceways listed for direct burial without concrete encasement	450	18
Other approved raceways	450	18

*Raceways approved for burial only where concrete encased shall require a concrete envelope not less than 50 mm (2 in.) thick.

680.21

Motors (*Permanently Installed Pools*)

(A) **Wiring Methods.** The wiring to a pool motor shall comply with (A)(1) unless modified for specific circumstances by (A)(2), (A)(3), (A)(4), or (A)(5).

(5) **Cord-and-Plug Connections.** Pool-associated motors shall be permitted to employ cord-and-plug connections. The flexible cord shall not exceed 900 mm (3 ft) in length. The flexible cord shall include a copper equipment grounding conductor sized in accordance with 250.122 but not smaller than 12 AWG. The cord shall terminate in a grounding-type attachment plug.

680.23

Underwater Luminaires (*Permanently Installed Pools*)

This section covers all luminaires installed below the normal water level of the pool.

(A) General

(3) **GFCI Protection, Relamping.** A ground-fault circuit interrupter shall be installed in the branch circuit supplying luminaires operating at more than the low voltage contact limit such that there is no shock hazard during relamping. The installation of the ground-fault circuit interrupter shall be such that there is no shock hazard with any likely fault-condition combination that involves a person in a conductive path from any ungrounded part of the branch circuit or the luminaire to ground.

680.21

Motors

(C) **GFCI Protection.** Outlets supplying pool pump motors connected to single-phase 120 volt through 240 volt branch circuits rated 15 or 20 amperes, whether by receptacle or by direct connection, shall be provided with ground-fault circuit-interrupter protection for personnel.

680.25

Feeders (*Permanently Installed Pools*)

These provisions shall apply to any feeder on the supply side of panelboards supplying branch circuits for pool equipment covered in Part II of this article and on the load side of the service equipment or the source of a separately derived system.

(B) Grounding. An equipment grounding conductor shall be installed with the feeder conductors between the grounding terminal of the pool equipment panelboard and the grounding terminal of the applicable service equipment or source of a separately derived system. For other than (1) existing feeders covered in 680.25(A), Exception, or (2) feeders to separate buildings that do not utilize an insulated equipment grounding conductor in accordance with 680.25(B)(2), this equipment grounding conductor shall be insulated.

(1) Size. This conductor shall be sized in accordance with 250.122 but not smaller than 12 AWG. On separately derived systems, this conductor shall be sized in accordance with 250.30(A)(8) but not smaller than 8 AWG.

680.26

Equipotential Bonding (*Permanently Installed Pools*)

(B) Bonded Parts. The parts specified in 680.26(B)(1) through (B)(7) shall be bonded together using solid copper conductors, insulated covered, or bare, not smaller than 8 AWG or with rigid metal conduit of brass or other identified corrosion-resistant metal. Connections to bonded parts shall be made in accordance with 250.8. An 8 AWG or larger solid copper bonding conductor provided to reduce voltage gradients in the pool area shall not be required to be extended or attached to remote panelboards, service equipment, or electrodes.

(1) Conductive Pool Shells. Bonding to conductive pool shells shall be provided as specified in 680.26(B)(1)(a) or (B)(1)(b). Poured concrete, pneumatically applied or sprayed concrete, and concrete block with painted or plastered coatings shall all be considered conductive materials due to water permeability and porosity. Vinyl liners and fiberglass composite shells shall be considered to be nonconductive materials.

(b) Copper Conductor Grid. A copper conductor grid shall be provided and shall comply with (b)(1) through (b)(4).

(1) Be constructed of minimum 8 AWG bare solid copper conductors bonded to each other at all points of crossing. The bonding shall be in accordance with 250.8 or other approved means.

(2) Conform to the contour of the pool and the pool deck

(3) Be arranged in a 300-mm (12-in.) by 300-mm (12-in.) network of conductors in a uniformly spaced perpendicular grid pattern with a tolerance of 100 mm (4 in.)

(4) Be secured within or under the pool no more than 150 mm (6 in.) from the outer contour of the pool shell

680.26

Equipotential Bonding (*Permanently Installed Pools*)

(B) Bonded Parts. The parts specified in 680.26(B)(1) through (B)(7) shall be bonded together using solid copper conductors, insulated covered, or bare, not smaller than 8 AWG or with rigid metal conduit of brass or other identified corrosion-resistant metal. Connections to bonded parts shall be made in accordance with 250.8. An 8 AWG or larger solid copper bonding conductor provided to reduce voltage gradients in the pool area shall not be required to be extended or attached to remote panelboards, service equipment, or electrodes.

