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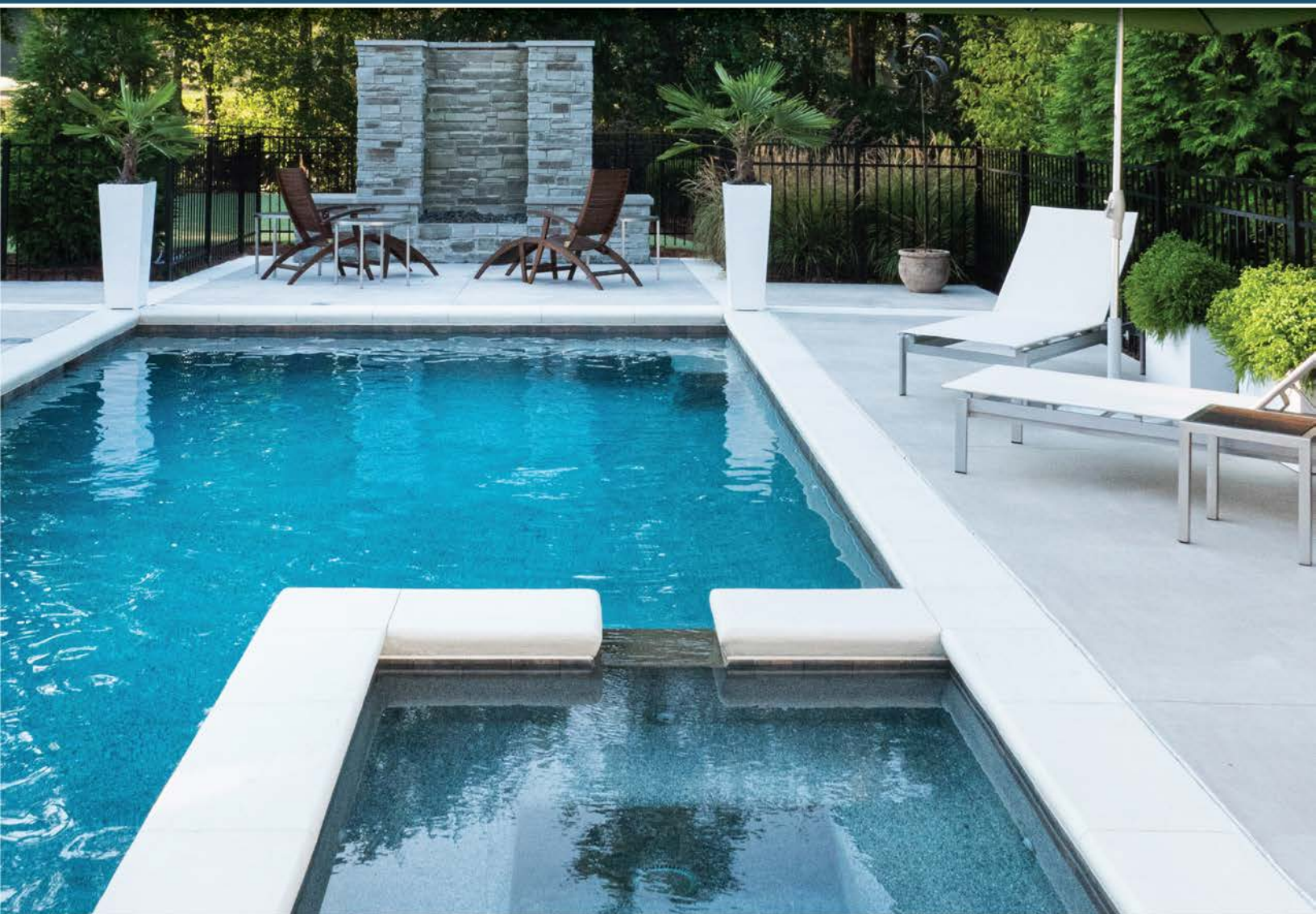


Mike Holt's Illustrated Guide to

Article 680

SWIMMING POOLS, SPAS, HOT TUBS, FOUNTAINS, AND SIMILAR INSTALLATIONS

Extracted from Understanding the National Electrical Code® Volume 2



Mike Holt Enterprises

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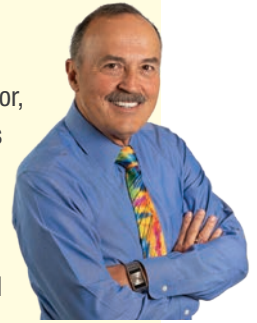
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ABOUT THE AUTHOR

Mike Holt is an author, businessman, educator, speaker, publisher and *NEC*® expert. He has written hundreds of electrical training books and articles, founded three successful businesses, and has taught thousands of electrical *Code* seminars across the United States and internationally.



Mike's approach to electrical training is based on his own experience as an electrician, contractor, inspector and teacher. He's always felt a responsibility to his students and to the electrical industry to provide education beyond the scope of just passing an exam. This commitment, coupled with the lessons he learned at the University of Miami's MBA program, have helped him build one of the largest electrical training and publishing companies in the United States.

Mike's one-of-a-kind presentation style and his ability to simplify and clarify technical concepts explain his unique position as one of the premier educators and *Code* experts in the country. His passion for the electrical field drives his goal to increase electrical safety and improve lives.

Mike's commitment to pushing boundaries and setting high standards extends into his personal life. He's an eight-time Overall National Barefoot Waterski Champion with more than 20 gold medals, many national records, and he has competed in three World Barefoot Tournaments. In 2015, at the tender age of 64, he started a new adventure—competitive mountain bike racing. Every day he continues to find ways to motivate himself, both mentally and physically.

Mike and his wife, Linda, reside in New Mexico and Florida, and are the parents of seven children and six grandchildren. As his life has changed over the years, a few things have remained constant: his commitment to God, his love for his family, and doing what he can to change the lives of others through his products and seminars.

*I dedicate this book to the
Lord Jesus Christ,
my mentor and teacher.
Proverbs 16:3*



ARTICLE 680

SWIMMING POOLS, SPAS, HOT TUBS, FOUNTAINS, AND SIMILAR INSTALLATIONS

Introduction to Article 680—Swimming Pools, Spas, Hot Tubs, Fountains, and Similar Installations

The requirements contained in Article 680 apply to the installation of electrical wiring and equipment for swimming pools, spas, hot tubs, fountains, hydromassage bathtubs, and electrically powered pool lifts. The overriding concern of this article is to keep people and electricity separated.

This article is divided into eight parts. The various parts apply to certain types of installations, so be careful to determine which parts of this article apply to what and where. For instance, Part I and Part II apply to spas and hot tubs installed outdoors, except as modified in Part IV. In contrast, hydromassage bathtubs are only covered by Part VII. Read the details of Article 680 carefully so you will be able to provide a safe installation.

- ▶ **Part I. General.**
- ▶ **Part II. Permanently Installed Pools.** Installations at permanently installed pools must comply with both Parts I and II of this article.
- ▶ **Part III. Storable Swimming Pools, Storable Spas, and Storable Hot Tubs.** Installations of storable pools, storable spas, and storable hot tubs must comply with Parts I and III of Article 680.
- ▶ **Part IV. Spas and Hot Tubs.** Spas and hot tubs must comply with Parts I and IV of this article; outdoor spas and hot tubs must also comply with Part II in accordance with 680.42.
- ▶ **Part V. Fountains.** Parts I and V apply to permanently installed fountains. If they have water in common with a pool, Part II also applies. Self-contained, portable fountains are covered by Article 422, Parts II and III.
- ▶ **Part VI. Pools and Tubs for Therapeutic Use.** Parts I and VI apply to pools and tubs for therapeutic use in health care facilities, gymnasiums, athletic training rooms, and similar installations.
- ▶ **Part VII. Hydromassage Bathtubs.** Only Part VII of Article 680 applies to hydromassage bathtubs.
- ▶ **Part VIII. Electrically Powered Pool Lifts.** Parts I and II apply to electrically powered pool lifts only when referenced in Part VIII.

Part I. General Requirements for Pools, Spas, Hot Tubs, and Fountains

Author's Comment:

- ▶ The requirements contained in Part I of Article 680 apply to permanently installed pools [680.20], storable pools [680.30], spas and hot tubs [680.42 and 680.43], fountains [680.50], and pool lifts [680.80].

680.1 Scope

Article 680 applies to the installation of electric wiring and equipment for swimming pools, hot tubs, spas, fountains, hydromassage bathtubs, and pool lifts. ▶ **Figure 680-1**

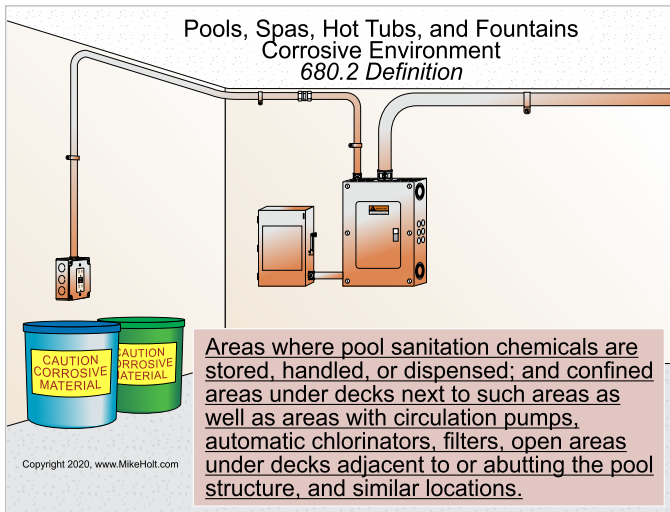


► Figure 680-1

680.2 Definitions

The definitions in this section apply only within this article.

