675.15 Lightning Protection

If an irrigation machine has a stationary point, a grounding electrode system in accordance with Article 250, Part III, shall be connected to the machine at the stationary point for lightning protection.

Where the electrical power supply to irrigation machine equipment is a service, the requirements of Article 250 for grounding the system and equipment are applicable. Due to the physical location of irrigation equipment, the most likely grounding electrode of the types covered in 250.52 is a driven ground rod or ground plate. Consideration should be given to the requirements of 250.60 and NFPA 780, *Standard for the Installation of Lightning Protection Systems*, in areas where lightning protection is critical. A common electrode system is not permitted to be used for the dual function of grounding the electric service and grounding the lightning protection system. The separate electrode systems are required to be bonded together.

675.16 Energy from More Than One Source

Equipment within an enclosure receiving electric energy from more than one source shall not be required to have a disconnecting means for the additional source, provided that its voltage is 30 volts or less and it meets the requirements of Part III of Article 725.

675.17 Connectors

External plugs and connectors on the equipment shall be of the weatherproof type.

Unless provided solely for the connection of circuits meeting the requirements of Part III of Article 725, external plugs and connectors shall be constructed as specified in 250.124(A).

II. Center Pivot Irrigation Machines

675.21 General

The provisions of Part II are intended to cover additional special requirements that are peculiar to center pivot irrigation machines. See 675.2 for the definition of *Center Pivot Irrigation Machine*.

675.22 Equivalent Current Ratings

To establish ratings of controllers, disconnecting means, conductors, and the like, for the inherent intermittent duty of center pivot irrigation machines, the determinations in 675.22(A) and (B) shall be used.

The ratings of electrical components of any circuit should be selected so as to avoid extensive damage to the equipment during a short circuit or ground fault. Requirements for establishing ratings of components of special equipment for inherent intermittent duty are covered in 675.22. Also see the commentary following 110.10 and 430.52.

(A) Continuous-Current Rating. The equivalent continuous-current rating for the selection of branch-circuit conductors and branch-circuit devices shall be equal to 125 percent of the motor nameplate full-load current rating of the largest motor plus 60 percent of the sum of the motor nameplate full-load current ratings of all remaining motors on the circuit.

(B) Locked-Rotor Current. The equivalent locked-rotor current rating shall be equal to the numerical sum of two times the locked-rotor current of the largest motor plus 80 percent of the sum of the motor nameplate full-load current ratings of all the remaining motors on the circuit.

ARTICLE 680
Swimming Pools, Fountains, and Similar Installations

Summary of Changes

- **680.2 Permanently Installed Swimming, Wading, Immersion and Therapeutic Pools; Pool; and Storable Swimming, Wading, or Immersion Pool:** Added *immersion* to these definitions to include pools, other than swimming and wading pools, in which people are partially or totally immersed.
- **680.10:** Specified that underground raceways located 5 ft or less from the pool must be installed as a complete system.
- **680.12:** Established a minimum 5-ft horizontal clearance between disconnecting means and inside walls of pools, spas, and hot tubs.
- **680.21(A):** Clarified that 680.21(A)(1) is modified by 680.21(A)(2) through (A)(5).
- **680.22(A)(1):** Revised the receptacle clearance from 5 ft to 6 ft.
- **680.22(A)(2), 680.22(A)(3):** Revised the receptacle clearance from 10 ft to 6 ft.
- **680.22(B):** Added requirement for GFCI protection for all 15- and 20-ampere, 125- and 240-volt, single-phase receptacles and other outlets that supply pool pump motors.
- **680.22(E) and FPN:** Added clearance requirement for other outlets, including, but not limited to, fire alarm, communications, remote control, and signaling.

- **680.23(A)(6):** Revised to permit luminaires installed facing up to be listed for use without a protective guard over the lens.
- **680.23(B)(6):** Revised to require sufficient cord length to move the luminaire from the water to the pool deck or other dry location for maintenance.
- **608.23(F)(1):** Added Type AC cable with an insulated equipment grounding conductor as a wiring method permitted inside of buildings.
- **680.24(A)(2):** Clarified that where luminaires operate at 15 volts or less, (A)(2)(C) applies.
- **680.26(B)(1):** Specified acceptable means for bonding to shells of pools constructed of conductive material.
- **680.26(B)(2):** Revised to require bonding of paved and unpaved perimeter surfaces extending 3 ft horizontally from edge of pool, and provided new means for bonding the perimeter surfaces and required connection points to bonding element of a conductive pool shell.
- **680.26(C):** Added a requirement to provide a bonded conductive surface of not less than 9 $in.^2$ in contact with the pool water.
- **680.31:** Added requirement for cord-and-plug-connected filter pumps to be equipped with a ground-fault circuit interrupter integral to the cord cap or located in the power supply cord.
- **680.43(A) & (A)(1):** Revised the receptacle clearance from 5 ft to 6 ft.
- **680.43(E):** Revised to allow only a solid conductor for bonding.
- **680.51(E):** Clarified that the limitation in length applies to each individual cord.
- **680.71:** Added requirement for individual branch circuit supply and for ready access to ground-fault circuit interrupter protecting the equipment.
- **680.74:** Added provision for point of connection to circulating pump motors and to specify that bonding is not required for double insulated motors, and clarified that only solid conductors can be used for bonding and that bonding jumper(s) is only for connecting specified items at the hydromassage bathtub location.

Contents

I. General

680.1 Scope

The provisions of this article apply to the construction and installation of electrical wiring for, and equipment in or adjacent to, all swimming, wading, therapeutic, and decorative pools; fountains; hot tubs; spas; and hydromassage bathtubs, whether permanently installed or storable, and to metallic auxiliary equipment, such as pumps, filters, and similar equipment. The term *body of water* used throughout Part I applies to all bodies of water covered in this scope unless otherwise amended.

Article 680 applies to decorative pools and fountains; swimming, wading, and wave pools; therapeutic tubs and tanks; hot tubs; spas; hydromassage bathtubs; and similar installations including pools used in religious services where participants are immersed in water. The installations covered by this article can be indoors or outdoors, permanent or storable, and may or may not be directly supplied by electrical circuits of any nature. Requirements for natural and artificially made bodies of water not covered by Article 680 are contained in Article 682.

Studies conducted by Underwriters Laboratories, various manufacturers, and others indicate that a person in a

swimming pool can receive a severe electric shock by reaching out and touching the energized casing of a faulty appliance — such as a radio or a hair dryer — as the person's body, which due to immersion has a lower resistance to electric current, establishes a conductive path through the water to earth. Also, a person not in contact with a faulty appliance or any grounded object can receive an electric shock and be rendered immobile by a potential gradient in the water itself. This level of electrical current necessary to cause immobilization may not be fatal from an electrical shock perspective but is dangerous from an accidental drowning standpoint. Shock hazards in and around a swimming pool can result from faulty electrical equipment directly associated with the pool or from faulty electrical equipment not associated with but in close proximity to the pool.

Accordingly, the requirements of Article 680 covering effective bonding and grounding, installation of receptacles and luminaires, use of GFCIs, modified wiring methods, and so on, apply not only to the installation of the pool but also to installations and equipment adjacent to or associated with the pool.

Enhanced electric shock protection in this wet environment, where it is intended that people are immersed in bodies of water that also contain electrical equipment, is provided through one or more of the following means:

- GFCI protection and low-voltage equipment
- Double-insulated equipment
- Insulation and isolation
- Equipotenial bonding
- Physical separation and restricted locations
- Robust physical protection requirements for circuit conductors

680.2 Definitions

Cord-and-Plug-Connected Lighting Assembly. A lighting assembly consisting of a luminaire intended for installation in the wall of a spa, hot tub, or storable pool, and a cord-and-plug-connected transformer.

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

Equipment, Fixed. Equipment that is fastened or otherwise secured at a specific location.

Equipment, Portable. Equipment that is actually moved or can easily be moved from one place to another in normal use.

Equipment, Stationary. Equipment that is not easily moved from one place to another in normal use.

Forming Shell. A structure designed to support a wet-niche luminaire assembly and intended for mounting in a pool or fountain structure.

Fountain. Fountains, ornamental pools, display pools, and reflection pools. The definition does not include drinking fountains.

Hydromassage Bathtub. A permanently installed bathtub equipped with a recirculating piping system, pump, and associated equipment. It is designed so it can accept, circulate, and discharge water upon each use.

See the commentary following 680.71, 680.73, and 680.74.

Maximum Water Level. The highest level that water can reach before it spills out.

No-Niche Luminaire. A luminaire intended for installation above or below the water without a niche.

Packaged Spa or Hot Tub Equipment Assembly. A factory-fabricated unit consisting of water-circulating, heating, and control equipment mounted on a common base, intended to operate a spa or hot tub. Equipment can include pumps, air blowers, heaters, lights, controls, sanitizer generators, and so forth.

The definition of *packaged spa or hot tub equipment assembly* clarifies which assemblies are subject to the requirements of 680.44.

Packaged Therapeutic Tub or Hydrotherapeutic Tank Equipment Assembly. A factory-fabricated unit consisting of water-circulating, heating, and control equipment mounted on a common base, intended to operate a therapeutic tub or hydrotherapeutic tank. Equipment can include pumps, air blowers, heaters, lights, controls, sanitizer generators, and so forth.

Permanently Installed Decorative Fountains and Reflection Pools. Those that are constructed in the ground, on the ground, or in a building in such a manner that the fountain cannot be readily disassembled for storage, whether or not served by electrical circuits of any nature. These units are primarily constructed for their aesthetic value and are not intended for swimming or wading.

Permanently Installed Swimming, Wading, Immersion, and Therapeutic Pools. Those that are constructed in the ground or partially in the ground, and all others capable of holding water in a depth greater than 24 inches and all pools installed inside of a building, regardless of water depth, whether or not served by electrical circuits of any nature.

The word *immersion* has been added to extend this definition to pools used in religious services or for some other function in which people become immersed as an inherent use or purpose of the pool. Also see the commentary following Part VI, Pools and Tubs for Therapeutic Use.

Pool. Manufactured or field-constructed equipment designed to contain water on a permanent or semipermanent basis and used for swimming, wading, immersion, or therapeutic purposes.

Pool Cover, Electrically Operated. Motor-driven equipment designed to cover and uncover the water surface of a pool by means of a flexible sheet or rigid frame.

The requirements for electrically operated pool covers are found in 680.27(B).

Self-Contained Spa or Hot Tub. Factory-fabricated unit consisting of a spa or hot tub vessel with all water-circulating, heating, and control equipment integral to the unit. Equipment can include pumps, air blowers, heaters, lights, controls, sanitizer generators, and so forth.

The definition of *self-contained spa or hot tub* clarifies which assemblies are subject to the requirements of 680.44.

Self-Contained Therapeutic Tubs or Hydrotherapeutic Tanks. A factory-fabricated unit consisting of a therapeutic tub or hydrotherapeutic tank with all water-circulating, heating, and control equipment integral to the unit. Equipment may include pumps, air blowers, heaters, light controls, sanitizer generators, and so forth.

Spa or Hot Tub. A hydromassage pool, or tub for recreational or therapeutic use, not located in health care facilities, designed for immersion of users, and usually having a filter, heater, and motor-driven blower. It may be installed indoors or outdoors, on the ground or supporting structure, or in the ground or supporting structure. Generally, a spa or hot tub is not designed or intended to have its contents drained or discharged after each use.

See the commentary following 680.41, 680.42, 680.43, and 680.44.

Storable Swimming, Wading, or Immersion Pool. Those that are constructed on or above the ground and are capable of holding water to a maximum depth of 24 inches, or a pool with nonmetallic, molded polymeric walls or inflatable fabric walls regardless of dimension.

See the commentary following 680.30 and Exhibit 680.16.

Originally, storable pools were not specifically addressed in the *NEC*. Article 680 was written to provide guidance relative to permanent, in-ground pools and their unique construction requirements because of the unusual earth-water-electricity-human body environment created in the finished product. The conductivity of moist concrete or metal walls buried in the ground, the incorporation of large masses of reinforcing steel, and the inclusion of stainless-steel handrails and diving-board stands, as well as 120-volt lights in the pool structure, all called for the strict wiring, bonding, and grounding requirements of Article 680.