(2) Perimeter Surfaces. The perimeter surface shall extend for 1 m (3 ft) horizontally beyond the inside walls of the pool and shall include unpaved surfaces as well as poured concrete surfaces and other types of paving. Perimeter surfaces less than 1 m (3 ft) separated by a permanent wall or building 1.5 m (5 ft) in height or more shall require equipotential bonding on the pool side of the permanent wall or building. Bonding to perimeter surfaces shall be provided as specified in 680.26(B)(2)(a) or (2)(b) and shall be attached to the pool reinforcing steel or copper conductor grid at a minimum of four (4) points uniformly spaced around the perimeter of the pool. For nonconductive pool shells, bonding at four points shall not be required.

(a) Structural Reinforcing Steel. (Text unchanged; see *NEC* for full text)

(b) Alternate Means. (Text unchanged; see *NEC* for full text)

680.26

Equipotential Bonding (*Permanently Installed Pools*)

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(7) Fixed Metal Parts. All fixed metal parts shall be bonded, including but not limited to, metal sheathed cables and raceways, metal piping, metal awnings, metal fences, and metal door and window frames.

Exception No. 1: Those separated from the pool by a permanent barrier that prevents contact by a person shall not be required to be bonded.

Exception No. 2: Those greater than 1.5 m (5 ft) horizontally of the inside walls of the pool shall not be required to be bonded.

Exception No. 3: Those greater than 3.7 m (12 ft) measured vertically above the maximum water level of the pool, or as measured vertically above any observation stands, towers, or platforms, or any diving structures, shall not be required to be bonded.

Code Language

680.32

Ground-Fault Circuit Interrupters Required (*Storable Pools*)

All electrical equipment, including power-supply cords, used with storable pools shall be protected by ground-fault circuit interrupters. All 125-volt, 15- and 20-ampere receptacles located within 6.0 m (20 ft) of the inside walls of a storable pool shall be protected by a ground-fault circuit interrupter. In determining these dimensions, the distance to be measured shall be the shortest path the supply cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, doorway with hinged or sliding door, window opening, or other effective permanent barrier.

680.42

Outdoor Installations (*Spas and Hot Tubs*)

A spa or hot tub installed outdoors shall comply with the provisions of Parts I and II of this article, except as permitted in 680.42(A) and (B), that would otherwise apply to pools installed outdoors.

(A) Flexible Connections. Listed packaged spa or hot tub equipment assemblies or self-contained spas or hot tubs utilizing a factory-installed or assembled control panel or panelboard shall be permitted to use flexible connections as covered in 680.42(A)(1) and (A)(2).

(1) Flexible Conduit. Liquidtight flexible metal conduit or liquidtight flexible nonmetallic conduit shall be permitted in lengths of not more than 1.8 m (6 ft) external to the spa or hot tub enclosure in addition to the length needed within the enclosure to make the electrical connection.

680.43

Indoor Installations (*Spas and Hot Tubs*)

A spa or hot tub installed indoors shall comply with the provisions of Parts I and II of this article except as modified by this section and shall be connected by the wiring methods of Chapter 3.

Exception No. 1: *Listed spa and hot tub packaged units rated 20 amperes or less shall be permitted to be cord-and-plug-connected to facilitate the removal or disconnection of the unit for maintenance and repair.*

Exception No. 2: *The equipotential bonding requirements for perimeter surfaces in 680.26(B)(2) shall not apply to a listed self-contained spa or hot tub installed above a finished floor.*

680.62

Therapeutic Tubs (*Hydrotherapeutic Tanks*)

Therapeutic tubs, used for the submersion and treatment of patients, that are not easily moved from one place to another in normal use or that are fastened or otherwise secured at a specific location, including associated piping systems, shall conform to Part VI.

(B) **Bonding.** The following parts shall be bonded together:

- (1) All metal fittings within or attached to the tub structure
- (2) Metal parts of electrical equipment associated with the tub water circulating system, including pump motors
- (3) Metal-sheathed cables and raceways and metal piping that are within 1.5 m (5 ft) of the inside walls of the tub and not separated from the tub by a permanent barrier
- (4) All metal surfaces that are within 1.5 m (5 ft) of the inside walls of the tub and not separated from the tub area by a permanent barrier
- (5) Electrical devices and controls that are not associated with the therapeutic tubs and located within 1.5 m (5 ft) from such units.