Corrosive Environment. Areas where pool sanitation chemicals are stored, handled, or dispensed; and confined areas under decks adjacent to such areas as well as areas with circulation pumps, automatic chlorinators, filters, open areas under decks adjacent to or abutting the pool structure, and similar locations. ► Figure 680-2



► Figure 680-2

Note: Sanitation chemicals and pool water pose a risk of corrosion (gradually damaging or destroying materials) due to the presence of oxidizers (for example, calcium hypochlorite, sodium hypochlorite, bromine, and chlorinated isocyanurates) and chlorinating agents that

release chlorine when dissolved in water. More information about swimming pool chemicals can be found on or in the following:

- (1) Environmental Protection Agency website
- (2) NFPA 400, *Hazardous Materials Code*
- (3) Advisory: Swimming Pool Chemicals: Chlorine, OSWER 90-008.1, available from the *EPA National Service Center for Environmental Publications* (NSCEP)

Electrically Powered Pool Lift. An electrically powered lift that provides accessibility to and from a pool or spa for people with disabilities. ► Figure 680-3



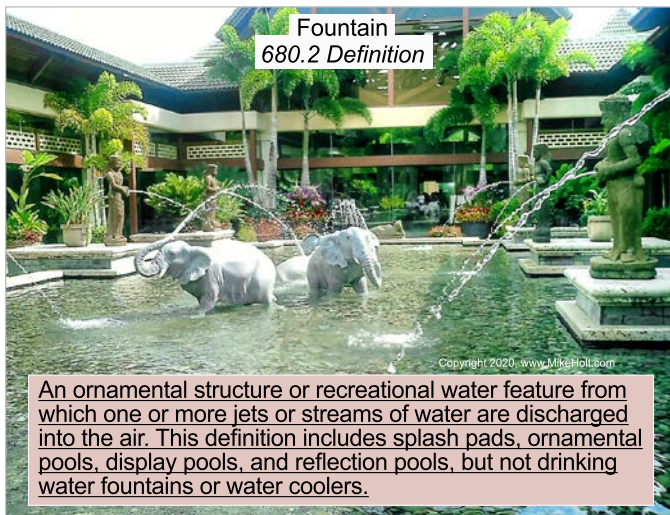
► Figure 680-3

Forming Shell. A structure designed to support a wet-niche luminaire. ► Figure 680-4



► Figure 680-4

Fountain. An ornamental structure or recreational water feature from which one or more jets or streams of water are discharged into the air including splash pads, ornamental pools, display pools, and reflection pools. This definition does not include drinking water fountains or water coolers. ▶Figure 680-5



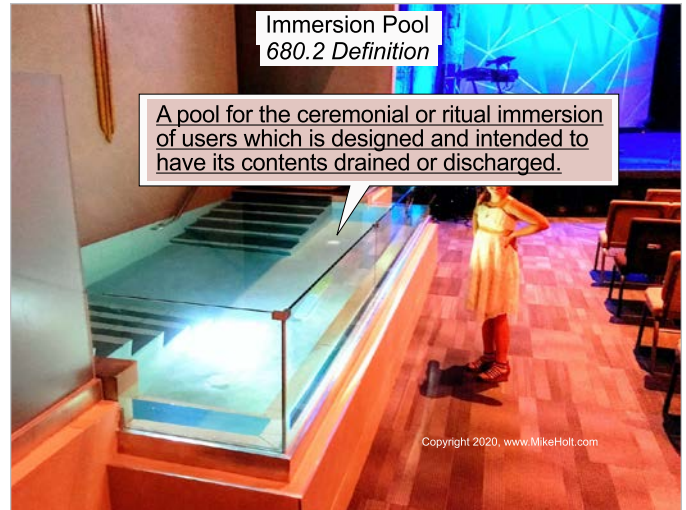
▶Figure 680-5

Hydromassage Bathtub. A permanently installed bathtub with a recirculating piping system designed to accept, circulate, and discharge water after each use. ▶Figure 680-6



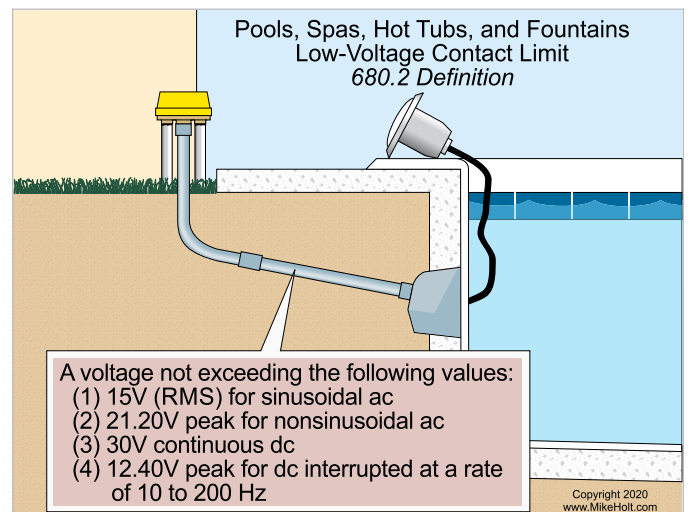
▶Figure 680-6

Immersion Pool. A pool for the ceremonial or ritual immersion of users which is designed and intended to have its contents drained or discharged. ▶Figure 680-7



▶Figure 680-7

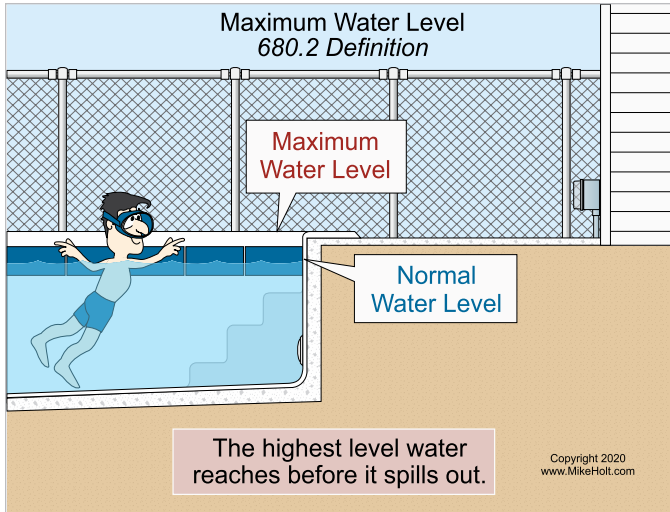
Low-Voltage Contact Limit. A voltage not exceeding the following values: ▶Figure 680-8



▶Figure 680-8

- (1) 15V (RMS) for sinusoidal alternating current.
- (2) 21.20V peak for nonsinusoidal alternating current.
- (3) 30V for continuous direct current.
- (4) 12.40V peak for direct current that is interrupted at a rate of 10 to 200 Hz.

Maximum Water Level. The highest level water reaches before it spills out. ▶Figure 680-9



► Figure 680-9

Permanently Installed Swimming, Wading, Immersion, and Therapeutic Pools. Pools constructed in the ground or partially in the ground, pools capable of holding water of a depth greater than 42 in., and pools installed inside a building. ►Figure 680-10



► Figure 680-10

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

Author's Comment:

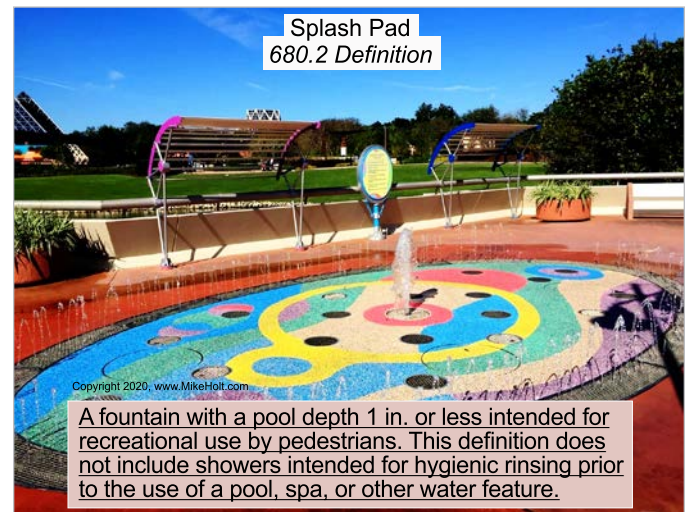
- The definition of a pool includes baptisteries (immersion pools) which must comply with the requirements of Article 680.
- An above ground pool having a maximum water depth greater than 42 in. is considered a permanent pool. See the definition of 'storable pool.'