Storable pools, on the other hand, are intended to be temporary structures, without the need for special wiring or modification to the pool site. They are usually sold as a complete package, consisting of the pool walls, vinyl liner, plumbing kit, and pump/filter device. A storable pool is often disassembled and stored during the winter months. Regional preferences, weather patterns, economic considerations, and design characteristics of the pool are all factors influencing this action. The original Article 680 definition of *storable pool* was "One that is so constructed that it may be readily disassembled for storage and reassembled to its original integrity."

Part III of Article 680 was created to address the special equipment specifications of storable pools, and Underwriters Laboratories developed testing and labeling criteria for listing the pump/filter units designed especially for these pools. This equipment has the following characteristics:

1. It must have an approved system of double insulation or the equivalent.
2. It is permitted to have a flexible cord equipped with a parallel-blade, grounding-type attachment plug for electrical connection.
3. It must have a grounding conductor included in the flexible cord.
4. The flexible cord is not limited to 3 ft, as required by 680.7(A), and is specified by UL to be not less than 25 ft long. This length was chosen to discourage the use of extension cords.

The UL labeling requirement for these listed units includes the wording "Do Not Use with Permanently Installed Pools." In some cases, consumers and swimming pool installers, however, have found it desirable to use these pump/filter units on any aboveground or on-ground pool, regardless of the pool's dimensions or "storability."

Storable pools are supplied as two distinct types. One type is intended to be disassembled at the end of each swimming season. The second type, by the nature of its construction, can be disassembled, but manufacturers recommend leaving it assembled. The pools in the latter category frequently require special modification to and preparation of

thepool site, making them impractical to disassemble. Draining these pools, especially the larger ones, increases the likelihood of costly damage caused by shrinkage of the vinyl liner material.

The main factor differentiating the two types of pools is wall height. Generally, pools, other than the inflatable type, intended to be disassembled at season's end have wall heights of 42 in. or less, while those not intended for disassembly have wall heights of 48 in. or more. The surface area of the pools is not a factor. Inflatable pools are treated as storable pools regardless of their wall height.

Through-Wall Lighting Assembly. A lighting assembly intended for installation above grade, on or through the wall of a pool, consisting of two interconnected groups of components separated by the pool wall.

Wet-Niche Luminaire. A luminaire intended for installation in a forming shell mounted in a pool or fountain structure where the luminaire will be completely surrounded by 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 680.3 Other Articles

Topic	Section or Article
Wiring	Chapters 1–4
Junction box support	314.23
Rigid polyvinyl chloride conduit (Type PVC)	352.12
Reinforced thermosetting resin conduit (Type RTRC)	355.12
Audio Equipment	Article 640, Parts I and II
Adjacent to pools and fountains	640.10
Underwater speakers*	

*Underwater loudspeakers shall be installed in accordance with 680.27(A).

Note that 314.23 (E) specifies the requirements for the support of threaded boxes that do not contain devices and that 352.12 (B) does not permit luminaires or most other electrical equipment to be supported by rigid nonmetallic conduit. Exhibit 680.1 shows a properly supported junction box for a wet-niche luminaire. Also see the commentary following 314.23(E).

680.4 Approval of Equipment

All electrical equipment installed in the water, walls, or decks of pools, fountains, and similar installations shall comply with the provisions of this article.

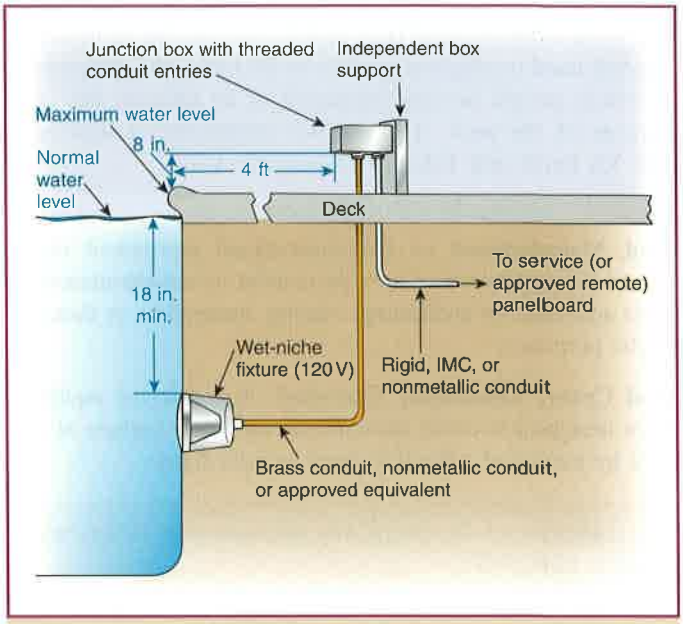


Exhibit 680.1 Wet-niche luminaire installation with junction box supported above pool deck.

680.5 Ground-Fault Circuit Interrupters

Ground-fault circuit interrupters (GFCIs) shall be self-contained units, circuit-breaker or receptacle types, or other listed types.

See the definition of *ground-fault circuit interrupter (GFCI)* in Article 100.

A GFCI is intended to be used only in a circuit that has a solidly grounded conductor; however, an equipment grounding conductor is not necessary for the GFCI to function. A Class A GFCI trips where the current to ground has a value in the range of 4 through 6 mA; it is suitable for use in swimming pool circuits. It should be noted, however, that circuits supplying pool equipment that were installed before local adoption of the 1965 edition of the *Code* may have sufficient leakage current to cause a Class A GFCI to trip. A Class B GFCI trips if the current to ground exceeds 20 mA; it is suitable for use only with underwater swimming pool lighting installed before the local adoption of the 1965 *Code*.

680.6 Grounding

Electrical equipment shall be grounded in accordance with Parts V, VI, and VII of Article 250 and connected by wiring methods of Chapter 3, except as modified by this article. The following equipment shall be grounded:

(1) Through-wall lighting assemblies and underwater luminaires, other than those low-voltage lighting products listed for the application without a grounding conductor

(2) All electrical equipment located within 1.5 m (5 ft) of the inside wall of the specified body of water
(3) All electrical equipment associated with the recirculating system of the specified body of water
(4) Junction boxes
(5) Transformer enclosures
(6) Ground-fault circuit interrupters
(7) Panelboards that are not part of the service equipment and that supply any electrical equipment associated with the specified body of water

Electrical equipment other than underwater luminaires and pool-associated motors is required to be connected by the wiring methods of Chapter 3 and grounded in accordance with Article 250. For example, an outdoor receptacle installed to meet the requirements of 680.22(A)(3) is permitted to be wired with Type UF cable containing an insulated or bare conductor for equipment grounding purposes. Circuits for pools may be derived from an existing remote panelboard supplied by an approved cable assembly, as specified in 680.25(A), Exception. The requirements of 680.6 permit Type UF cable to be used for the receptacle required by 680.22(A)(3) and for some pool-related equipment, but circuit conductors for underwater luminaires are required to be run in raceways. Circuit conductors for pool-associated motors other than flexible cord, as permitted by 680.7, are required to be installed in raceways except in the interior of one-family dwelling units, where any raceway or cable assembly permitted by Chapter 3 is acceptable if the equipment grounding conductor is at least 12 AWG copper and is enclosed by the wiring method.

Equipment grounding requirements are contained in 680.6, 680.21(A)(1), 680.23(F)(2), and 680.25(B). These requirements specify that equipment grounding conductors be connected to non–current-carrying metal parts of the specified equipment. These equipment grounding conductors are required to be run with the circuit conductors in rigid metal conduit, intermediate conduit, listed MC cable (for motors only), or rigid nonmetallic conduit (electrical metallic tubing is permitted in or on buildings, and electrical nonmetallic tubing is permitted inside buildings), and they must be terminated at the grounding terminal bus of the service panelboard, the source of the separately derived system, or the subpanel. This equipment grounding conductor provides a path of low impedance that limits the voltage to ground and facilitates operation of the circuit overcurrent protective device(s). The equipment grounding conductor is required to be an insulated copper conductor not smaller than 12 AWG.

The requirements of 680.6, 680.21(A)(1), 680.23(F)(2), and 680.25(B) are in addition to the bonding requirements in 680.26. The intent of the bonding requirements is to establish an equipotential plane to limit the voltage between all non–current-carrying parts of electrical and nonelectrical equipment in the pool area.

Bonding conductors may be insulated, covered, or bare and are required to be 8 AWG solid copper or larger. They may be direct buried, and, if connected to metal parts of the pool structure or metal parts of electrical equipment, they may be externally clamped or attached and are not required to be accessible. All these parts form a common grid that establishes an equipotential bonding system, and they do not have to be run to the equipment grounding terminals of panelboards or service equipment.

680.7 Cord-and-Plug-Connected Equipment

Fixed or stationary equipment, other than underwater luminaires, for a permanently installed pool shall be permitted to be connected with a flexible cord and plug to facilitate the removal or disconnection for maintenance or repair.

(A) Length. For other than storable pools, the flexible cord shall not exceed 900 mm (3 ft) in length.

(B) Equipment Grounding. The flexible cord shall have 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.

(C) Construction. The equipment grounding conductors shall be connected to a fixed metal part of the assembly. The removable part shall be mounted on or bonded to the fixed metal part.

In some climates, it is preferable to disconnect and remove a permanent pool's filter pump during cold-weather months. A 3-ft cord is permitted, to facilitate the removal of fixed or stationary equipment for maintenance and storage. The 3-ft cord limitation does not apply to cord-and-plug-connected filter pumps used with storable-type pools (covered in Part III of Article 680), since these pumps are neither fixed nor stationary. Listed filter pumps for use with storable pools are considered portable and are permitted to be equipped with cords longer than 3 ft.

680.8 Overhead Conductor Clearances

Overhead conductors shall meet the clearance requirements in this section. Where a minimum clearance from the water level is given, the measurement shall be taken from the maximum water level of the specified body of water.

(A) Power. With respect to service drop conductors and open overhead wiring, swimming pool and similar installations shall comply with the minimum clearances given in Table 680.8 and illustrated in Figure 680.8.

Table 680.8 Overhead Conductor Clearances

Clearance Parameters	Insulated Cables, 0–750 Volts to Ground, Supported on and Cabled Together with a Solidly Grounded Bare Messenger or Solidly Grounded Neutral Conductor		All Other Conductors Voltage to Ground			
			0 through 15 kV		Over 15 through 50 kV	
	m	ft	m	ft	m	ft
A. Clearance in any direction to the water level, edge of water surface, base of diving platform, or permanently anchored raft	6.9	22.5	7.5	25	8.0	27
B. Clearance in any direction to the observation stand, tower, or diving platform	4.4	14.5	5.2	17	5.5	18
C. Horizontal limit of clearance measured from inside wall of the pool	This limit shall extend to the outer edge of the structures listed in A and B of this table but not to less than 3 m (10 ft).					

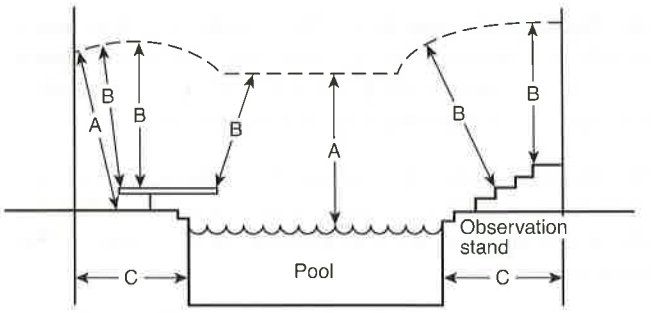


Figure 680.8 Clearances from Pool Structures.

FPN: Open overhead wiring as used in this article typically refers to conductor(s) not in an enclosed raceway.

(B) Communications Systems. Communication, radio, and television coaxial cables within the scope of Articles 800 through 820 shall be permitted at a height of not less than 3.0 m (10 ft) above swimming and wading pools, diving structures, and observation stands, towers, or platforms.

(C) Network-Powered Broadband Communications Systems. The minimum clearances for overhead network-powered broadband communications systems conductors from pools or fountains shall comply with the provisions in Table 680.8 for conductors operating at 0 to 750 volts to ground.