Exception: Small conductive surfaces not likely to become energized, such as air and water jets and drain fittings not connected to metallic piping, and towel bars, mirror frames, and similar nonelectrical equipment not connected to metal framing, shall not be required to be bonded.

680.73

Accessibility (*Hydromassage Bathtubs*)

Hydromassage bathtub electrical equipment shall be accessible without damaging the building structure or building finish. Where the hydromassage bathtub is cord- and plug-connected with the supply receptacle accessible only through a service access opening, the receptacle shall be installed so that its face is within direct view and not more than 300 mm (1 ft) of the opening.

Code Language

680.74

Bonding (*Hydromassage Bathtubs*)

All metal piping systems and all grounded metal parts in contact with the circulating water shall be bonded together using a solid copper bonding jumper, insulated, covered, or bare, not smaller than 8 AWG. The bonding jumper shall be connected to the terminal on the circulating pump motor that is intended for this purpose. The bonding jumper shall not be required to be connected to a double insulated circulating pump motor. The 8 AWG or larger solid copper bonding jumper shall be required for equipotential bonding in the area of the hydromassage bathtub and shall not be required to be extended or attached to any remote panelboard, service equipment, or any electrode. The 8 AWG or larger solid copper bonding jumper shall be long enough to terminate on a replacement non-double insulated pump motor, and shall be terminated to the equipment grounding conductor of the branch circuit of the motor when a double insulated circulating pump motor is used.

Code Language

682.14

Submersible or Floating Equipment Power Connection(s) (*Natural and Artificially Made Bodies of Water*)

Submersible or floating equipment shall be cord- and plug-connected, using extra hard usage cord, as designated in Table 400.4 and listed with a "W" suffix. The plug and receptacle combination shall be arranged to be suitable for the location while in use. Disconnecting means shall be provided to isolate each submersible or floating electrical equipment from its supply connection(s) without requiring the plug to be removed from the receptacle.

Exception: Equipment listed for direct connection and equipment anchored in place and incapable of routine movement caused by water currents or wind shall be permitted to be connected using wiring methods covered in 682.13.

(A) Type and Marking. The disconnecting means shall consist of a circuit breaker, switch, or both, or molded case switch, and shall be specifically marked to designate which receptacle or other outlet it controls.

(B) Location. The disconnecting means shall be readily accessible on land, located not more than 750 mm (30 in.) from the receptacle it controls, and shall be located in the supply circuit ahead of the receptacle. The disconnecting means shall be located within sight of but not closer than 1.5 m (5 ft) from the shoreline and shall be elevated not less than 300 mm (12 in.) above the datum plane.

682.31

Equipment Grounding Conductors (*Natural and Artificially Made Bodies of Water*)

(A) Type. Equipment grounding conductors shall be insulated copper conductors sized in accordance with 250.122 but not smaller than 12 AWG.

(B) Feeders. Where a feeder supplies a remote panelboard or other distribution equipment, an insulated equipment grounding conductor shall extend from a grounding terminal in the service to a grounding terminal and busbar in the remote panelboard or other distribution equipment.

(C) Branch Circuits. The insulated equipment grounding conductor for branch circuits shall terminate at a grounding terminal in a remote panelboard or other distribution equipment or the grounding terminal in the main service equipment.

(D) Cord-and-Plug-Connected Appliances. Where grounded, cord-and-plug-connected appliances shall be grounded by means of an equipment grounding conductor in the cord and a grounding-type attachment plug.

682.32 Bonding of Non-Current-Carrying Metal Parts. All metal parts in contact with the water, all metal piping, tanks, and all non-current-carrying metal parts that are likely to become energized shall be bonded to the grounding terminal in the distribution equipment.

690.4

Installation [Solar Photovoltaic (PV) Systems]

(A) Photovoltaic Systems.

Photovoltaic system(s) shall be permitted to supply a building or other structure in addition to any other electricity supply system(s).

690.4

Installation [Solar Photovoltaic (PV) Systems]

(B) Conductors of Different Systems. Photovoltaic source circuits and PV output circuits shall not be contained in the same raceway, cable tray, cable, outlet box, junction box, or similar fitting as conductors, feeders, or branch circuits of other non-PV systems, unless the conductors of the different systems are separated by a partition. PV system conductors shall be identified as required in 690.4(B)(1) through (4). The means of identification shall be permitted by separate color coding, marking tape, tagging, or other approved means.

(1) Photovoltaic Source Circuits. Photovoltaic source circuits shall be identified at all points of termination, connection, and splices.