Spa or Hot Tub. A hydromassage pool or tub designed for recreational or therapeutic use typically not drained after each use. ►Figure 680-11



► Figure 680-11

Splash Pad. A fountain with a water depth 1 in. or less intended for recreational use by pedestrians. This definition does not include showers intended for hygienic rinsing prior to use of a pool, spa, or other water feature. ►Figure 680-12



► Figure 680-12

Storable Swimming Pools. A pool that is intended to be stored when not in use, constructed on or above the ground, and are capable of holding water to a depth of 42 in., or a pool constructed with nonmetallic, molded polymeric walls or inflatable fabric walls regardless of dimension.

Wet-Niche Luminaire. A luminaire intended to be installed in a forming shell where it will be completely surrounded by water. ▶Figure 680–13



► **Figure 680–13**

680.3 Approval of Equipment

Electrical equipment and products covered by this article are required to be listed and must be installed in compliance with this article.

680.4 Inspections After Installation

The authority having jurisdiction is permitted to require periodic inspection and testing.

680.5 Ground-Fault Circuit Interrupters

The GFCI requirements in Article 680, unless otherwise noted, are in addition to the requirements in 210.8.

680.6 Bonding and Equipment Grounding

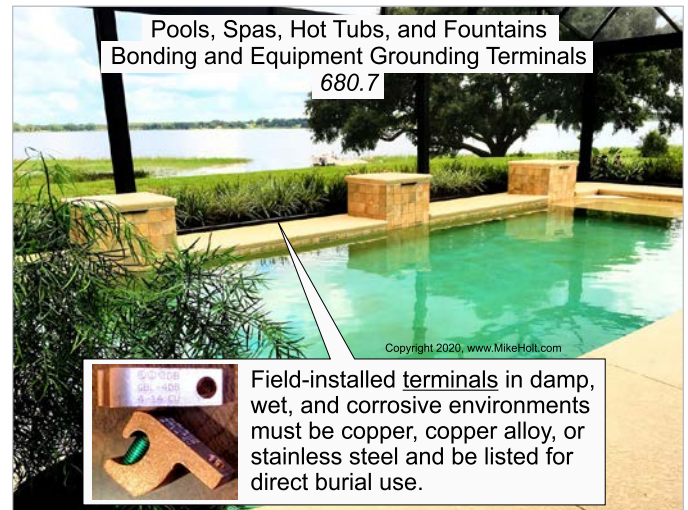
Electrical equipment must be bonded in accordance with Part V of Article 250 and must be connected to the equipment grounding conductor requirements of Parts VI and VII of that article. Equipment must be connected by the wiring methods in Chapter 3 unless modified by this article. Equipment subject to these requirements include:

- (1) Through-wall lighting assemblies and underwater luminaires except for listed low-voltage lighting.

- (2) All electrical equipment within 5 ft of the inside wall of the specified body of water.
- (3) All electrical equipment associated with the water recirculating system.
- (4) Junction boxes.
- (5) Transformer and power-supply enclosures.
- (6) Ground-fault circuit interrupters.
- (7) Subpanels that supply associated equipment.

680.7 Bonding and Equipment Grounding Terminals

Terminals used for bonding and equipment grounding must be identified as suitable for use in wet and corrosive environments. Field-installed terminals in damp, wet, and corrosive environments must be copper, copper alloy, or stainless steel and be listed for direct burial use. ▶**Figure 680-14**

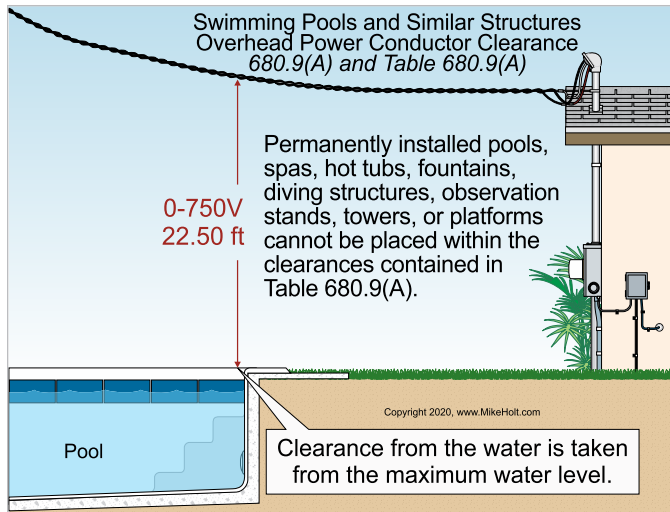


► **Figure 680–14**

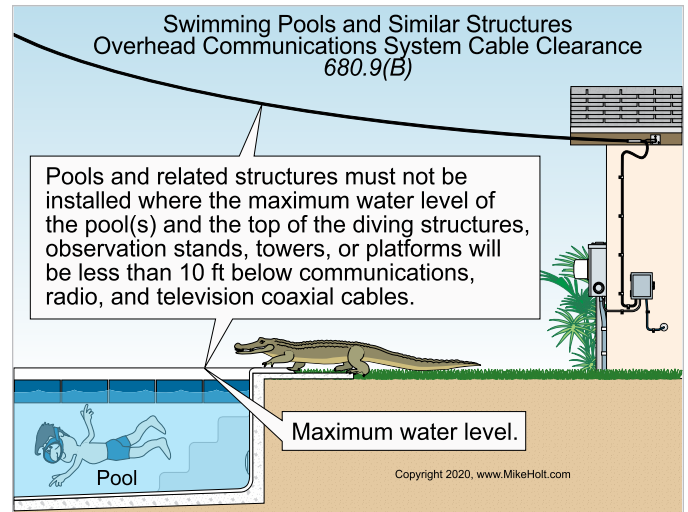
680.9 Overhead Conductor Clearance

Overhead conductors must meet the clearance from the maximum water level requirements contained in Table 680.9(A).

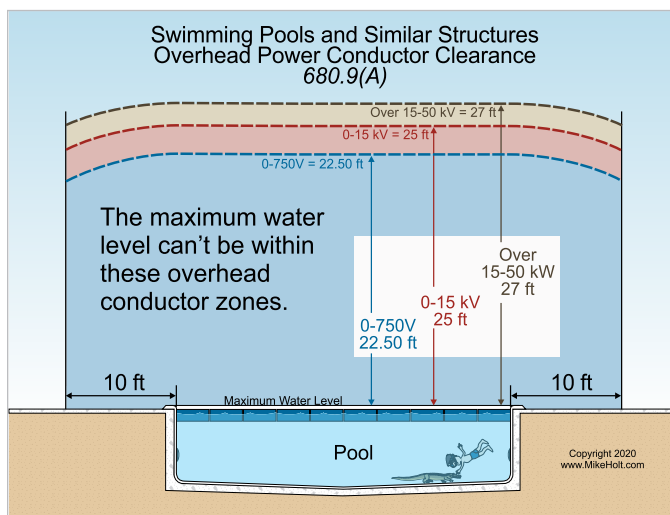
(A) Overhead Power Conductors. Permanently installed pools, spas, hot tubs, fountains, diving structures, observation stands, towers, or platforms cannot be placed within the clearances contained in Table 680.9(A). ▶Figure 680-15 and ▶Figure 680-16



► Figure 680-15



► Figure 680-17



► Figure 680-16

Author's Comment:

- This rule does not prohibit utility-owned overhead service-drop conductors from being installed over a pool, spa, hot tub, or fountain [90.2(B)(5)]. However, it does prohibit a pool, spa, hot tub, or fountain from being installed under an existing service drop that is not at least 22½ ft above the water.

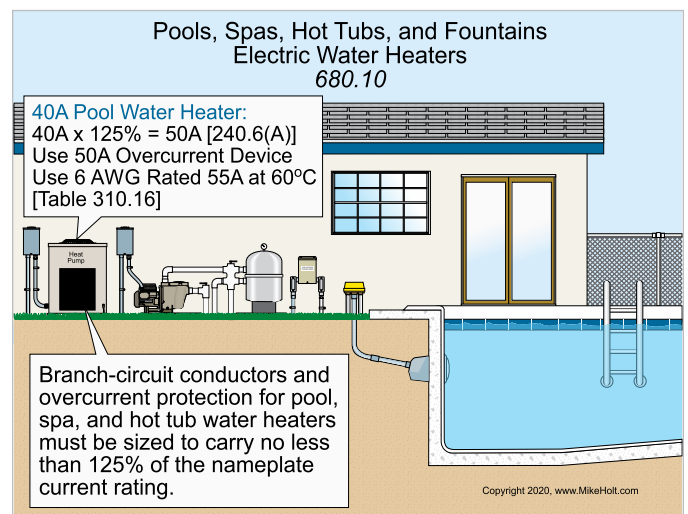
(B) Communications Systems. Swimming and wading pools, and diving structures, observation stands, towers, or platforms must not be installed where the maximum water level of the pool(s) and the top of the diving structures, observation stands, towers, or platforms will be less than 10 ft below communications, radio, and television coaxial cables. ► Figure 680-17

Author's Comment:

- This rule does not prohibit a utility-owned communications overhead cable from being installed over a pool, spa, hot tub, or fountain [90.2(B)(4)]. It does prohibit a pool, spa, hot tub, or fountain from being installed under an existing communications utility overhead supply that is not at least 10 ft above the water.