Service drop conductors, conductors of network-powered broadband communications systems, and aerial feeders and branch circuits are permitted to be located above a swimming pool and associated pool structures where provided with the clearances specified in Table 680.8. Overhead conductors of communications systems are required to comply with 680.8(B). These clearances consider such factors as the use of skimmers with aluminum handles and provide sufficient separation between the conductors and the pool. In some instances, locating a swimming pool below electric fixed conductors is unavoidable; for example, on a building lot with limited area or an existing lot where the electric supply lines are already in place. The clearances for conductors from pools and pool structures harmonize the *NEC* with ANSI C2, *National Electrical Safety Code (NESC)*. The maximum water level of the body of water (pool, spa, hot tub, or other) is used to determine compliance with 680.8. For the definition of *maximum water level*, see 680.2.

680.9 Electric Pool Water Heaters

All electric pool water heaters shall have the heating elements subdivided into loads not exceeding 48 amperes and protected at not over 60 amperes. The ampacity of the branch-circuit conductors and the rating or setting of overcurrent protective devices shall not be less than 125 percent of the total nameplate-rated load.

680.10 Underground Wiring Location

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.

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 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.

This section allows wiring within 5 ft of the inside walls of the swimming pool under two conditions. The first condition permits wiring to pool-associated equipment such as an underwater luminaire. The second condition permits wiring not associated with the pool within this area where spatial constraints such as property lines preclude the 5-ft minimum separation.

Under the second condition, underground wiring located within the 5-ft zone is required to be installed in rigid metal conduit, intermediate metal conduit, or rigid nonmetallic conduit and must be buried to a depth not less than that required by Table 680.10 for these permitted wiring methods. The raceway must be installed as a complete system between points of termination and cannot simply be a sleeve through the 5-ft zone. Beyond the 5-ft zone, the minimum cover requirements of Table 300.5 apply to the underground wiring methods used for circuits rated 600 volts and less.

As indicated by the title of this section (Underground Wiring Location), the focus of 680.10 is to mitigate shock hazards that may occur as a result of a faulty or damaged underground installation that is in close proximity to the swimming pool. Due to water splashing out of the pool and water dripping off those who have been in the pool, the area within 5 ft of the inside walls is generally the wettest location; as a result, electrical leakage from underground installations presents a greater shock hazard in this continuously wet environment.

680.11 Equipment Rooms and Pits

Electrical equipment shall not be installed in rooms or pits that do not have drainage that adequately prevents water accumulation during normal operation or filter maintenance.

680.12 Maintenance Disconnecting Means

One or more means to simultaneously disconnect all ungrounded conductors shall be provided for all utilization equipment other than lighting. Each means shall be readily accessible and within sight from its equipment and shall be located at least 1.5 m (5 ft) horizontally from the inside walls of a pool, spa, or hot tub unless separated from the open water by a permanently installed barrier that provides a 1.5 m (5 ft) reach path or greater. This horizontal distance is to be measured from the water's edge along the shortest path required to reach the disconnect.

A readily accessible disconnecting means is required to be located within sight of pool, spa, and hot tub equipment in order to provide service personnel with the ability to safely disconnect power while servicing equipment such as motors, heaters, and control panels. Underwater luminaires are not subject to this requirement. The proximity of the disconnecting means to the pool must be not less than 5 ft unless the disconnecting means is separated from the water by a permanent barrier. See Exhibit 680.2.

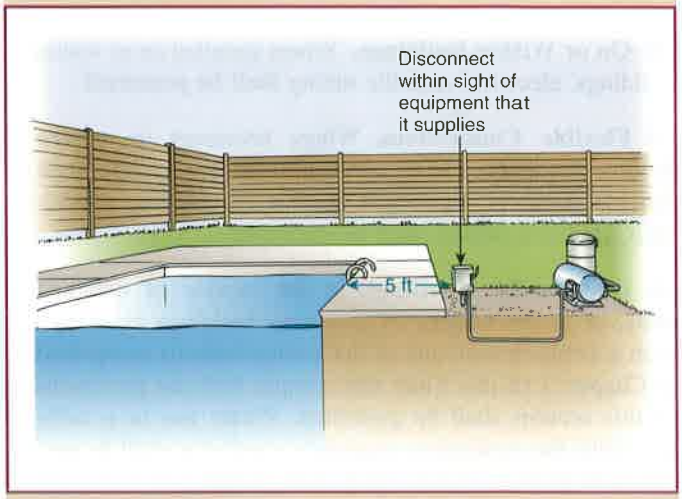


Exhibit 680.2 Required pool equipment disconnect. The disconnect for pool equipment must be located within sight of the pool equipment and at least 5 ft from the pool.

II. Permanently Installed Pools

680.20 General

Electrical installations at permanently installed pools shall comply with the provisions of Part I and Part II of this article.

680.21 Motors

(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).

(1) General. The branch circuits for pool-associated motors shall be installed in rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit, reinforced thermosetting resin conduit, or Type MC cable listed for the location. Other wiring methods and materials shall be permitted in specific locations or applications as covered in this section. Any wiring method employed shall contain an insulated copper equipment grounding conductor sized in accordance with 250.122 but not smaller than 12 AWG.

Type MC cable listed for the application is permitted as a wiring method for swimming pool motor circuits. This listing requirement ensures that the MC cable is suitable for the environmental and installation conditions typically encountered with swimming pool pump motors. Type MC cables listed for installation in direct sunlight or direct burial are marked to indicate suitability for such applications.

Other than cable assemblies installed on the interior of a one-family dwelling per 680.21(A)(4), wiring methods used for the supply circuit to a swimming pool pump motor must include an insulated, copper equipment grounding conductor not less than 12 AWG.

(2) On or Within Buildings. Where installed on or within buildings, electrical metallic tubing shall be permitted.

(3) Flexible Connections. Where necessary to employ flexible connections at or adjacent to the motor, liquidtight flexible metal or liquidtight flexible nonmetallic conduit with approved fittings shall be permitted.

(4) One-Family Dwellings. In the interior of dwelling units, or in the interior of accessory buildings associated with a dwelling unit, any of the wiring methods recognized in Chapter 3 of this *Code* that comply with the provisions of this section shall be permitted. Where run in a cable assembly, the equipment grounding conductor shall be permitted to be uninsulated, but it shall be enclosed within the outer sheath of the cable assembly.

(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 an equipment grounding conductor sized in accordance with 250.122 and shall terminate in a grounding-type attachment plug.

(B) Double Insulated Pool Pumps. A listed cord-and-plug-connected pool pump incorporating an approved system of double insulation that provides a means for grounding only the internal and nonaccessible, non–current-carrying metal parts of the pump shall be connected to any wiring method recognized in Chapter 3 that is suitable for the location. Where the bonding grid is connected to the equipment grounding conductor of the motor circuit in accordance with the second paragraph of 680.26(B)(4), the branch-circuit wiring shall comply with 680.21(A).

Cord-and-plug-connected double-insulated swimming pool filter pumps have been used with permanently installed aboveground pools and some storable pools, regardless of the pool's size, for many years without any known field-related problems. The internal metal parts of a swimming pool filter pump incorporating a system of double insulation are grounded; however, they are not required to be incorporated into the bonding system required by 680.26(B) because the act of bonding compromises the double-insulation system.

680.22 Area Lighting, Receptacles, and Equipment

(A) Receptacles.

(1) Circulation and Sanitation System, Location. Receptacles that provide power for water-pump motors or for other loads directly related to the circulation and sanitation system shall be located at least 3.0 m (10 ft) from the inside walls of the pool, or not less than 1.83 m (6 ft) from the inside walls of the pool if they meet all of the following conditions:

(1) Consist of single receptacles
(2) Employ a locking configuration
(3) Are of the grounding type
(4) Have GFCI protection

(2) Other Receptacles, Location. Other receptacles shall be not less than 1.83 m (6 ft) from the inside walls of a pool.

(3) Dwelling Unit(s). Where a permanently installed pool is installed at a dwelling unit(s), no fewer than one 125-volt, 15- or 20-ampere receptacle on a general-purpose branch circuit shall be located not less than 1.83 m (6 ft) from, and not more than 6.0 m (20 ft) from, the inside wall of the pool. This receptacle shall be located not more than 2.0 m (6 ft 6 in.) above the floor, platform, or grade level serving the pool.

(4) GFCI Protection. All 15- and 20-ampere, single-phase, 125-volt receptacles located within 6.0 m (20 ft) of the inside walls of a pool shall be protected by a ground-fault circuit interrupter.

(5) Measurements. In determining the dimensions in this section addressing receptacle spacings, 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.

The requirements of 680.22(A) apply to receptacles located near a permanently installed pool or fountain. They do not apply to direct-connected equipment. Direct-connected pool pump motors are covered in 680.22(B). Permission is given in 680.22(A)(1) to allow a single locking- and grounding-type receptacle to supply a recirculation pump motor where the receptacle is located not less than 6 ft from the inside walls of the pool or fountain and is protected by a GFCI.

As required by 680.22(A)(3), each permanently installed pool in a residential setting is required to have at least one receptacle, which must be located at least 6 ft from the pool and not more than 20 ft from the pool. The intent of this requirement is to permit ordinary appliances to be safely plugged in and used near the pool but to avoid the need for extension cords in the vicinity of the pool. The 6-ft minimum dimension was chosen so that an appliance with a 6-ft cord could not be accidentally knocked into the pool.

GFCI protection of all 125-volt receptacles located within 20 ft of a pool or fountain is required by 680.22(A)(4). This rule applies to pools located outdoors or indoors, permanently installed or storable, and for residential or commercial use. Because people within 20 ft of a pool are normally subjected to dampness and moisture, the GFCI requirement within the 20-ft space is warranted.

Examples of receptacles meeting the requirements of 680.22(A) are shown in Exhibits 680.3 and 680.4. Exhibit 680.5 illustrates that the determination of the minimum distance for receptacles from a pool does not include receptacles within a structure. Receptacles within a structure are permitted to be less than 6 ft from the pool. Where this installation is at a dwelling unit, it is necessary to provide at least one receptacle between 6 ft and 20 ft from the inside walls of the pool. This location precludes having to run the cord of an appliance used on the pool deck through a doorway.

(B) GFCI Protection. Outlets supplying pool pump motors from branch circuits with short-circuit and ground-fault protection rated 15 or 20 amperes, 125 volt or 240 volt, single phase, whether by receptacle or direct connection, shall be provided with ground-fault circuit-interrupter protection for personnel.

All outlets supplied by single-phase, 15- and 20-ampere, 125-volt or 240-volt branch circuits for swimming pool pump motors are required to have GFCI protection. It should be noted that 680.22(B) applies to these outlets regardless of their proximity to the swimming pool and that it applies to cord-and-plug-connected and direct-connected (hard-wired) swimming pool pump motors.

(C) Luminaires, Lighting Outlets, and Ceiling-Suspended (Paddle) Fans.

(1) New Outdoor Installation Clearances. In outdoor pool areas, luminaires, lighting outlets, and ceiling-suspended (paddle) fans installed above the pool or the area extending 1.5 m (5 ft) horizontally from the inside walls of the pool shall be installed at a height not less than 3.7 m (12 ft) above the maximum water level of the pool.