(2) Photovoltaic Output and Inverter Circuits. The conductors of PV output circuits and inverter input and output circuits shall be identified at all points of termination, connection, and splices.

(3) Conductors of Multiple Systems. Where the conductors of more than one PV system occupy the same junction box, raceway, or equipment, the conductors of each system shall be identified at all termination, connection, and splice points.

Exception: Where the identification of the conductors is evident by spacing or arrangement, further identification is not required.

(4) Grouping. Where the conductors of more than one PV system occupy the same junction box or raceway with removable cover(s), the ac and dc conductors of each system shall be grouped separately by wire ties or similar means at least once, and then shall be grouped at intervals not to exceed 1.8 m (6 ft).

Exception: The requirement for grouping shall not apply if the circuit enters from a cable or raceway unique to the circuit that makes the grouping obvious.

690.4

Installation [Solar Photovoltaic (PV) Systems]

(E) Wiring and Connections. The equipment and systems in 690.4(A) through (D) and all associated wiring and interconnections shall be installed only by qualified persons.

Informational Note: See Article 100 for the definition of qualified person.

690.4

Installation [Solar Photovoltaic (PV) Systems]

(F) Circuit Routing. Photovoltaic source and PV output conductors, in and out of conduit, and inside of a building or structure, shall be routed along building structural members such as beams, rafters, trusses, and columns where the location of those structural members can be determined by observation. Where circuits are imbedded in built-up, laminate, or membrane roofing materials in roof areas not covered by PV modules and associated equipment, the location of circuits shall be clearly marked.

690.4

Installation [Solar Photovoltaic (PV) Systems]

(H) Multiple Inverters. A PV system shall be permitted to have multiple utility-interactive inverters installed in or on a single building or structure. Where the inverters are remotely located from each other, a directory in accordance with 705.10 shall be installed at each dc PV system disconnecting means, at each ac disconnecting means and at the main service disconnecting means showing the location of all ac and dc PV system disconnecting means in the building.

Exception: A directory shall not be required where all inverters and PV dc disconnecting means are grouped at the main service disconnecting means.

Code Language

690.10

Stand-Alone Systems (PV Systems)

The premises wiring system shall be adequate to meet the requirements of this Code for a similar installation connected to a service.

The wiring on the supply side of the building or structure disconnecting means shall comply with this Code except as modified by 690.10(A) through (E).

(E) Back-fed Circuit Breakers. Plug-in type back-fed circuit breakers connected to a stand-alone inverter output in either stand-alone or utility-interactive systems shall be secured in accordance with 408.36(D). Circuit breakers that are marked "line" and "load" shall not be backfed.

690.11

Arc-Fault Circuit Protection (DC)

PV systems with dc source circuits, dc output circuits, or both on or penetrating a building operating at a PV system maximum system voltage of 80 volts or greater shall be protected by a listed (DC) arc-fault circuit interrupter, PV type, or other system components listed to provide equivalent protection. The PV arc-fault protection means shall comply with the following requirements:

- (1) The system shall detect and interrupt arcing faults resulting from a failure in the intended continuity of a conductor, connection, module, or other system component in the dc PV source and output circuits.
- (2) The system shall disable or disconnect one of the following:
 - a. Inverters or charge controllers connected to the fault circuit when the fault is detected
 - b. The system components within the arcing circuit
- (3) The system shall require that the disabled or disconnected equipment be manually restarted.
- (4) The system shall have an annunciator that provides a visual indication that the circuit interrupter has operated. This indication shall not reset automatically.

690.43

Equipment Grounding (*Solar Photovoltaic Systems*)

Equipment grounding conductors and devices shall comply with 690.43(A) through (F).

(A) Equipment Grounding Required. Exposed non-current-carrying metal parts of PV module frames, electrical equipment, and conductor enclosures shall be grounded in accordance with 250.134 or 250.136(A) regardless of voltage.

(B) Equipment Grounding Conductor Required. An equipment grounding conductor between a PV array and other equipment shall be required in accordance with 250.110.

(C) Structure as Equipment Grounding Conductor. Devices listed and identified for grounding the metallic frames of PV modules or other equipment shall be permitted to bond the exposed metal surfaces or other equipment to mounting structures. Metallic mounting structures, other than building steel, used for grounding purposes shall be identified as equipment-grounding conductors or shall have identified bonding jumpers or devices connected between the separate metallic sections and shall be bonded to the grounding system.