680.10 Electric Water Heaters

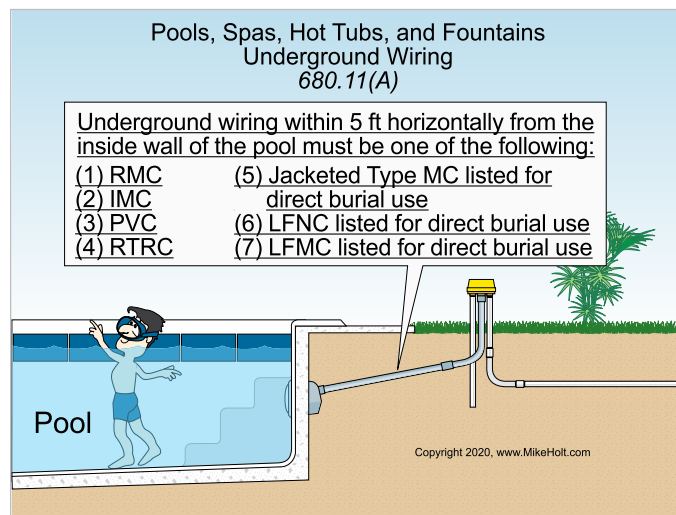
Branch-circuit conductors and overcurrent protection for pool, spa, and hot tub water heaters must be sized to carry no less than 125 percent of the nameplate current rating. ► Figure 680-18



► Figure 680-18

680.11 Underground Wiring

(A) Underground Wiring. Underground wiring located within 5 ft horizontally from the inside wall of the pool must be one of the following wiring methods. ▶ **Figure 680-19**



▶ **Figure 680-19**

- (1) Rigid metal conduit
- (2) Intermediate metal conduit
- (3) Rigid polyvinyl chloride conduit
- (4) Reinforced thermosetting resin conduit
- (5) Jacketed Type MC cable listed for direct burial use
- (6) Liquidtight flexible nonmetallic conduit listed for direct burial use
- (7) Liquidtight flexible metal conduit listed for direct burial use

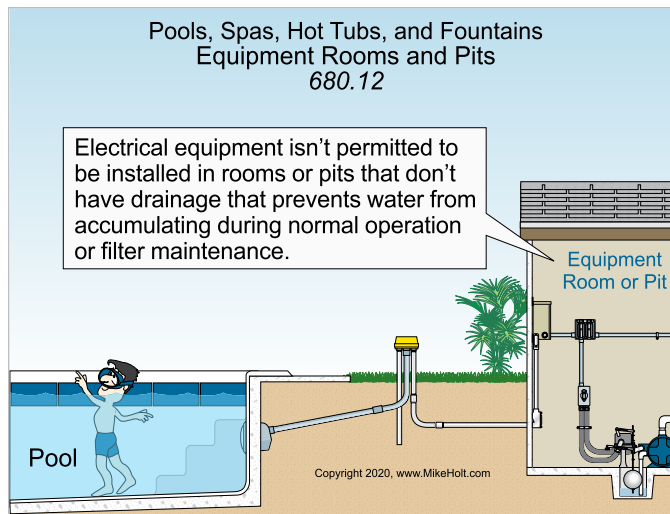
(B) Wiring Under Pools. Underground wiring beneath pools is permitted for the supply of pool equipment permitted by this article and no other loads.

(C) Minimum Cover Requirements. Minimum cover depths contained in 300.5 apply.

680.12 Equipment Rooms and Pits

Permanently installed pools, storable pools, spas, hot tubs, or fountain equipment are not permitted to be located in rooms or pits that do not have drainage that prevents water accumulation during normal operation or filter maintenance. ▶ **Figure 680-20**

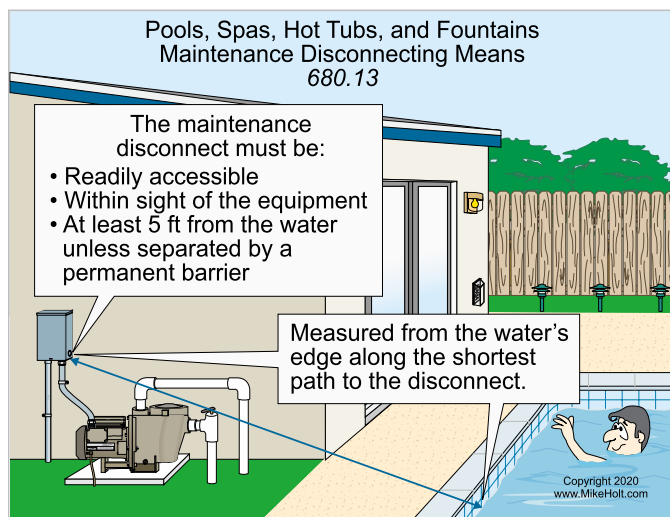
Equipment must be suitable for the corrosive environment in accordance with 300.6.



▶ **Figure 680-20**

680.13 Maintenance Disconnecting Means

A maintenance disconnect is required for pool, spa, hot tub, or fountain equipment other than lighting. The maintenance disconnect must be readily accessible and located within sight and at least 5 ft from the pool, spa, hot tub, or fountain equipment unless separated from the open water by a permanently installed barrier. This horizontal distance is measured from the water's edge along the shortest path required to reach the disconnect. ▶ **Figure 680-21**



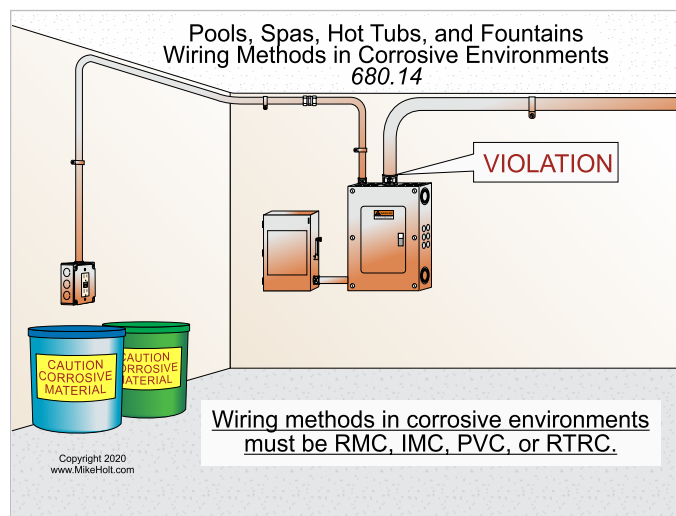
▶ **Figure 680-21**

Author's Comment:

- ▶ According to Article 100, "Within Sight" means that it is visible and not more than 50 ft from the location of the equipment.

680.14 Wiring Methods in Corrosive Environment

Wiring methods in corrosive environments must be rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit, or reinforced thermosetting resin conduit. ▶Figure 680-22



▶Figure 680-22

Part II. Permanently Installed Pools

680.20 General

The requirements contained in Part I and Part II apply to permanently installed pools as defined by 680.2 and above ground pools having a water depth greater than 42 in.

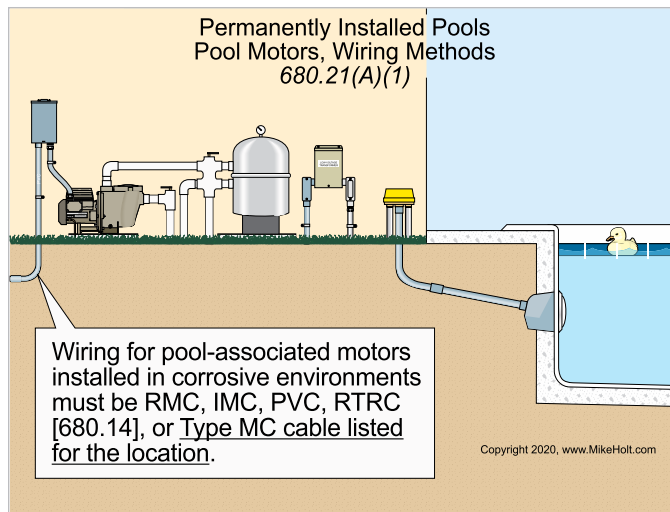
680.21 Pool Motors

(A) Wiring Methods. The wiring to a pool-associated motor must comply with 680.21(A)(1) unless modified by (A)(2) or (A)(3).