(2) Indoor Clearances. For installations in indoor pool areas, the clearances shall be the same as for outdoor areas unless modified as provided in this paragraph. If the branch circuit supplying the equipment is protected by a ground-

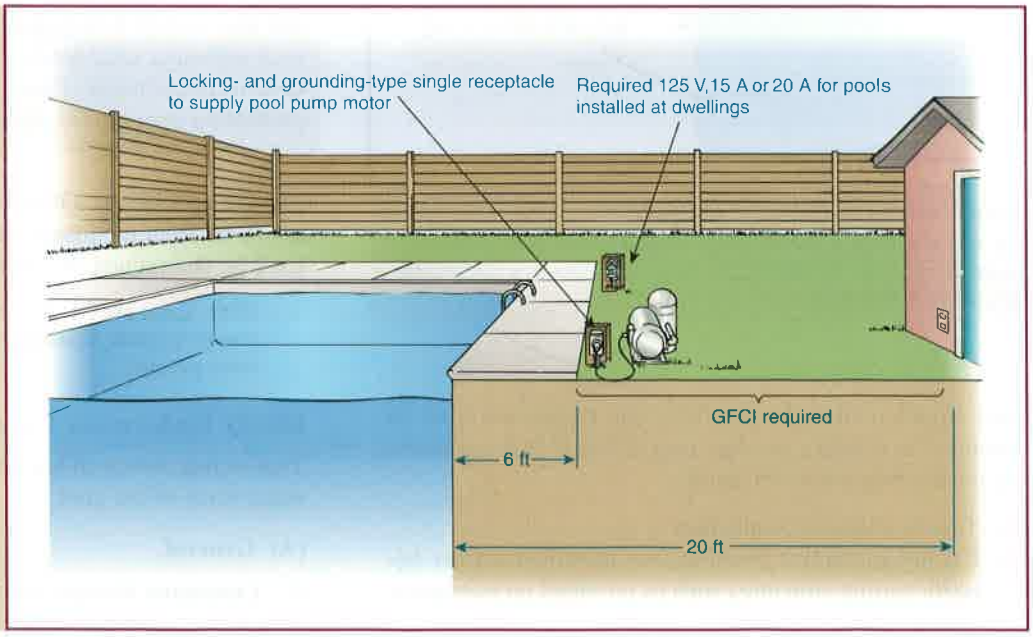


Exhibit 680.3 An example of a receptacle installed according to 680.22(A). For permanently installed pools at a dwelling unit(s), it is mandatory to install a 125-volt receptacle between 6 ft and 20 ft from the inside wall of the pool.

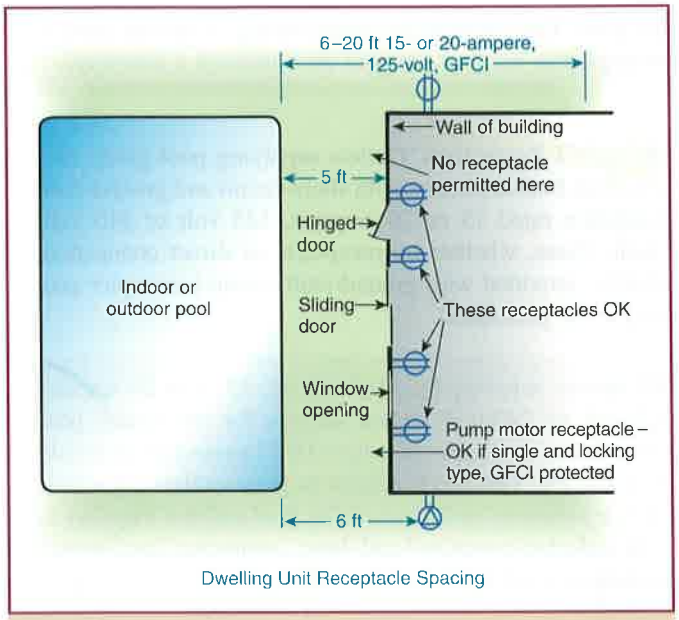


Exhibit 680.4 Acceptable receptacle locations within 20 ft of a permanently installed swimming pool.

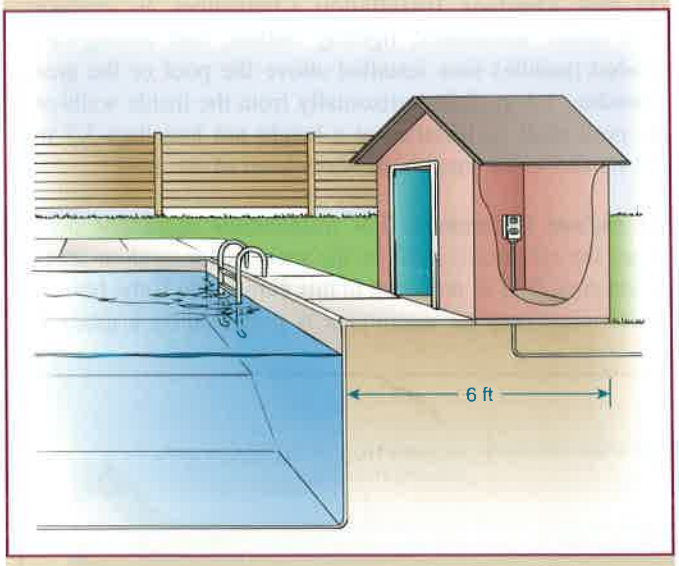


Exhibit 680.5 Permitted receptacle location less than 6 ft from the inside wall of a permanently installed pool. The minimum distance required by 680.22(A) does not apply to a receptacle located in a structure.

fault circuit interrupter, the following equipment shall be permitted at a height not less than 2.3 m (7 ft 6 in.) above the maximum pool water level:

(1) Totally enclosed luminaires
(2) Ceiling-suspended (paddle) fans identified for use beneath ceiling structures such as provided on porches or patios

(3) Existing Installations. Existing luminaires and lighting outlets located less than 1.5 m (5 ft) measured horizontally from the inside walls of a pool shall be not less than 1.5 m (5 ft) above the surface of the maximum water level, shall be rigidly attached to the existing structure, and shall be protected by a ground-fault circuit interrupter.

(4) GFCI Protection in Adjacent Areas. Luminaires, lighting outlets, and ceiling-suspended (paddle) fans installed in the area extending between 1.5 m (5 ft) and 3.0 m (10 ft) horizontally from the inside walls of a pool shall be protected by a ground-fault circuit interrupter unless installed not less than 1.5 m (5 ft) above the maximum water level and rigidly attached to the structure adjacent to or enclosing the pool.

(5) Cord-and-Plug-Connected Luminaires. Cord-and-plug-connected luminaires shall comply with the requirements of 680.7 where installed within 4.9 m (16 ft) of any point on the water surface, measured radially.

See Exhibit 680.6 for diagrams that clarify the limitations applicable to certain zones surrounding outdoor and indoor pools.

(D) Switching Devices. Switching devices shall be located at least 1.5 m (5 ft) horizontally from the inside walls of a pool unless separated from the pool by a solid fence, wall, or other permanent barrier. Alternatively, a switch that is listed as being acceptable for use within 1.5 m (5 ft) shall be permitted.

Panelboards containing circuit breakers, time clocks, pool light switches, and similar switching devices, where located not less than 5 ft horizontally from the inside walls of a pool without a solid fence, wall, or other permanent barrier, must be out of reach of persons who are in the pool, thereby preventing contact and possible shock hazards.

(E) Other Outlets. Other outlets shall be not less than 3.0 m (10 ft) from the inside walls of the pool. Measurements shall be determined in accordance with 680.22(A)(5).

FPN: Other outlets may include, but are not limited to, remote-control, signaling, fire alarm, and communications circuits.

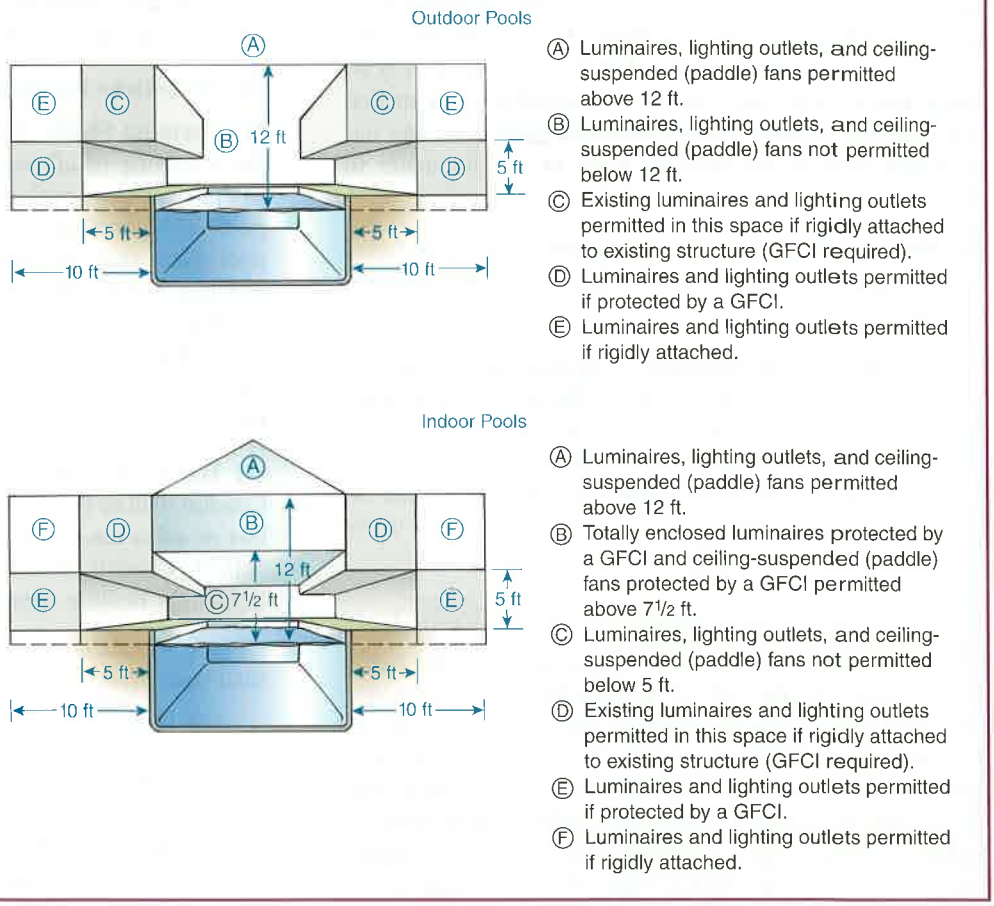
680.23 Underwater Luminaires

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

(A) General.

(1) Luminaire Design, Normal Operation. The design of an underwater luminaire supplied from a branch circuit either

Exhibit 680.6 Limitations that apply to the placement of luminaires, lighting outlets, and ceiling-suspended fans in the area surrounding outdoor and indoor pools.



directly or by way of a transformer meeting the requirements of this section shall be such that, where the luminaire is properly installed without a ground-fault circuit interrupter, there is no shock hazard with any likely combination of fault conditions during normal use (not relamping).

Dry-niche, no-niche, or wet-niche underwater luminaires operating at more than 15 volts require GFCI protection. See the commentary following 680.5.

Branch-circuit conductors for dry-niche luminaires are required to be installed in approved rigid metal conduit, intermediate metal conduit, or rigid nonmetallic conduit from the luminaire to a panelboard or the service equipment. Branch-circuit conductors for wet-niche luminaires leaving the pool junction box are required to be enclosed in rigid metal conduit, intermediate metal conduit, liquidtight flexible nonmetallic conduit, or rigid nonmetallic conduit, except where located in or on buildings, where the conductors are permitted to be installed in electrical metallic tubing or electrical nonmetallic tubing. Unlike wet-niche luminaires, a junction box is not required for dry-niche luminaires. If a junction box is used, it is not required to be elevated or located as specified in 680.24(A)(2). (See Exhibits 680.1 and 680.7.)

(2) Transformers. Transformers used for the supply of underwater luminaires, together with the transformer enclosure, shall be listed as a swimming pool and spa transformer. The transformer shall be an isolated winding type with an ungrounded secondary that has a grounded metal barrier between the primary and secondary windings.

Unless marked otherwise, UL-listed swimming pool and spa transformers are not suitable for connection to a conduit that extends directly to an underwater pool light forming shell. Swimming pool and spa transformers are not permitted to be used outdoors unless marked "For Outdoor Use" or in an equivalent manner that signifies that they have been found acceptable for both outdoor and indoor use. See 110.3(B).

(3) GFCI Protection, Relamping. A ground-fault circuit interrupter shall be installed in the branch circuit supplying

luminaires operating at more than 15 volts 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.

(4) Voltage Limitation. No luminaires shall be installed for operation on supply circuits over 150 volts between conductors.

(5) Location, Wall-Mounted Luminaires. Luminaires mounted in walls shall be installed with the top of the luminaire lens not less than 450 mm (18 in.) below the normal water level of the pool, unless the luminaire is listed and identified for use at lesser depths. No luminaire shall be installed less than 100 mm (4 in.) below the normal water level of the pool.