(D) PV Mounting Systems and Devices. Devices and systems used for mounting PV modules that are also used to provide grounding of the module frames shall be identified for the purpose of grounding PV modules.

(E) Adjacent Modules. Devices identified and listed for bonding the metallic frames of PV modules shall be permitted to bond the exposed metallic frames of PV modules to the metallic frames of adjacent PV modules.

(F) All Conductors Together. Equipment grounding conductors for the PV array and structure (where installed) shall be contained within the same raceway or cable, or otherwise run with the PV array circuit conductors when those circuit conductors leave the vicinity of the PV array.

690.47

Grounding Electrode System (Solar Photovoltaic Systems)

(C) Systems with Alternating-Current and Direct-Current Grounding Requirements. Photovoltaic systems having dc circuits and ac circuits with no direct connection between the dc grounded conductor and ac grounded conductor shall have a dc grounding system. The dc grounding system shall be bonded to the ac grounding system by one of the methods listed in (1), (2), or (3).

This section shall not apply to ac PV modules.

When using the methods of (C)(2) or (C)(3), the existing ac grounding-electrode system shall meet the applicable requirements of Article 250, Part III.

(1) Separate Direct-Current Grounding Electrode System Bonded to the ac Grounding Electrode System

(2) Common Direct-Current and Alternating-Current Grounding Electrode.

(3) Combined Direct-Current Grounding-Electrode Conductor and Alternating-Current Equipment-Grounding Conductor.

(see *NEC* for complete text)

Article 694

Small Wind Electric Systems

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695.3

Power Source(s) for Electric Motor-Driven Fire Pumps

Electric motor-driven fire pumps shall have a reliable source of power.

(A) Individual Sources.

- (1) Electric Utility Service Connection.
- (2) On-Site Power Production Facility.
- (3) Dedicated Feeder.

(B) Multiple Sources.

- (1) Individual Sources.
- (2) Individual Source and On-site Standby Generator.

- (C) **Multibuilding Campus-Style Complexes.**
 - (1) Feeder Sources.
 - (2) Feeder and Alternate Source.
 - (3) Selective Coordination.
 - (D) **On-site Standby Generator as Alternate Source.**
 - (1) Capacity.
 - (2) Connection.
 - (3) Adjacent Disconnects.
 - (E) Arrangement.
 - (F) Phase Converters.
- (see *NEC* for complete text)

695.4

Continuity of Power (*Fire Pumps*)

Circuits that supply electric motor-driven fire pumps shall be supervised from inadvertent disconnection as covered in 695.4(A) or (B).

(A) Direct Connection

(B) Connection Through Disconnecting Means and Overcurrent Device

(1) Number of Disconnecting Means

- (a) General*
- (b) Feeder Sources*
- (c) On-Site Standby Generator*

(2) Overcurrent Device Selection

- (a) Individual Sources*
- (b) On-Site Standby Generators*

(3) Disconnecting Means

- (a) Features and Location*
- (b) Disconnect Marking*
- (c) Controller Marking*
- (d) Supervision*

695.6

Power Wiring (*Fire Pumps*)

Power circuits and wiring methods shall comply with the requirements in 695.6(A) through (J), and as permitted in 230.90(A), Exception No. 4; 230.94, Exception No. 4; 240.13; 230.208; 240.4(A); and 430.31.

(A) Supply Conductors

- (1) Services and On-Site Power Production Facilities**
- (2) Feeders**

- (a) *Independent Routing*
- (b) *Associated Fire Pump Loads*
- (c) *Protection from Potential Damage*
- (d) *Inside of a Building*

(B) Conductor Size

- (1) **Fire Pump Motors and Other Equipment**
- (2) **Fire Pump Motors Only**

(C) Overload Protection

(D) Pump Wiring

(E) Loads Supplied by Controllers and Transfer Switches

(F) Mechanical Protection

(G) Ground-Fault Protection of Equipment

(H) Listed Electrical Circuit Protective System to Controller Wiring.

(I) Junction Boxes

(J) Raceway Terminations

700.2

Definitions (*Emergency Systems*)

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*.

Part V

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.

700.10

Wiring, Emergency System

(D) Fire Protection. Emergency systems shall meet the additional requirements in 700.10(D)(1) through (D)(3) in assembly occupancies for not less than 1000 persons or in buildings above 23 m (75 ft) in height with any of the following occupancy classes: assembly, educational, residential, detention and correctional, business, and mercantile.