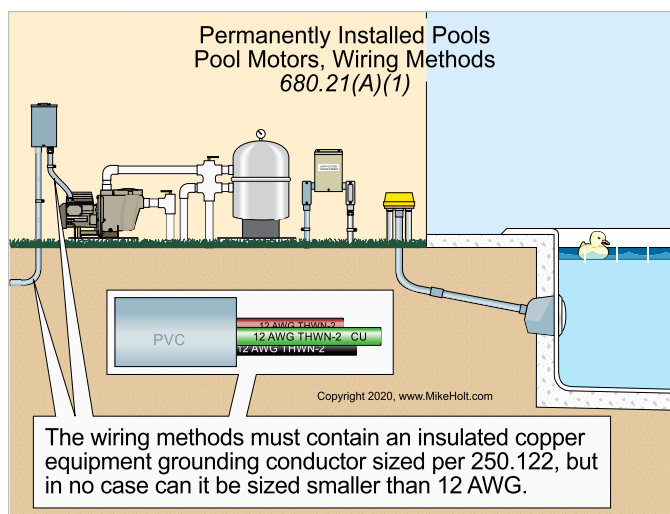
(1) General. Branch-circuit wiring for pool-associated motors installed in corrosive locations must be rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit, reinforced thermosetting resin conduit [680.14], or Type MC cable listed for the location. ▶Figure 680-23

The wiring methods must contain an insulated copper equipment grounding conductor sized in accordance with 250.122, but in no case can it be sized smaller than 12 AWG. ▶Figure 680-24

Where installed in noncorrosive environments, any Chapter 3 wiring method is permitted.



▶Figure 680-23



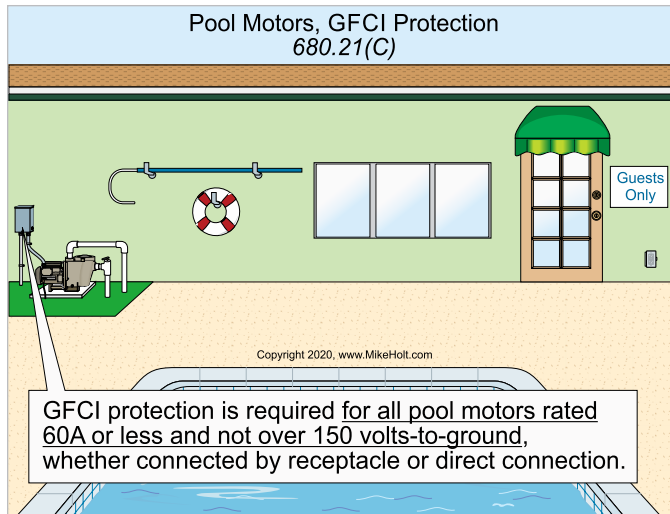
▶Figure 680-24

(2) Flexible Connections. Liquidtight flexible metal and liquidtight flexible nonmetallic conduit are permitted.

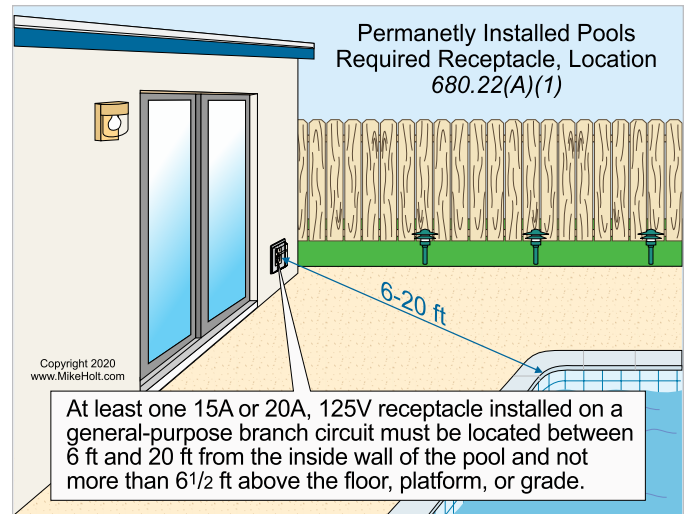
(C) GFCI Protection. GFCI protection is required for all pool motors rated 60A or less and not over 150V to ground, whether connected by receptacle or by direct connection. ▶Figure 680-25

Ex: Listed low-voltage motors not requiring grounding, with ratings not exceeding the low-voltage contact limit supplied by transformers or power supplies that comply with 680.23(A)(2), may be installed without GFCI protection.

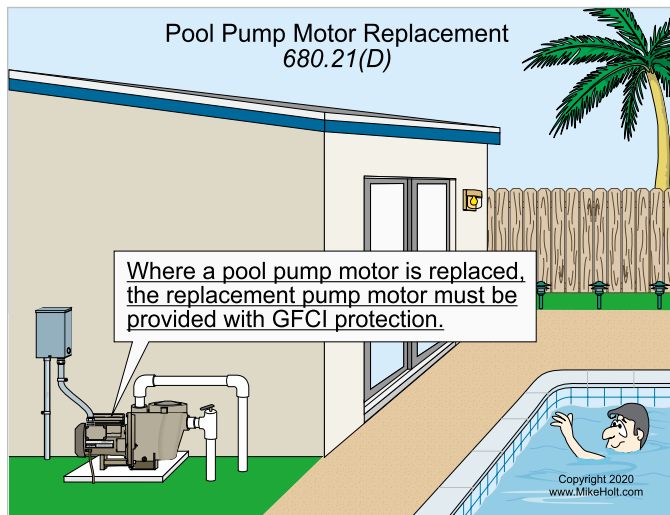
(D) Pool Pump Motor Replacement. Where a pool pump motor is replaced, the replacement pump motor must be provided with GFCI protection. Figure 680-26



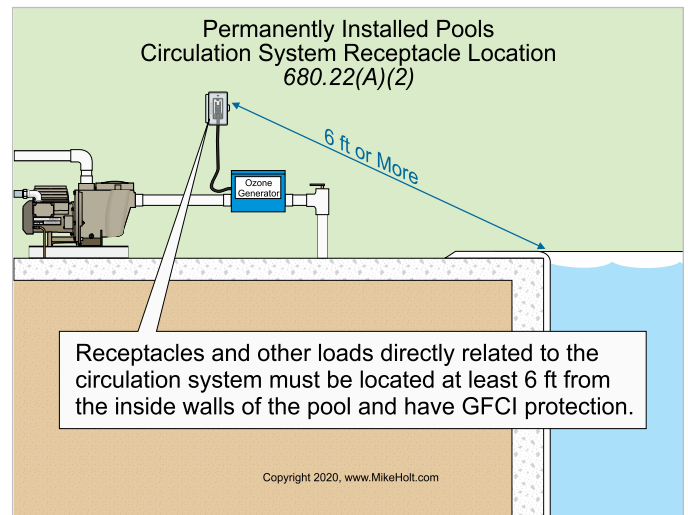
► Figure 680-25



► Figure 680-27



► Figure 680-26



► Figure 680-28

680.22 Receptacles, Luminaires, and Switches

(A) Receptacles.

(1) Required Receptacle, Location. At least one 15A or 20A, 125V receptacle installed on a general-purpose branch circuit must be located not less than 6 ft and not more than 20 ft from the inside wall of a permanently installed pool. This receptacle must be located not more than 6 1/2 ft above the floor, platform, or grade level serving the pool. ►Figure 680-27

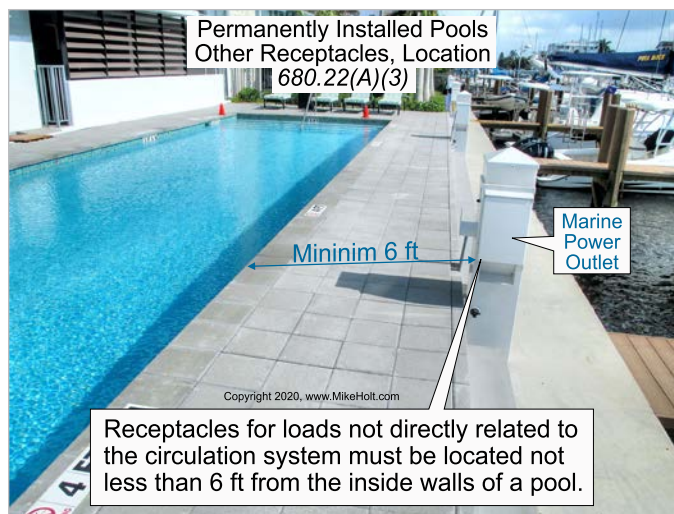
(2) Circulation System. Receptacles for permanently installed pool motors, or other loads directly related to the circulation system, must be located at least 6 ft from the inside walls of the pool and have GFCI protection. ►Figure 680-28

(3) Other Receptacles. Receptacles for loads not directly related to the circulation system must be located not less than 6 ft from the inside walls of a permanently installed pool. ►Figure 680-29

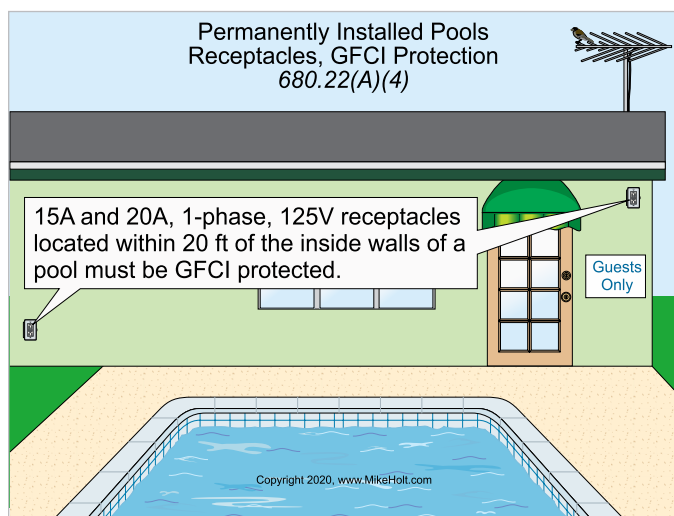
(4) GFCI Protection. 15A and 20A, single-phase, 125V receptacles located within 20 ft of the inside walls of a pool must be GFCI protected. ►Figure 680-30