The reason for the 18-in. minimum submergence requirement is to reduce the likelihood that a person in the water and hanging onto the side of the pool directly over a luminaire will have his or her chest in line with the luminaire. This section covers luminaires that have been investigated and found acceptable for use where a person's chest may be directly in front of a luminaire. The highest level of leakage current in a pool coming from a wet-niche luminaire with a broken lens and bulb is found directly in front of the luminaire.

(6) Bottom-Mounted Luminaires. A luminaire facing upward shall comply with either (1) or (2):

(1) Have the lens adequately guarded to prevent contact by any person
(2) Be listed for use without a guard

(7) Dependence on Submersion. Luminaires that depend on submersion for safe operation shall be inherently protected against the hazards of overheating when not submerged.

Luminaires that depend on submersion for safe operation are required to be inherently protected against the hazards of overheating when not submerged; for example, during a relamping process. Protection against overheating is required to be built into a luminaire or to be a part of it. A remotely located low-water cutoff switch does not provide the intended protection.

(8) Compliance. Compliance with these requirements shall be obtained by the use of a listed underwater luminaire and by installation of a listed ground-fault circuit interrupter in the branch circuit or a listed transformer for luminaires operating at not more than 15 volts.

(B) Wet-Niche Luminaires.

(1) Forming Shells. Forming shells shall be installed for the mounting of all wet-niche underwater luminaires and shall be equipped with provisions for conduit entries. Metal parts of the luminaire and forming shell in contact with the pool water shall be of brass or other approved corrosion-resistant metal. All forming shells used with nonmetallic conduit systems, other than those that are part of a listed low-voltage lighting system not requiring grounding, shall include provisions for terminating an 8 AWG copper conductor.

(2) Wiring Extending Directly to the Forming Shell. Conduit shall be installed from the forming shell to a junction box or other enclosure conforming to the requirements in 680.24. Conduit shall be rigid metal, intermediate metal, liquidtight flexible nonmetallic, or rigid nonmetallic.

(a) *Metal Conduit.* Metal conduit shall be approved and shall be of brass or other approved corrosion-resistant metal.

(b) *Nonmetallic Conduit.* Where a nonmetallic conduit is used, an 8 AWG insulated solid or stranded copper bonding jumper shall be installed in this conduit unless a listed low-voltage lighting system not requiring grounding is used. The bonding jumper shall be terminated in the forming shell, junction box or transformer enclosure, or ground-fault circuit-interrupter enclosure. The termination of the 8 AWG bonding jumper in the forming shell shall be covered with, or encapsulated in, a listed potting compound to protect the connection from the possible deteriorating effect of pool water.

Where rigid nonmetallic conduit or liquidtight flexible nonmetallic conduit is used between a forming shell for a wet-niche luminaire and a junction box or other enclosure, an 8 AWG insulated copper bonding jumper is required to be installed in the conduit to provide electrical continuity between the forming shell and the junction box or other enclosure. The conduit must be sized large enough to enclose both the 8 AWG insulated copper bonding jumper and the approved flexible cord that supplies the wet-niche luminaire, to facilitate easy withdrawal and insertion of the bonding conductor and the cord. Low-voltage lighting systems that are listed for installation without an equipment grounding or bonding conductor are exempt from this requirement.

(3) Equipment Grounding Provisions for Cords. Wet-niche luminaires that are supplied by a flexible cord or cable shall have all exposed non–current-carrying metal parts grounded by an insulated copper equipment grounding conductor that is an integral part of the cord or cable. This

grounding conductor shall be connected to a grounding terminal in the supply junction box, transformer enclosure, or other enclosure. The grounding conductor shall not be smaller than the supply conductors and not smaller than 16 AWG.

(4) Luminaire Grounding Terminations. The end of the flexible-cord jacket and the flexible-cord conductor terminations within a luminaire shall be covered with, or encapsulated in, a suitable potting compound to prevent the entry of water into the luminaire through the cord or its conductors. In addition, the grounding connection within a luminaire shall be similarly treated to protect such connection from the deteriorating effect of pool water in the event of water entry into the luminaire.

(5) Luminaire Bonding. The luminaire shall be bonded to, and secured to, the forming shell by a positive locking device that ensures a low-resistance contact and requires a tool to remove the luminaire from the forming shell. Bonding shall not be required for luminaires that are listed for the application and have no non–current-carrying metal parts.

(6) Servicing. All wet-niche luminaires shall be removable from the water for inspection, relamping, or other maintenance. The forming shell location and length of cord in the forming shell shall permit personnel to place the removed luminaire on the deck or other dry location for such maintenance. The luminaire maintenance location shall be accessible without entering or going in the pool water.

Custom swimming pool installations where the pool is incorporated as an architectural feature of a building or structure can present access problems for those who have to change the lamps of an underwater luminaire. In some cases, the length of the flexible cord connected to a wet-niche luminaire does not permit the luminaire to be removed from the pool for relamping or servicing. To address the concern over a person having to be in the pool in order to change lamps, this requirement specifies that the underwater luminaire installation has to be made such that changing of the lamp occurs on the pool deck or other dry location outside of the pool, and the location can be accessed without having to enter the pool water.

(C) Dry-Niche Luminaires.

(1) Construction. A dry-niche luminaire shall be provided with a provision for drainage of water and a means for accommodating one equipment grounding conductor for each conduit entry.

(2) Junction Box. A junction box shall not be required but, if used, shall not be required to be elevated or located as specified in 680.24(A)(2) if the luminaire is specifically identified for the purpose.

(D) No-Niche Luminaires. A no-niche luminaire shall meet the construction requirements of 680.23(B)(3) and be installed in accordance with the requirements of 680.23(B). Where connection to a forming shell is specified, the connection shall be to the mounting bracket.

(E) Through-Wall Lighting Assembly. A through-wall lighting assembly shall be equipped with a threaded entry or hub, or a nonmetallic hub, for the purpose of accommodating the termination of the supply conduit. A through-wall lighting assembly shall meet the construction requirements of 680.23(B)(3) and be installed in accordance with the requirements of 680.23. Where connection to a forming shell is specified, the connection shall be to the conduit termination point.

(F) Branch-Circuit Wiring.

(1) Wiring Methods. Branch-circuit wiring on the supply side of enclosures and junction boxes connected to conduits run to wet-niche and no-niche luminaires, and the field wiring compartments of dry-niche luminaires, shall be installed using rigid metal conduit, intermediate metal conduit, liquidtight flexible nonmetallic conduit, rigid polyvinyl chloride conduit, or reinforced thermosetting resin conduit. Where installed on buildings, electrical metallic tubing shall be permitted, and where installed within buildings, electrical nonmetallic tubing, Type MC cable, electrical metallic tubing, or Type AC cable shall be permitted. In all cases, an insulated equipment grounding conductor sized in accordance with Table 250.122 but not less than 12 AWG shall be required.

Exception: Where connecting to transformers for pool lights, liquidtight flexible metal conduit or liquidtight flexible nonmetallic conduit shall be permitted. The length shall not exceed 1.8 m (6 ft) for any one length or exceed 3.0 m (10 ft) in total length used. Liquidtight flexible nonmetallic conduit, Type B (LFNC-B), shall be permitted in lengths longer than 1.8 m (6 ft).

(2) Equipment Grounding. Through-wall lighting assemblies, wet-niche, dry-niche, or no-niche luminaires shall be connected to an insulated copper equipment grounding conductor installed with the circuit conductors. The equipment grounding conductor shall be installed without joint or splice except as permitted in (F)(2)(a) and (F)(2)(b). The equipment grounding conductor shall be sized in accordance with Table 250.122 but shall not be smaller than 12 AWG.

Exception: An equipment grounding conductor between the wiring chamber of the secondary winding of a transformer and a junction box shall be sized in accordance with the overcurrent device in this circuit.

(a) If more than one underwater luminaire is supplied by the same branch circuit, the equipment grounding conduc-

tor, installed between the junction boxes, transformer enclosures, or other enclosures in the supply circuit to wet-niche luminaires, or between the field-wiring compartments of dry-niche luminaires, shall be permitted to be terminated on grounding terminals.

(b) If the underwater luminaire is supplied from a transformer, ground-fault circuit interrupter, clock-operated switch, or a manual snap switch that is located between the panelboard and a junction box connected to the conduit that extends directly to the underwater luminaire, the equipment grounding conductor shall be permitted to terminate on grounding terminals on the transformer, ground-fault circuit interrupter, clock-operated switch enclosure, or an outlet box used to enclose a snap switch.

See the commentary following 680.23(A)(2).

(3) Conductors. Conductors on the load side of a ground-fault circuit interrupter or of a transformer, used to comply with the provisions of 680.23(A)(8), shall not occupy raceways, boxes, or enclosures containing other conductors unless one of the following conditions applies:

(1) The other conductors are protected by ground-fault circuit interrupters.
(2) The other conductors are grounding conductors.
(3) The other conductors are supply conductors to a feed-through-type ground-fault circuit interrupter.
(4) Ground-fault circuit interrupters shall be permitted in a panelboard that contains circuits protected by other than ground-fault circuit interrupters.

680.24 Junction Boxes and Electrical Enclosures for Transformers or Ground-Fault Circuit Interrupters

(A) Junction Boxes. A junction box connected to a conduit that extends directly to a forming shell or mounting bracket of a no-niche luminaire shall meet the requirements of this section.

(1) Construction. The junction box shall be listed as a swimming pool junction box and shall comply with the following conditions:

(1) Be equipped with threaded entries or hubs or a nonmetallic hub
(2) Be comprised of copper, brass, suitable plastic, or other approved corrosion-resistant material
(3) Be provided with electrical continuity between every connected metal conduit and the grounding terminals by means of copper, brass, or other approved corrosion-resistant metal that is integral with the box

(2) Installation. Where the luminaire operates over 15 volts, the junction box location shall comply with (A)(2)(a) and (A)(2)(b). Where the luminaire operates at 15 volts or less, the junction box location shall be permitted to comply with (A)(2)(c).

(a) *Vertical Spacing.* The junction box shall be located not less than 100 mm (4 in.), measured from the inside of the bottom of the box, above the ground level, or pool deck, or not less than 200 mm (8 in.) above the maximum pool water level, whichever provides the greater elevation.

(b) *Horizontal Spacing.* The junction box shall be located not less than 1.2 m (4 ft) from the inside wall of the pool, unless separated from the pool by a solid fence, wall, or other permanent barrier.

(c) *Flush Deck Box.* If used on a lighting system operating at 15 volts or less, a flush deck box shall be permitted if both of the following apply:

(1) An approved potting compound is used to fill the box to prevent the entrance of moisture.
(2) The flush deck box is located not less than 1.2 m (4 ft) from the inside wall of the pool.

(B) Other Enclosures. An enclosure for a transformer, ground-fault circuit interrupter, or a similar device connected to a conduit that extends directly to a forming shell or mounting bracket of a no-niche luminaire shall meet the requirements of this section.

(1) Construction. The enclosure shall be listed and labeled for the purpose and meet the following requirements:

(1) Equipped with threaded entries or hubs or a nonmetallic hub
(2) Comprised of copper, brass, suitable plastic, or other approved corrosion-resistant material
(3) Provided with an approved seal, such as duct seal at the conduit connection, that prevents circulation of air between the conduit and the enclosures
(4) Provided with electrical continuity between every connected metal conduit and the grounding terminals by means of copper, brass, or other approved corrosion-resistant metal that is integral with the box

(2) Installation.

(a) *Vertical Spacing.* The enclosure shall be located not less than 100 mm (4 in.), measured from the inside of the bottom of the box, above the ground level, or pool deck, or not less than 200 mm (8 in.) above the maximum pool water level, whichever provides the greater elevation.

(b) *Horizontal Spacing.* The enclosure shall be located not less than 1.2 m (4 ft) from the inside wall of the pool, unless separated from the pool by a solid fence, wall, or other permanent barrier.

(C) Protection. Junction boxes and enclosures mounted above the grade of the finished walkway around the pool

shall not be located in the walkway unless afforded additional protection, such as by location under diving boards, adjacent to fixed structures, and the like.

(D) Grounding Terminals. Junction boxes, transformer enclosures, and ground-fault circuit-interrupter enclosures connected to a conduit that extends directly to a forming shell or mounting bracket of a no-niche luminaire shall be provided with a number of grounding terminals that shall be no fewer than one more than the number of conduit entries.