Informational Note: For the definition of Occupancy Classification, see Section 5.1 of NFPA 101-2006, *Life Safety Code*.
[ROP 13-170]

(1) **Feeder-Circuit Wiring.** Feeder-circuit wiring shall meet one of the following conditions:

(1) Be installed in spaces or areas that are fully protected by an approved automatic fire suppression system

(2) Be a listed electrical circuit protective system with a minimum 2-hour fire rating

Informational Note: UL guide information for electrical circuit protection systems (FHIT) contains information on proper installation requirements to maintain the fire rating.

(3) Be protected by a listed thermal barrier system for electrical system components with a minimum 2-hour fire rating

(4) Be protected by a listed fire-rated assembly that has a minimum fire rating of 2 hours and contains only emergency wiring circuits.

(5) Be encased in a minimum of 50 mm (2 in.) of concrete

~~(6) Be a cable listed to maintain circuit integrity for not less than 1 hour when installed in accordance with the listing requirements~~

700.12

General Requirements. Current (*Emergency Systems — Sources of Power*)

(F) **Unit Equipment.** Individual unit equipment for emergency illumination shall consist of the following:

(1) A rechargeable battery

(2) A battery charging means

(3) Provisions for one or more lamps mounted on the equipment, or shall be permitted to have terminals for remote lamps, or both

(4) A relaying device arranged to energize the lamps automatically upon failure of the supply to the unit equipment

The batteries shall be of suitable rating and capacity to supply and maintain at not less than 87½ percent of the nominal battery voltage for the total lamp load associated with the unit for a period of at least 1½ hours, or the unit equipment shall supply and maintain not less than 60 percent of the initial emergency illumination for a period of at least 1½ hours. Storage batteries, whether of the acid or alkali type, shall be designed and constructed to meet the requirements of emergency service.

Unit equipment shall be permanently fixed in place (i.e., not portable) and shall have all wiring to each unit installed in accordance with the requirements of any of the wiring methods in Chapter 3. Flexible cord-and-plug-connection shall be permitted, provided that the cord does not exceed 900 mm (3 ft) in length. The branch circuit feeding the unit equipment shall be the same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches. The branch circuit that feeds unit equipment shall be clearly identified at the distribution panel. Emergency luminaires that obtain power from unit equipment and are not part of the unit equipment shall be wired to the unit equipment as required by 700.10 and by one of the wiring methods of Chapter 3.

Exception No. 1: *In a separate and uninterrupted area supplied by a minimum of three normal lighting circuits, a separate branch circuit for unit equipment shall be permitted if it originates from the same panelboard as that of the normal lighting circuits and is provided with a lock-on feature.*

Exception No. 2: *Remote heads providing lighting for the exterior of an exit door shall be permitted 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.

Exception: *Selective coordination shall not be required 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, where practicable, for the purposes described in 701.6(A), (B), (C), and (D).

(A) Derangement. To indicate derangement of the standby source

(B) Carrying Load. To indicate that the standby source is carrying load

(C) Not Functioning. To indicate that the battery charger is not functioning

Informational Note: For signals for generator sets, see NFPA 110-2005, *Standard for Emergency and Standby Power Systems*.

(D) Ground Fault. To indicate a ground fault in solidly grounded wye legally required standby systems of more than 150 volts to ground and circuit-protective devices rated 1000 amperes or more. The sensor for the ground-fault signal devices shall be located at, or ahead of, the main system disconnecting means for the legally required standby source, and the maximum setting of the signal devices shall be for a ground-fault current of 1200 amperes. Instructions on the course of action to be taken in event of indicated ground fault shall be located at or near the sensor location.

Informational Note: For signals for generator sets, see NFPA 110-2005, *Standard for Emergency and Standby Power Systems*.

708.10

Feeder and Branch Circuit Wiring [*Critical Operations Power Systems (COPS)*]

(A) Identification

(2) Receptacle Identification. In a building in which COPS are present with other types of power systems described in other sections in this article, the cover plates for the receptacles or the receptacles themselves supplied from the COPS shall have a distinctive color or marking so as to be readily identifiable.

Exception: *If the COPS supplies power to a DCOA that is a stand-alone building, receptacle cover plates or the receptacles themselves shall not be required to have distinctive marking.*

708.14

Wiring of HVAC, Fire Alarm, Security, Emergency Communications, and Signaling Systems [*Critical Operations Power Systems (COPS)*]

All conductors or cables shall be installed using any of the metal wiring methods permitted by 708.10(C)(1) and in addition shall comply with 708.14(1) through 708.14(8) as applicable.