(5) Pool Equipment Room. At least one GFCI-protected 15A or 20A, 125V receptacle must be located within a pool equipment room. Receptacles rated 150V or less to ground within the pool equipment room must be GFCI protected. ►Figure 680-31

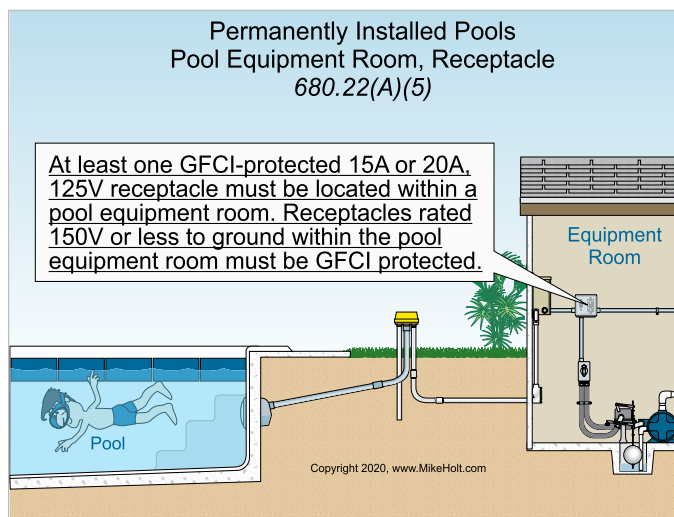
(6) Measurements. The receptacle distance is measured as the shortest path an appliance cord will follow without passing through a wall, doorway, or window.



▶ Figure 680-29



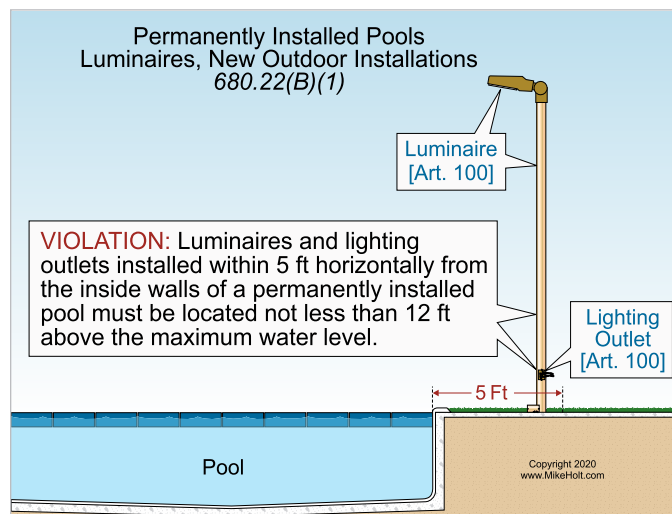
▶ Figure 680-30



▶ Figure 680-31

(B) Luminaires and Ceiling Fans.

(1) New Outdoor Installations. Luminaires and lighting outlets installed not less than 5 ft horizontally from the inside walls of a permanently installed pool must be located not less than 12 ft above the maximum water level. ▶ **Figure 680-32**



▶ Figure 680-32

Author's Comment:

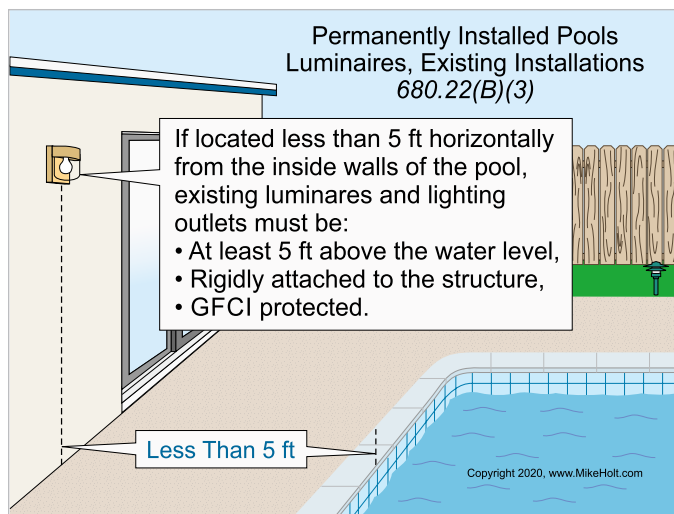
- ▶ According to 680.2, the "Maximum Water Level" is the highest level water reaches before it spills out.

(3) Existing Installations. Existing lighting outlets within 5 ft horizontally from the inside walls of a permanently installed pool must not be less than 5 ft above the surface of the maximum water level, be rigidly attached to the existing structure, and be GFCI protected. ▶ **Figure 680-33**

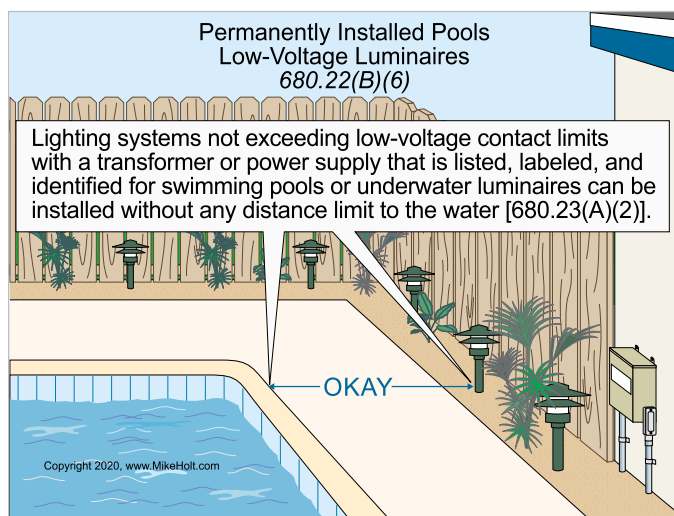
(4) GFCI Protection in Adjacent Areas. GFCI protection is required for lighting outlets located between 5 ft and 10 ft horizontally from the inside walls of a permanently installed pool and not less than 5 ft above the maximum water level.

(6) Low-Voltage Luminaires. Low-voltage lighting systems not exceeding low-voltage contact limits with a transformer or power supply that is listed, labeled, and identified for swimming pools or underwater luminaires can be installed without any distance limit to the water [680.23(A)(2)]. ▶ **Figure 680-34**

All other low-voltage lighting must not be installed within 10 ft from the edge of the water in accordance with 411.5(B).



▶ Figure 680-33

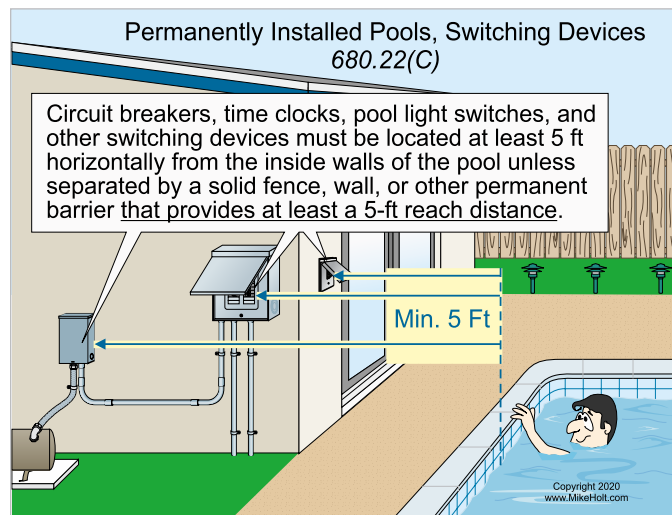


▶ Figure 680-34

(7) Low-Voltage Gas-Fired Luminares, Fireplaces, Fire Pits, and Similar Equipment. Listed gas-fired luminaires, fireplaces, fire pits, and similar equipment using low-voltage ignitors supplied by listed transformers or power supplies that comply with 680.23(A)(2) and do not exceed the low-voltage contact limit can be located less than 5 ft from the inside walls of the pool.

(8) Measurements. In determining the dimensions in this section addressing luminaires, the distance to be measured must be the shortest path an imaginary cord connected to the luminaire will follow without piercing a floor, wall, ceiling, doorway with a hinged or sliding door, window opening, or other effective permanent barrier.

(C) Switching Devices. Circuit breakers, time clocks, pool light switches, and other switching devices must be located not less than 5 ft horizontally from the inside walls of a permanently installed pool unless separated by a solid fence, wall, or other permanent barrier that provides at least a 5-foot reach distance. ▶ Figure 680-35



▶ Figure 680-35

(D) Other Outlets. Other outlets must be not less than 10 ft from the inside walls of the pool.