(E) Strain Relief. The termination of a flexible cord of an underwater luminaire within a junction box, transformer enclosure, ground-fault circuit interrupter, or other enclosure shall be provided with a strain relief.

(F) Grounding. The equipment grounding conductor terminals of a junction box, transformer enclosure, or other enclosure in the supply circuit to a wet-niche or no-niche luminaire and the field-wiring chamber of a dry-niche luminaire shall be connected to the equipment grounding terminal of the panelboard. This terminal shall be directly connected to the panelboard enclosure.

The requirements in 680.24(A) through (F) cover the construction and installation of boxes and enclosures associated with underwater luminaires. Boxes and enclosures used for the supply wiring to wet-niche and no-niche underwater luminaires must be listed for the purpose by a recognized testing laboratory. The provisions of 680.24(D) ensure the availability of integral grounding terminals necessary for the grounding and bonding of underwater luminaires. A box that is listed but not specifically for use with swimming pools does not provide the correct number of integral grounding and bonding terminals. The number of grounding terminals in a box or enclosure is required to be one more than the number of conduit entries for which the box is designed.

In an installation where nonmetallic conduit is the wiring method between the wet-niche forming shell and the deck (junction) box, a bonding jumper and an equipment grounding conductor in that conduit must be terminated in the junction box. The bonding jumper is covered in 680.23(B)(2)(b). The use of nonmetallic conduit requires the installation of an insulated, copper bonding jumper in that section of conduit between the deck box and the wet-niche forming shell. This conductor can be solid or stranded and must not be smaller than 8 AWG. The function of this conductor is twofold. It permanently bonds all non–current-carrying metal surfaces of the forming shell to any non–current-carrying parts of the deck box and to the equipment grounding conductor of the circuit that supplies the wet-niche luminaire. Additionally, this conductor serves as the path for ground-fault current in the event of a ground fault when the wet-niche luminaire is removed from the forming shell, as is typically done during relamping. Damage to the wet-niche luminaire supply cord could result in this ground-fault scenario.

The equipment grounding conductor is the one contained in the flexible cord supplying the wet-niche luminaire. In accordance with 680.23(B)(3), this conductor is required to be insulated, copper, and sized no smaller than the circuit conductors within the cord, but not smaller than 16 AWG.

In addition to the bonding jumper and equipment grounding conductor of the cord contained in the section of nonmetallic conduit between the forming shell and the deck box, the wiring method from the deck box to the power source is also required to contain a separate equipment grounding conductor. This equipment grounding conductor is required by 680.23(F)(2) and must be insulated, copper, and not smaller than 12 AWG. The grounding terminals within the deck (junction) box are used to terminate and bond together all of conductors.

Exhibit 680.7 illustrates an installation of a forming shell for a wet-niche luminaire and a flush junction (deck) box. (See Exhibit 680.1 for surface deck boxes.)

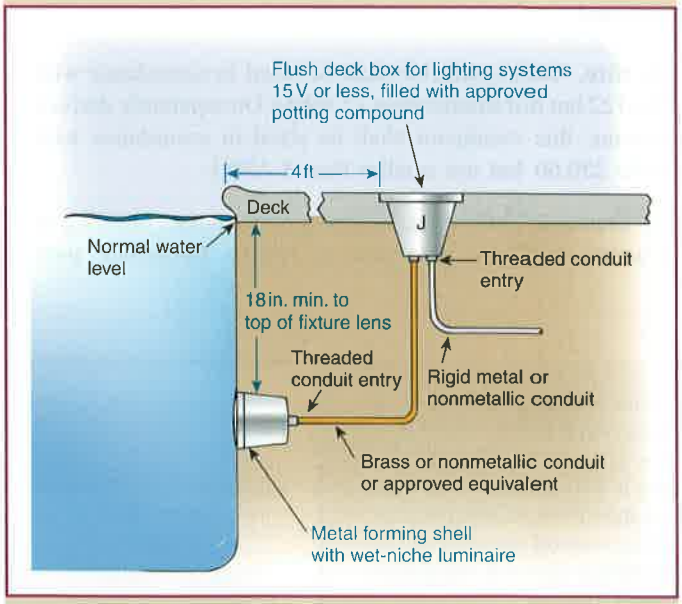


Exhibit 680.7 A flush junction (deck) box and a forming shell for a wet-niche luminaire installed according to 680.24(A)(2).

680.25 Feeders

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.

(A) Wiring Methods. Feeders shall be installed in rigid metal conduit, intermediate metal conduit, liquidtight flexi-

ble nonmetallic conduit, rigid polyvinyl chloride conduit, or reinforced thermosetting resin conduit. Electrical metallic tubing shall be permitted where installed on or within a building, and electrical nonmetallic tubing shall be permitted where installed within a building. Aluminum conduits shall not be permitted in the pool area where subject to corrosion.

Exception: An existing feeder between an existing remote panelboard and service equipment shall be permitted to run in flexible metal conduit or an approved cable assembly that includes an equipment grounding conductor within its outer sheath. The equipment grounding conductor shall comply with 250.24(A)(5).

(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 Table 250.66 but not smaller than 8 AWG.

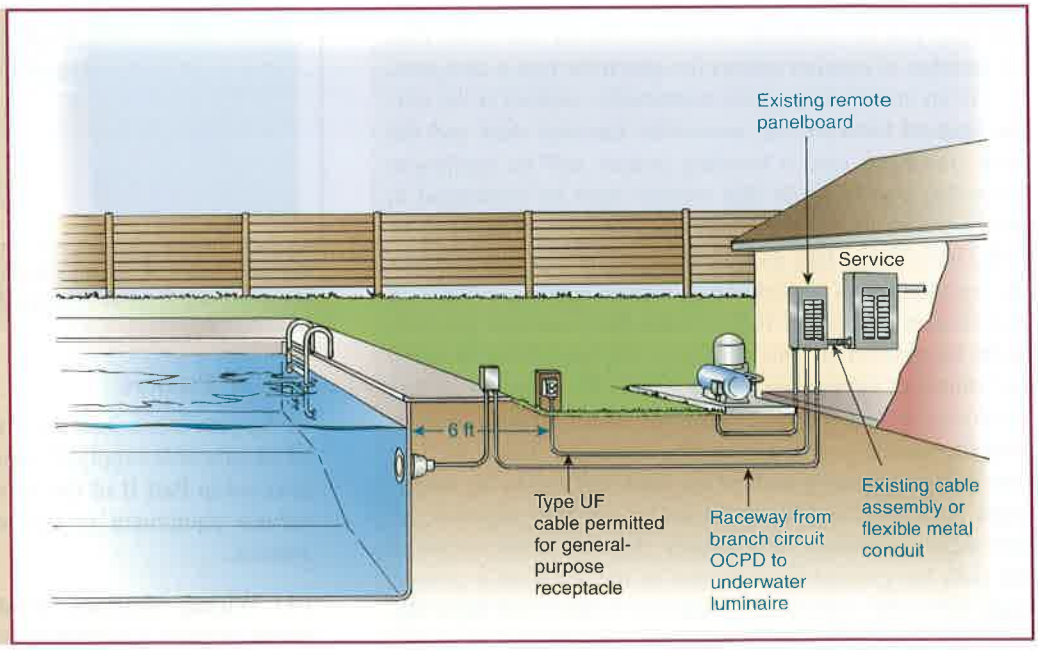
(2) Separate Buildings. A feeder to a separate building or structure shall be permitted to supply swimming pool equipment branch circuits, or feeders supplying swimming pool equipment branch circuits, if the grounding arrangements in the separate building meet the requirements in 250.32(B). Where installed in other than existing feeders covered in 680.25(A), Exception, a separate equipment grounding conductor shall be an insulated conductor.

The insulated equipment grounding conductor can be aluminum or copper and is required to be installed in a raceway. It should be understood that for an existing remote panelboard, the 680.25(A) Exception permits an approved cable assembly with an insulated or covered aluminum or copper equipment grounding conductor. See Exhibit 680.8.

Swimming pool equipment supplied by a separately derived system is covered in 680.25(B). Where a remote panelboard supplying a pool is supplied by a separately derived system, the rules covering the grounding conductor apply only to the feeder between the separately derived system and the panelboard, not all the way back to the service, which might be high voltage.

The general rule in 680.25(B) requires an equipment grounding conductor to be installed between a panelboard serving swimming pool equipment and the service or the source of a separately derived system. Section 680.25(B)(2) allows pool equipment to be supplied from a remote panelboard in a separate building where an insulated equipment grounding conductor is installed with the feeder circuit conductors run from the service (or derived system) to the panelboard and where the installation complies with 250.32(B). See Exhibit 680.9.

Exhibit 680.8 An existing remote panelboard supplying new pool equipment. A raceway is not required for this application if the existing feeder wiring method contains an insulated or covered equipment grounding conductor.



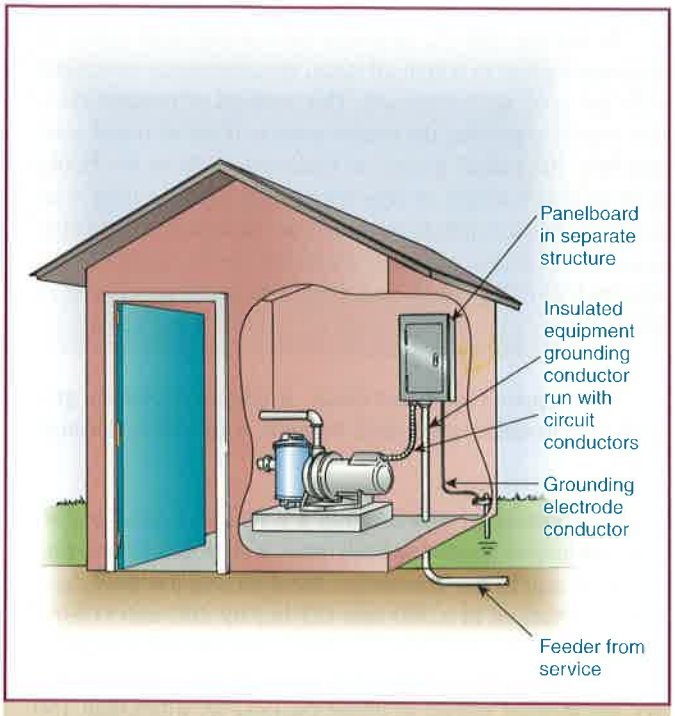


Exhibit 680.9 Grounding requirements per 680.25(B)(2) for remote panelboard and swimming pool equipment located in a structure remote from the service equipment.

680.26 Equipotential Bonding

(A) Performance. The equipotential bonding required by this section shall be installed to reduce voltage gradients in the pool area.

It is important to understand the difference between the terms *bonding* and *grounding* as they apply to Article 680. As defined in Article 100, bonding is "connected to establish electrical continuity and conductivity." As described in 680.26(A), the function of equipotential bonding differs from the primary function of bonding to meet the requirements of Article 250 in that providing a path for ground-fault current is not the function of the equipotential bonding grid and associated bonding conductors.

Creating an electrically safe environment in and around permanently installed swimming pools requires the installation of a bonding system with the sole function of establishing equal electrical potential (voltage) in the vicinity of the swimming pool. A person who is immersed in a pool or who is dripping wet, has a large amount of exposed skin, and is lying or walking on a concrete deck or other conductive perimeter surface is extremely vulnerable to any differences in electrical potential that may be present in the pool area.

The primary purpose of bonding in and around swimming pools is to ensure that voltage gradients in the pool area are not present. Section 680.26(B) specifies that the 8 AWG conductor's only function is equipotential bonding to eliminate the voltage gradient in the pool area and the bonding conductor is not required to extend or connect to any parts or equipment other than those covered in 680.26(B)(1) through (B)(7) and to a pool water bonding element covered in 680.26(C).

The reason for electrically connecting all of the metal parts described in 680.26(B)(1) through (7) is to ensure that they all are at the same electrical potential. This bonding reduces possible injurious or disabling shock hazards created by stray currents in the ground or piping connected to the swimming pool. Stray currents can also exist in nonmetallic piping because of the low resistivity of chlorinated water. See Exhibit 680.10.