- (1) All cables for fire alarm, security, signal systems, and emergency communications shall be shielded twisted pair cables.
- (2) Shields of cables for fire alarm, security, signal systems, and emergency communications shall be continuous.
- (3) Optical fiber cables shall be used for connections between two or more buildings on the property and under single management.
- (4) A listed primary protector shall be provided on all communications circuits. Listed secondary protectors shall be provided at the terminals of the communication circuits.

- (5) Conductors for all control circuits rated above 50V shall be installed with wire-rated not less than 600V.
- (6) Communications, fire alarm, and signaling circuits shall use relays with contact ratings that exceed circuit voltage and current ratings in the controlled circuit.
- (7) All cables for fire alarm, security, and signaling systems shall be riser rated and shall be a listed 2-hour electrical circuit protective system. Riser emergency communications cable shall be Type CMR-CI or shall be a listed 2-hour electrical circuit protective system.
- (8) Control, monitoring, and power wiring to HVAC systems shall be a listed 2-hour electrical circuit protective system.

725.3

Other Articles

(I) Vertical Support for Fire Rated Cables and Conductors. Vertical installations of circuit integrity (CI) cables and conductors installed in a raceway or conductors and cables of electrical protective systems shall be installed in accordance with 300.19.

760.3

Other Articles (*Fire Alarm Systems*)

Circuits and equipment shall comply with 760.3(A) through (K). Only those sections of Article 300 referenced in this article shall apply to fire alarm systems.

(A) Spread of Fire or Products of Combustion. see 300.21

(B) Ducts, Plenums, and Other Air-Handling Spaces. Section 300.22, where installed in ducts or plenums or other spaces used for environmental air.

Exception: As permitted in 760.53(B)(1) and (B)(2) and 760.154(A).

(C) Hazardous (Classified) Locations. Articles 500 through 516 and Article 517, Part IV, where installed in hazardous (classified) locations.

(D) Corrosive, Damp, or Wet Locations. Sections 110.11, 300.6, and 310.10(G), where installed in corrosive, damp, or wet locations.

- (E) **Building Control Circuits.** Article 725, where building control circuits (e.g., elevator capture, fan shutdown) are associated with the fire alarm system.
- (F) **Optical Fiber Cables.** Where optical fiber cables are utilized for fire alarm circuits, the cables shall be installed in accordance with Article 770.
- (G) **Installation of Conductors with Other Systems.** Installations shall comply with 300.8.
- (H) **Raceways or Sleeves Exposed to Different Temperatures.** Installations shall comply with 300.7(A).
- (I) **Vertical Support for Fire Rated Cables and Conductors.** Vertical installations of circuit integrity (CI) cables and conductors installed in a raceway or conductors and cables of electrical protective systems shall be installed in accordance with 300.19.
- (J) **Number and Size of Cables and Conductors in Raceway.** Installations shall comply with 300.17.
- (K) **Bushing.** A bushing shall be installed where cables emerge from raceway used for mechanical support or protection in accordance with 300.15(C).

760.41

NPLFA Circuit Power Source Requirements

- (A) **Power Source.** The power source of non-power-limited fire alarm circuits shall comply with Chapters 1 through 4, and the output voltage shall be not more than 600 volts, nominal. Fire alarm circuit disconnect shall be permitted to be secured in the "on" position.
- (B) **Branch Circuit.** The branch circuit supplying the fire alarm equipment(s) shall supply no other loads. The location of the branch circuit overcurrent protective device shall be permanently identified at the fire alarm control unit. The circuit disconnecting means shall have red identification, shall be accessible only to qualified personnel, and shall be identified as "FIRE ALARM CIRCUIT." The red identification shall not damage the overcurrent protective devices or obscure the manufacturer's markings. This branch circuit shall not be supplied through ground-fault circuit interrupters or arc-fault circuit interrupters.

770.2

Definitions (*Optical Fiber Cables and Raceways*)

Cable Routing Assembly. A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support, route and protect high densities of wires and cables, typically communications wires and cables, optical fiber and data (Class 2 and Class 3) cables associated with information technology and communications equipment.

770.100

Entrance Cable Bonding and Grounding (*Optical Fiber Cables and Raceways*)

Where required, the non-current-carrying metallic members of optical fiber cables entering buildings shall be bonded or grounded as specified in 770.100(A) through (D).

(B) **Electrode.** The bonding conductor and grounding electrode conductor shall be connected in accordance with 770.100(B)(1), (B)(2), or (B)(3).