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

(E) Other Equipment. Other equipment with ratings exceeding the low-voltage contact limit must be located at least 5 ft horizontally from the inside walls of a pool unless separated from the pool by a solid fence, wall, or other permanent barrier. ▶ Figure 680-36

680.23 Underwater Pool Luminares

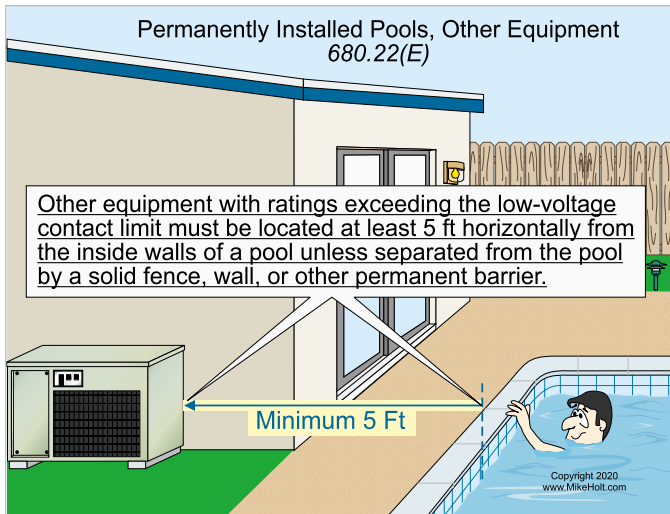
(A) General.

(2) Transformers and Power Supplies for Underwater Pool Luminares. Transformers and power supplies for underwater pool luminaires must be listed, labeled, and identified for swimming pool use.

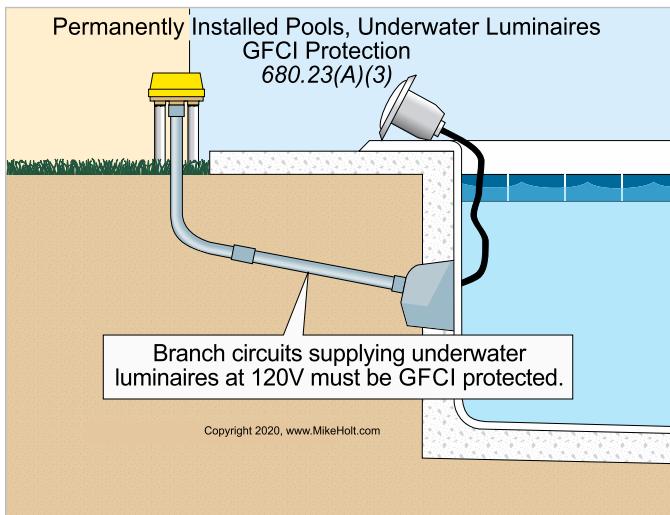
(3) GFCI Protection. Branch circuits supplying underwater pool luminaires at 120V must be GFCI protected. ▶ Figure 680-37

(5) Wall-Mounted Luminares. Underwater wall-mounted luminaires must be installed so the top of the luminaire lens is not less than 18 in. below the normal water level. ▶ Figure 680-38

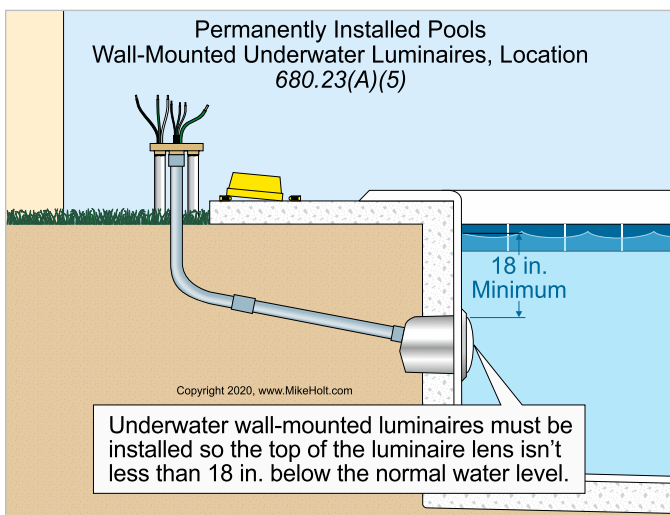
(B) Wet-Niche Luminares.



► Figure 680-36



► Figure 680-37

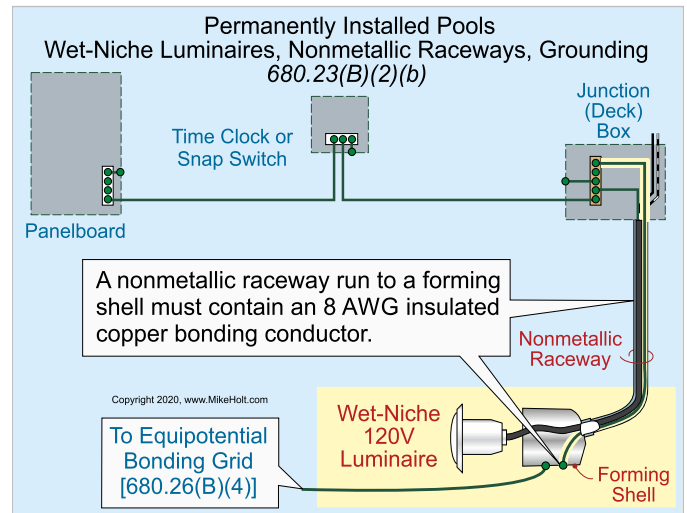


► Figure 680-38

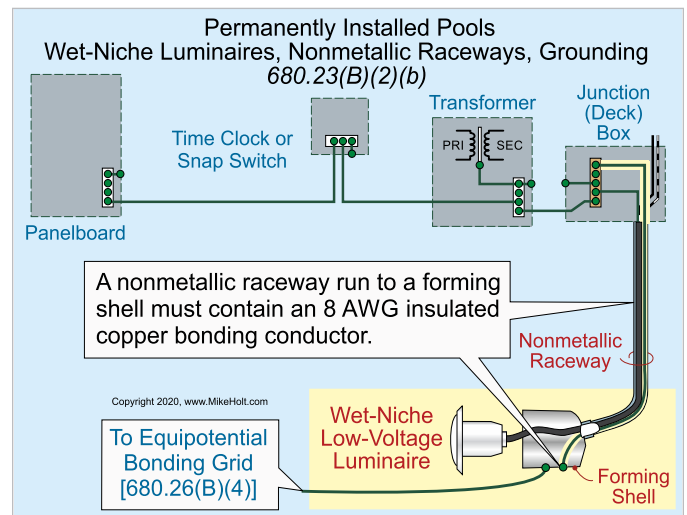
(2) Wiring to the Forming Shell.

(a) **Metal Conduit.** Metal conduit must be listed and identified as red brass or stainless steel.

(b) **Nonmetallic Raceway.** A nonmetallic raceway run to the forming shell of a wet-niche luminaire must contain an 8 AWG insulated (solid or stranded) copper conductor that terminates to the forming shell. ►Figure 680-39 and ►Figure 680-40



► Figure 680-39



► Figure 680-40

The termination of the 8 AWG bonding jumper in the forming shell must be covered with a listed potting compound to protect the connection from the possible deteriorating effects of pool water.

Author's Comment:

- ▶ According to 680.2, a “Wet-Niche Luminaire” is a luminaire intended to be installed in a forming shell where it will be completely surrounded by water. ▶ **Figure 680-41**



► **Figure 680-41**

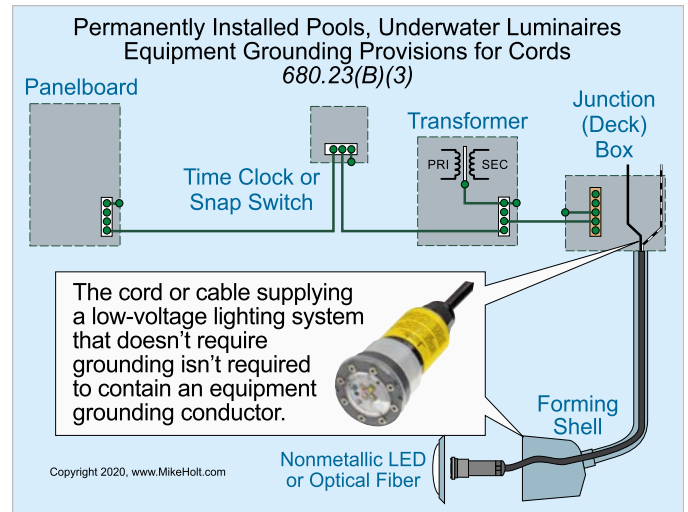
Author's Comment:

- ▶ According to Article 680.2, a “Forming Shell” is a structure mounted in a pool or fountain to support a wet-niche luminaire. ▶Figure 680-42



► **Figure 680-42**

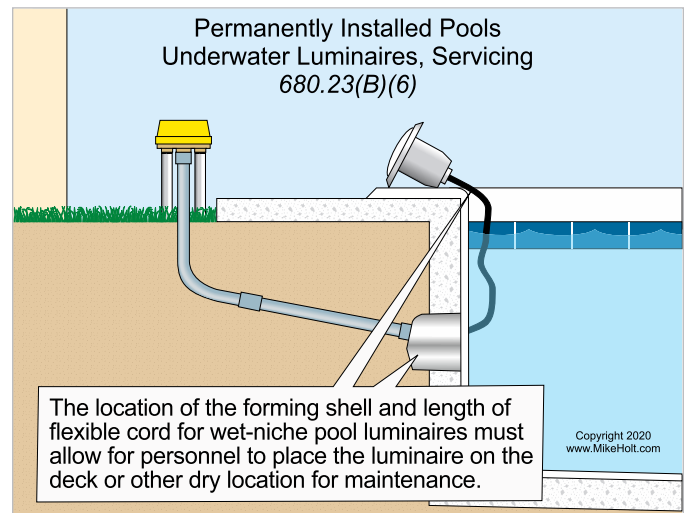
(3) Equipment Grounding Provisions for Cords. The cord or cable supplying a low-voltage underwater luminaire that does not require grounding does not require an equipment grounding conductor. **▶Figure 680-43**



► **Figure 680-43**

(6) Luminaire Servicing.