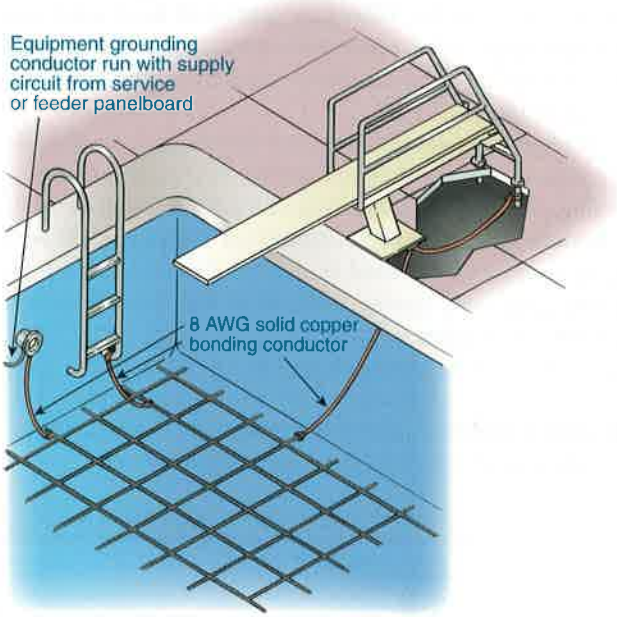


Exhibit 680.10 Bonding of conductive metal parts in a swimming pool.

(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.

(a) *Structural Reinforcing Steel.* Unencapsulated structural reinforcing steel shall be bonded together by steel tie wires or the equivalent. Where structural reinforcing steel is encapsulated in a nonconductive compound, a copper conductor grid shall be installed in accordance with 680.26(B)(1)(b).

Conductive pool shells include those constructed of poured concrete, pneumatically applied concrete, concrete block, and, of course, metal. Fiberglass and vinyl-lined pools are not considered to be conductive pool shells and are not subject to having a bonding grid installed around the entire contour of the pool shell.

Encapsulated reinforcing steel is not likely to provide the conductivity necessary to establish the required common bonding grid around the contour of a conductive pool shell. A bonding grid around the contour of the pool shell will not be formed if the steel is effectively encapsulated by a listed compound during installation and manufacturing. Therefore, a bonding connection to the encapsulated reinforcing steel is not required; however, a bonding grid around the contour of a conductive pool shell must be provided. The copper bonding grid is required to be constructed as prescribed in 680.26(B)(1)(b). See Exhibit 680.11.

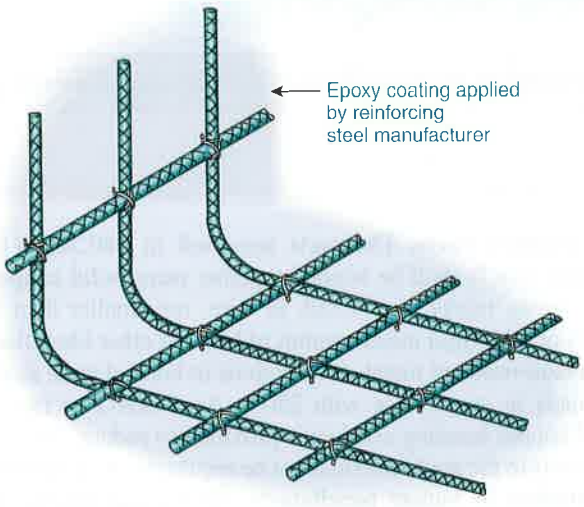


Exhibit 680.11 Epoxy-coated rebar, which does not require bonding.

In Exhibit 680.12, structural reinforcing steel serves as a common point to which all metal appurtenances associated with the pool are connected. This method of connection is one way of satisfying the requirement to bond all metal parts together. Individual pieces of hardware such as the hooks used to attach safety or lane ropes, that are less than 4 in. in any dimension and do not penetrate into the pool structure more than 1 in. are not required to be bonded, per 680.26(B)(5). The flush deck box meets the provisions of 680.24(A).

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

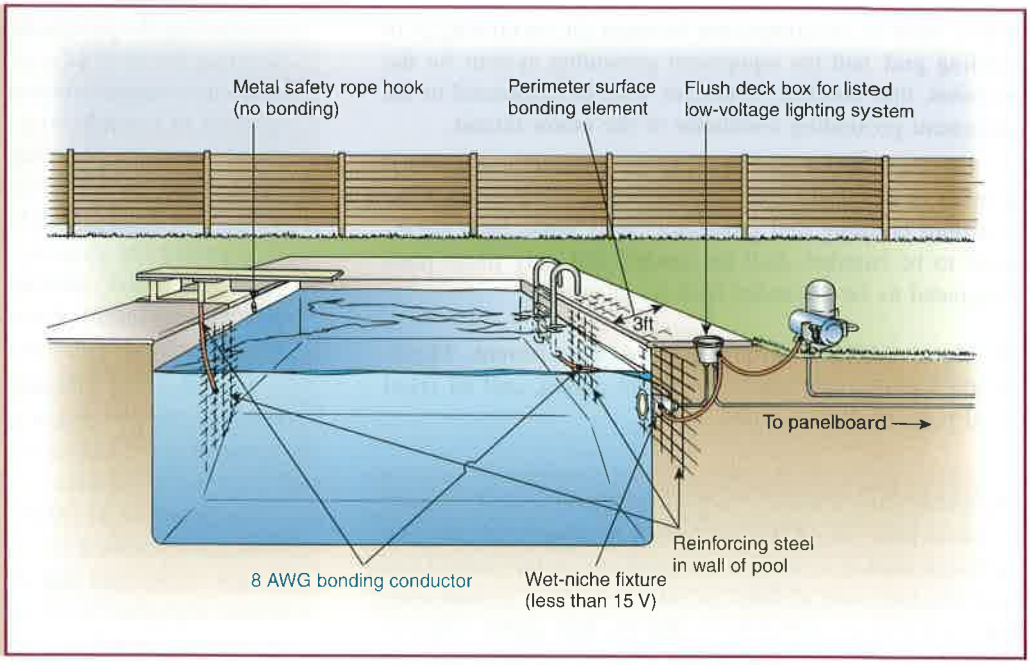
(1) Be constructed of minimum 8 AWG bare solid copper conductors bonded to each other at all points of crossing
(2) Conform to the contour of the pool and the pool deck
(3) Be arranged in a 300-mm (12-in.) by 300-mm (12-in.) network of conductors in a uniformly spaced perpendicular grid pattern with 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

(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 and other types of paving. 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.

The requirement for bonding perimeter surfaces now applies to paved and unpaved surfaces. An example of an unpaved perimeter surface would be the lawn surrounding a permanently installed aboveground swimming pool. Where the paved portion of the perimeter surface extends less than 3 ft horizontally from the inside walls of the pool, the perimeter bonding grid must be continued under the adjacent unpaved perimeter surface. If physical constraints (such as a wall or other physical barrier) prevent the perimeter from extending 3 ft beyond the inside walls of the pool, the bonding grid is required only to extend under the available perimeter area.

The perimeter bonding grid can be comprised of structural reinforcing metal (re-bar or welded wire mesh) that is conductive to the perimeter surface and installed in or under the perimeter surface. Where structural reinforcing steel is not available, a single, bare, solid 8 AWG or larger copper conductor can be installed around the perimeter of the pool in an area measuring between 18 in. and 24 in. from the

Exhibit 680.12 A poured-concrete pool with structural reinforcing steel that serves as the pool shell bonding grid.



inside pool walls. This 8 AWG bonding conductor can be installed in the paving material (i.e., in the concrete), or it can be buried in the material (*subgrade*) below the paving material. Where buried, the bonding conductor is to be not less than 4 in. and not more than 6 in. below the surface level of the subgrade material.

The perimeter surface bonding medium has to be connected, at four evenly spaced points around the pool perimeter, to either the structural steel of a conductive pool shell or to the copper bonding grid provided for the conductive pool shell that has encapsulated re-bar or no re-bar at all. Connection between the perimeter bonding medium and nonconductive pool shells is not required.

(a) *Structural Reinforcing Steel.* Structural reinforcing steel shall be bonded in accordance with 680.26(B)(1)(a).

(b) *Alternate Means.* Where structural reinforcing steel is not available or is encapsulated in a nonconductive compound, a copper conductor(s) shall be utilized where the following requirements are met:

(1) At least one minimum 8 AWG bare solid copper conductor shall be provided.
(2) The conductors shall follow the contour of the perimeter surface.
(3) Only listed splices shall be permitted.
(4) The required conductor shall be 450 to 600 mm (18 to 24 in.) from the inside walls of the pool.
(5) The required conductor shall be secured within or under the perimeter surface 100 mm to 150 mm (4 in. to 6 in.) below the subgrade.

(3) Metallic Components. All metallic parts of the pool structure, including reinforcing metal not addressed in 680.26(B)(1)(a), shall be bonded. Where reinforcing steel is encapsulated with a nonconductive compound, the reinforcing steel shall not be required to be bonded.

(4) Underwater Lighting. All metal forming shells and mounting brackets of no-niche luminaires shall be bonded.

Exception: Listed low-voltage lighting systems with nonmetallic forming shells shall not require bonding.

(5) Metal Fittings. All metal fittings within or attached to the pool structure shall be bonded. Isolated parts that are not over 100 mm (4 in.) in any dimension and do not penetrate into the pool structure more than 25 mm (1 in.) shall not require bonding.

(6) Electrical Equipment. Metal parts of electrical equipment associated with the pool water circulating system, including pump motors and metal parts of equipment associated with pool covers, including electric motors, shall be bonded.

Exception: Metal parts of listed equipment incorporating an approved system of double insulation shall not be bonded.

(a) *Double-Insulated Water Pump Motors.* Where a double-insulated water pump motor is installed under the provisions of this rule, a solid 8 AWG copper conductor of sufficient length to make a bonding connection to a replacement motor shall be extended from the bonding grid to an accessible point in the vicinity of the pool pump motor.

Where there is no connection between the swimming pool bonding grid and the equipment grounding system for the premises, this bonding conductor shall be connected to the equipment grounding conductor of the motor circuit.

(b) *Pool Water Heaters.* For pool water heaters rated at more than 50 amperes and having specific instructions regarding bonding and grounding, only those parts designated to be bonded shall be bonded and only those parts designated to be grounded shall be grounded.

(7) Metal Wiring Methods and Equipment. Metal-sheathed cables and raceways, metal piping, and all fixed metal parts shall be bonded.

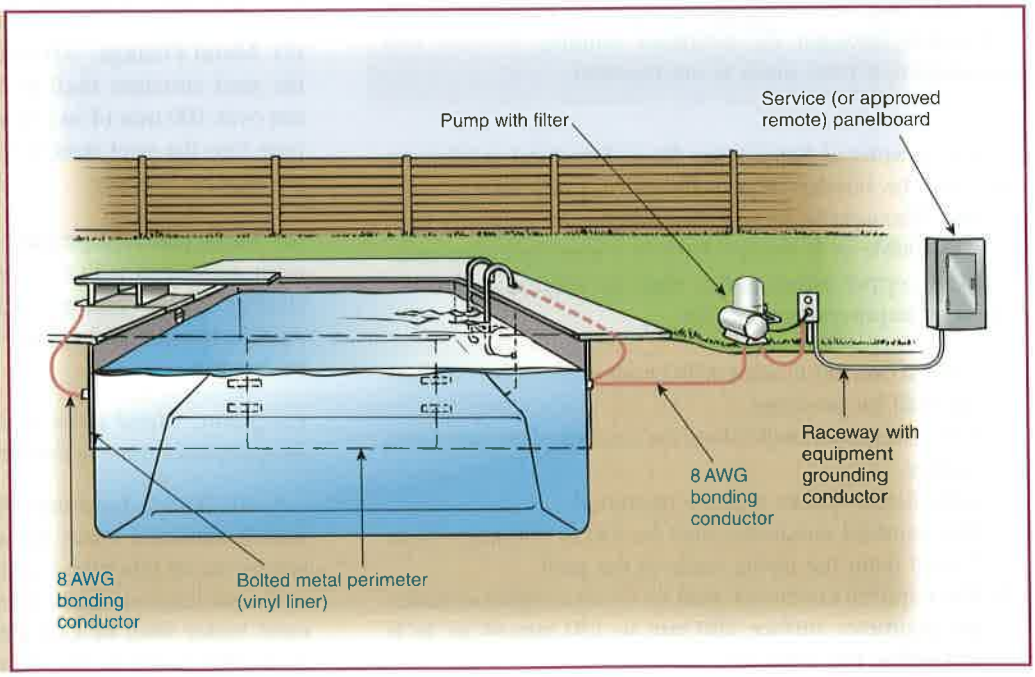
The metal parts required to be bonded per 680.26(B) include all metal parts of electrical equipment associated with the water-circulating system of the pool, all metal parts of the pool structure, and all fixed metal parts, which include conduit and piping, metal door frames, and metal window frames, within 5 ft of the inside walls of the pool and not separated by a permanent barrier. Other examples of fixed metal parts covered by this requirement include metal fences and metal awnings. The bonding of these parts can be accomplished by one or more of the following methods using a solid 8 AWG or larger, insulated, covered, or bare copper conductor. See Exhibit 680.13. Brass or other corrosion-resistant metal conduit can also be used as a bonding conductor for connecting metal parts together.