(1) **In Buildings or Structures with an Intersystem Bonding Termination.** If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor or grounding electrode conductor shall be connected to the intersystem bonding termination.

Informational Note: See Article 100 for the definition of *Intersystem Bonding Termination*.

800.2

Definitions (*Communication Circuits*)

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

800.154

Applications of Listed Communications Wires, and Cables, and Communications Raceways (*Communications Circuits*)

Permitted and non-permitted applications of listed communications wires, cables, and raceways shall be as indicated in Table 800.154(a). The permitted applications shall be subject to the installation requirements of 800.110 and 800.113. The substitutions for communications cables listed in Table 800.154(b) and illustrated in Figure 800.154 shall be permitted.

[see Table 800.154(a)]

800.100

Cable and Primary Protector Bonding and Grounding (*Communications Circuits*)

The primary protector and the metallic member(s) of the cable sheath shall be bonded or grounded as specified in 800.100(A) through (D).

(A) Bonding Conductor or Grounding Electrode Conductor.

(1) **Insulation.** The bonding conductor or grounding electrode conductor shall be listed and shall be permitted to be insulated, covered, or bare.

Article 810 – Part III

Amateur and Citizen Band Transmitting and Receiving Stations – Antenna Systems (*Radio and Television Equipment*)

810.51 Other Sections

810.52 Size of Antenna

Table 810.52 Size of Amateur-Station-Outdoor Antenna Conductors

810.53 Size of Lead-in Conductors

810.54 Clearance on Building

810.55 Entrance to Building

810.56 Protection Against Accidental Contact

810.57 Antenna Discharge Units – Transmitting Stations

810.58 Bonding conductor and Grounding Electrode Conductors - Amateur and Citizen Band Transmitting and Receiving Stations

(A) Other Sections

(B) Size of Protective Bonding conductor or Grounding Electrode Conductor

(C) Size of Operating Bonding conductor or Grounding Electrode Conductor

820.100

Cable Bonding and Grounding (*Community Antenna Television and Radio Distribution Systems*)

The shield of the coaxial cable shall be bonded or grounded as specified in 820.100(A) through (D).

Exception: For communication systems using coaxial cable confined within the premises and isolated from outside cable plant, the shield shall be permitted to be grounded by a connection to an equipment grounding conductor as described in 250.118. Connecting to an equipment grounding conductor through a grounded receptacle using a dedicated grounding conductor and permanently connected listed device shall be permitted. Use of a cord and plug for the connection to an equipment grounding conductor shall not be permitted.

830.44

Overhead (Aerial) Cables (*Network-Powered Broadband Communications Systems*)

Overhead (aerial) network-powered broadband communications cables shall comply with 830.44(A) through (G).

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2007, National Electric Safety Code, Part 2, Safety Rules For Overhead Lines.

(F) Between Buildings. Network-powered broadband communications cables extending between buildings or structures and also the supports or attachment fixtures shall be identified as suitable for outdoor aerial applications and shall have sufficient strength to withstand the loads to which they may be subjected.

Exception: Where a network-powered broadband communications cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.

Article 840

Premises-Powered Broadband Communications Systems

I. General

840.1 Scope

840.2 Definitions

840.3 Other Articles

840.21 Access to Electrical Equipment Behind Panels Designed to Allow Access

840.24 Mechanical Execution of Work

840.25 Abandoned Cables

840.26 Spread of Fire or Products of Combustion

II. Cables Outside and Entering Building

840.44 Overhead Optical Fiber Cables

830.47 Underground Optical Fiber Cables Entering Buildings

840.48 Unlisted Cables and Raceways Entering Buildings

III. Protection

840.90 Protective Devices

840.93 Grounding or Interruption

IV. Grounding Methods

840.100 ONT and Optical Fiber Cable Grounding

840.101 Premises Circuits Not Leaving the Building

840.103 Equipment Grounding

840.106 Grounding and Bonding at Mobile Homes

V. Installation Methods Within Buildings

840.110 Raceways for Premises-Powered Broadband Communications Optical Fiber Cables

840.113 Installation Past the ONT

840.133 Installation of Optical Fibers and Electrical Conductors Associated with Premises-Powered Broadband Communications Systems

840.154 Applications of Listed Optical Fiber Cables and Raceways

VI. Listing Requirements

840.170 Equipment and Cables

Chapter 9

Tables — Notes to Tables

(5) For conductors not included in Chapter 9 such as multi-conductor cables and optical fiber cables, the actual dimensions shall be used.