- Connecting the parts directly to each other in series or parallel configurations
- Connecting the parts to the unencapsulated structural metal forming the shell of a conductive pool or connecting the parts to a copper conductor grid system used around the contour of a conductive pool shell
- Connecting the parts together using the pool shell constructed of bolted or welded steel as a common connection point. See Exhibit 680.13
- Connecting the parts to the perimeter bonding grid consisting of either structural reinforcing steel (re-bar or welded wire mesh) or a solid 8 AWG bare copper conductor encircling the perimeter of the pool

Exhibit 680.14 illustrates the use of brass rigid metal conduit or other corrosion-resistant metal conduit as a means to connect electrical equipment, such as the forming shell of a wet-niche luminaire, to the pool reinforcing steel.

As specified in 250.8 for the grounding and bonding connections required by Article 250, exothermic welding, pressure connectors and clamps specifically listed for the purpose, and other listed means are permitted as the method of connecting bonding conductors to swimming pool equipment required to be bonded. Connections in pool areas must be suitable for wet conditions and high levels of chlorine. High concentrations of chlorine in swimming pool water make the wet locations in the vicinity of swimming pool areas (including many pool pump rooms) a corrosive environment. The integrity of the bonding connections should be periodically inspected, particularly those bonding connections between the 8 AWG copper conductor and, for instance, an aluminum (or other dissimilar metal) ladder. See Exhibit 680.15 for an illustration of two acceptable methods of making swimming pool bonding connections.

Exhibit 680.13 A metal-perimeter (e.g., steel or aluminum) pool with bolted or welded sections. The metal pool perimeter, the metal ladder, metal diving board, and pump motor are all connected together using 8 AWG solid copper bonding conductors.



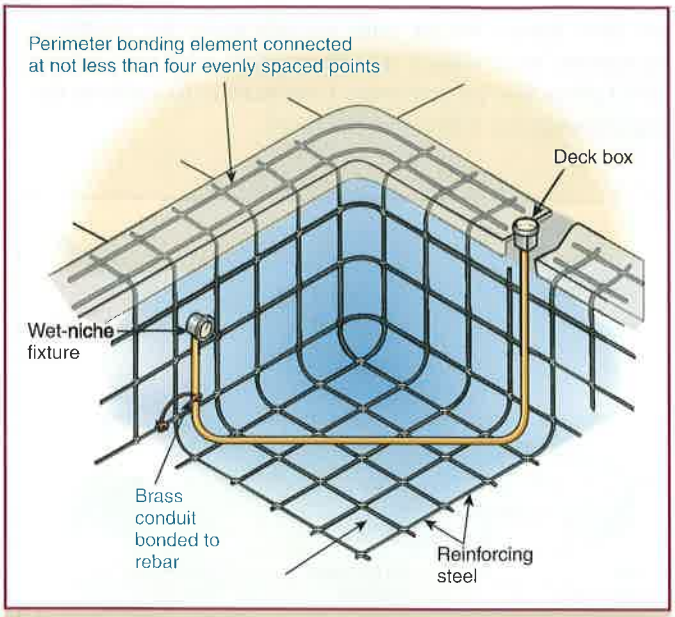


Exhibit 680.14 Brass rigid metal conduit used as a means to connect electrical equipment to the common bonding grid.

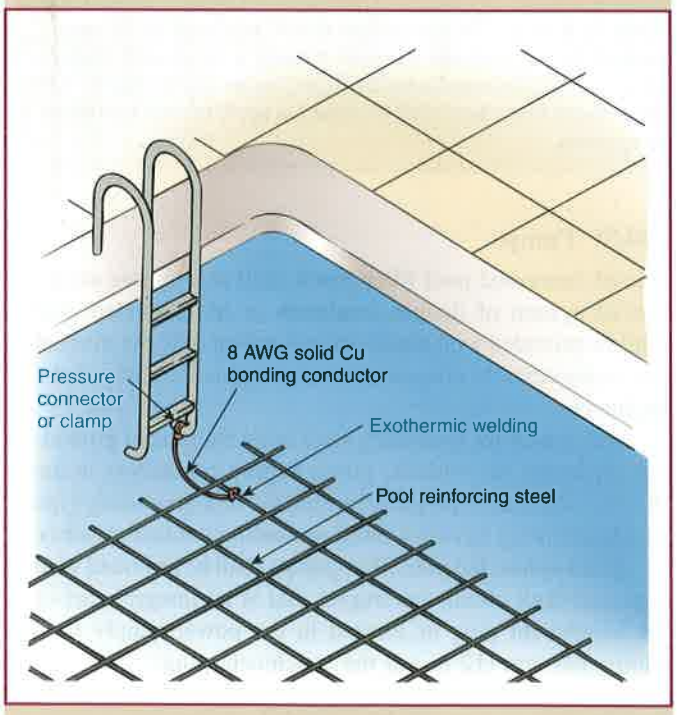


Exhibit 680.15 Bonding connections in a swimming pool.

Exception No. 1: Those separated from the pool by a permanent barrier 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.

(C) Pool Water. An intentional bond of a minimum conductive surface area of 5806 mm^2 (9 $in.^2$) shall be installed in contact with the pool water. This bond shall be permitted to consist of parts that are required to be bonded in 680.26(B).

680.27 Specialized Pool Equipment

(A) Underwater Audio Equipment. All underwater audio equipment shall be identified for the purpose.

(1) Speakers. Each speaker shall be mounted in an approved metal forming shell, the front of which is enclosed by a captive metal screen, or equivalent, that is bonded to, and secured to, the forming shell by a positive locking device that ensures a low-resistance contact and requires a tool to open for installation or servicing of the speaker. The forming shell shall be installed in a recess in the wall or floor of the pool.

(2) Wiring Methods. Rigid metal conduit of brass or other identified corrosion-resistant metal, liquidtight flexible nonmetallic conduit (LFNC-B), rigid polyvinyl chloride conduit, or reinforced thermosetting resin conduit shall extend from the forming shell to a listed junction box or other enclosure as provided in 680.24. Where rigid polyvinyl chloride conduit, reinforced thermosetting resin conduit, or liquidtight flexible nonmetallic conduit is used, an 8 AWG insulated solid or stranded copper bonding jumper shall be installed in this conduit. The bonding jumper shall be terminated in the forming shell and the junction box. The termination of the 8 AWG bonding jumper in the forming shell shall be covered with, or encapsulated in, a listed potting compound to protect such connection from the possible deteriorating effect of pool water.

(3) Forming Shell and Metal Screen. The forming shell and metal screen shall be of brass or other approved corrosion-resistant metal. All forming shells shall include provisions for terminating an 8 AWG copper conductor.

(B) Electrically Operated Pool Covers.

(1) Motors and Controllers. The electric motors, controllers, and wiring shall be located not less than 1.5 m (5 ft) from the inside wall of the pool unless separated from the pool by a wall, cover, or other permanent barrier. Electric motors installed below grade level shall be of the totally enclosed type. The device that controls the operation of the motor for an electrically operated pool cover shall be located such that the operator has full view of the pool.

FPN No. 1: For cabinets installed in damp and wet locations, see 312.2.

FPN No. 2: For switches or circuit breakers installed in wet locations, see 404.4.

FPN No. 3: For protection against liquids, see 430.11.

(2) Protection. The electric motor and controller shall be connected to a circuit protected by a ground-fault circuit interrupter.

(C) Deck Area Heating. The provisions of this section shall apply to all pool deck areas, including a covered pool, where electrically operated comfort heating units are installed within 6.0 m (20 ft) of the inside wall of the pool.

(1) Unit Heaters. Unit heaters shall be rigidly mounted to the structure and shall be of the totally enclosed or guarded type. Unit heaters shall not be mounted over the pool or within the area extending 1.5 m (5 ft) horizontally from the inside walls of a pool.

(2) Permanently Wired Radiant Heaters. Radiant electric heaters shall be suitably guarded and securely fastened to their mounting device(s). Heaters shall not be installed over a pool or within the area extending 1.5 m (5 ft) horizontally from the inside walls of the pool and shall be mounted at least 3.7 m (12 ft) vertically above the pool deck unless otherwise approved.

(3) Radiant Heating Cables Not Permitted. Radiant heating cables embedded in or below the deck shall not be permitted.

Only unit heaters and permanently connected radiant heaters are permitted in the area that extends 5 ft to 20 ft horizontally from the inside walls of a pool. Electric radiant heating cables embedded in the deck are not permitted.

III. Storable Pools

680.30 General

Electrical installations at storable pools shall comply with the provisions of Part I and Part III of this article.

Storable pools can be readily disassembled and are limited (other than inflatable type) to a maximum water depth of 42 in. Pools of any dimension with inflatable walls are considered storable. See the definition of *storable swimming, wading, or immersion pool* in 680.2. This type of pool and its associated equipment do not require bonding conductors. However, the filter pump must be double insulated, and the provision of grounding means consisting of an equipment grounding conductor that is an integral part of the flexible cord also is required. Underwriters Laboratories lists portable filter pumps for use with storable pools. All electrical equipment used with a storable pool is required to have GFCI protection for personnel. Exhibit 680.16 illustrates the requirements for a storable-type pool.

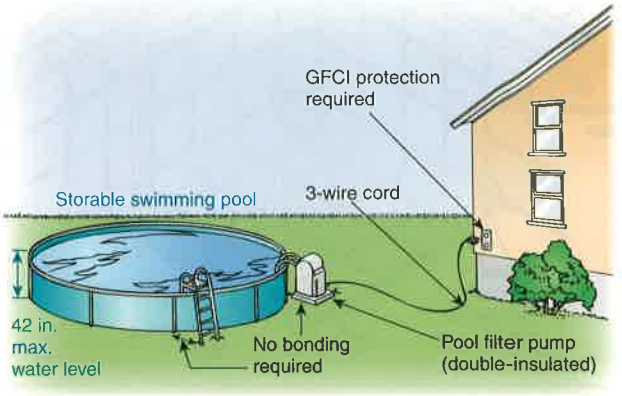


Exhibit 680.16 The requirements for a storable-type pool. Metal appurtenances are not required to be bonded. The 3-wire cord may be longer than 3 ft (listed filter pumps are equipped with cords 25 ft long). The receptacle shown can be a GFCI-type receptacle, a receptacle supplied through a GFCI-type receptacle, or a receptacle protected by a GFCI-type circuit breaker. The water depth restriction of 42 in. does not apply to inflatable swimming pools.

680.31 Pumps

A cord-connected pool filter pump shall incorporate an approved system of double insulation or its equivalent and shall be provided with means for grounding only the internal and nonaccessible non–current-carrying metal parts of the appliance.

The means for grounding shall be an equipment grounding conductor run with the power-supply conductors in the flexible cord that is properly terminated in a grounding-type attachment plug having a fixed grounding contact member.

Cord-connected pool filter pumps shall be provided with a ground-fault circuit interrupter that is an integral part of the attachment plug or located in the power supply cord within 300 mm (12 in.) of the attachment plug.

680.32 Ground-Fault Circuit Interrupters Required

All electrical equipment, including power-supply cords, used with storable pools shall be protected by ground-fault circuit interrupters.

All 125-volt 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