Pool. The location of the forming shell and length of flexible cord for wet-niche pool luminaires must allow for personnel to place the luminaire on the deck or other dry location for maintenance. ▶**Figure 680–44**



► **Figure 680-44**

The luminaire maintenance location must be accessible without entering or going into the pool water.

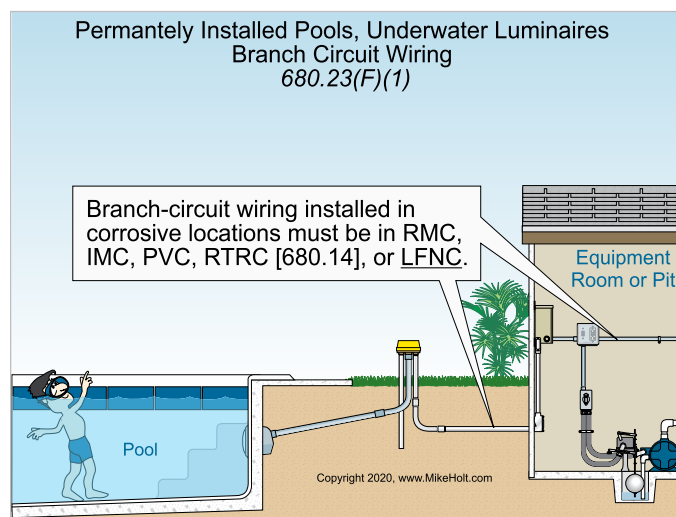
Spa. In spa locations where wet-niche luminaires are installed in the foot well of the spa, the location of the forming shell and length of flexible cord for the underwater spa luminaire must allow for personnel to place the luminaire on the bench where the spa can be drained to make the bench location dry. ▶Figure 680-45



▶ Figure 680-45

(F) Branch-Circuit Wiring.

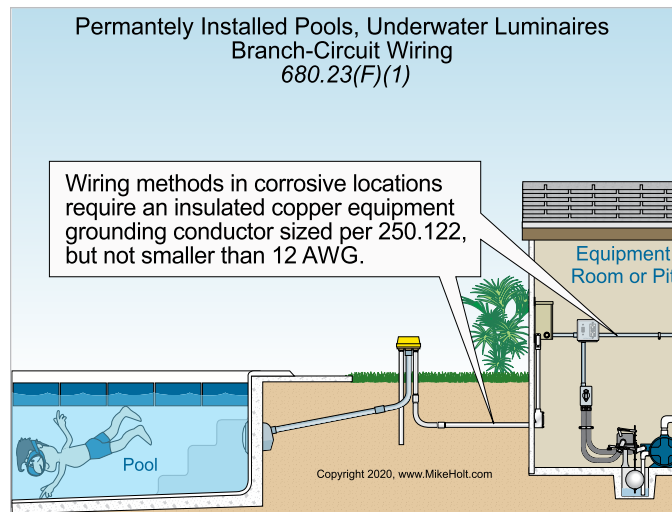
(1) General. Branch-circuit wiring installed in corrosive locations must be in rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit, reinforced thermosetting resin conduit [680.14], or liquidtight flexible nonmetallic conduit. ▶ Figure 680-46



▶ Figure 680-46

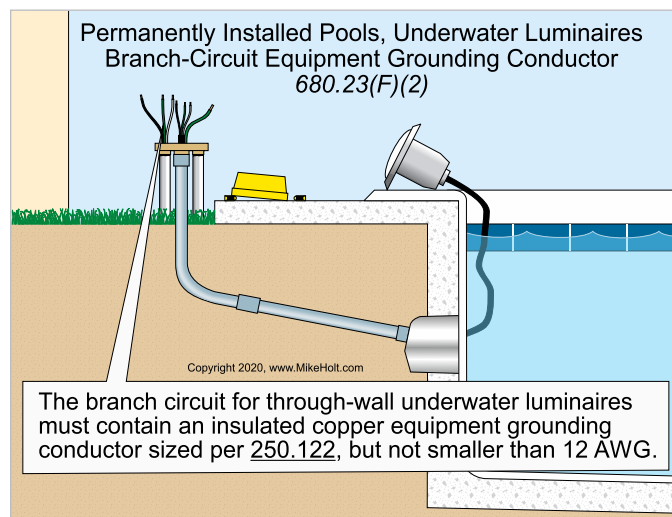
Wiring methods in corrosive environments must contain an insulated copper equipment grounding conductor sized in accordance with 250.122 but not smaller than 12 AWG. ▶ Figure 680-47

Where installed in noncorrosive environments, any Chapter 3 wiring method is permitted.



▶ Figure 680-47

(2) Branch-Circuit Equipment Grounding Conductor. Branch-circuit conductors for all through-wall underwater pool luminaires must have insulated copper equipment grounding conductors without joint or splice except as permitted in 680.23(F)(2)(a) and (b), sized in accordance with 250.122, and not smaller than 12 AWG. ▶ Figure 680-48

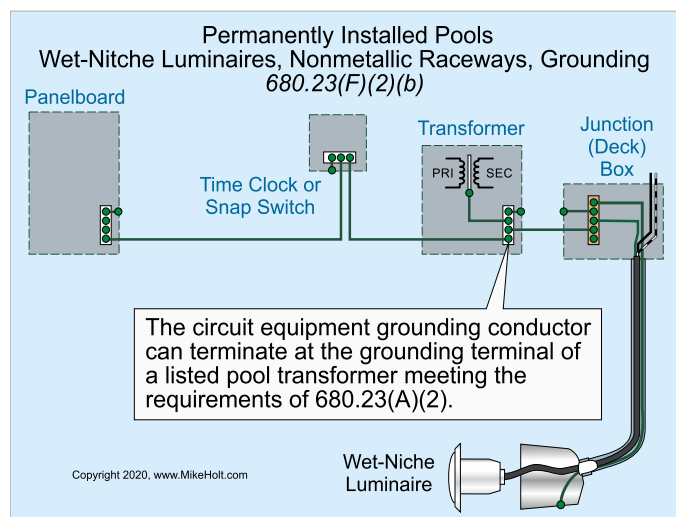


▶ Figure 680-48

The circuit equipment grounding conductor for the underwater pool luminaire is not permitted to be spliced, except for the following applications:

- (a) If more than one underwater pool luminaire is supplied by the same branch circuit, the circuit equipment grounding conductor can terminate at a listed pool junction box meeting the requirements of 680.24(A).

- (b) The circuit equipment grounding conductor can terminate at the grounding terminal of a listed pool transformer meeting the requirements of 680.23(A)(2). ▶ **Figure 680-49**



▶ **Figure 680-49**

(3) Conductors. The branch-circuit conductors for the underwater pool luminaire on the load side of a GFCI or transformer used to comply with 680.23(A)(8) are not permitted to occupy raceways or enclosures with other conductors unless the other conductors are:

- (1) GFCI protected or,
- (2) Equipment grounding conductors and bonding jumpers as required by 680.23(B)(2)(b) or,
- (3) Supply conductors to a feed-through-type GFCI.

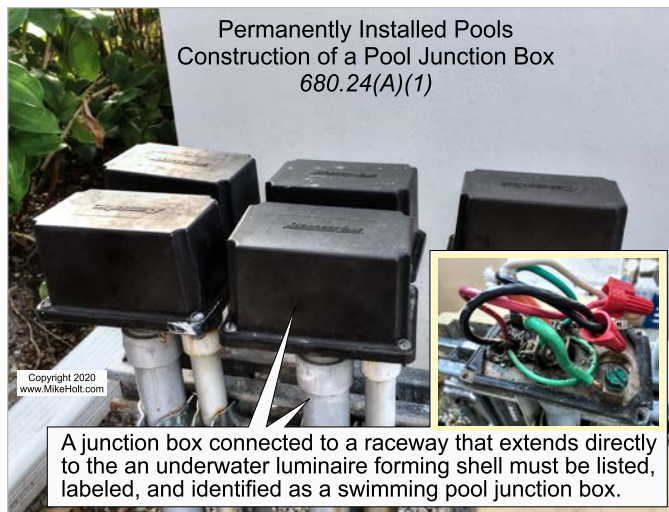
680.24 Junction Box, Transformer, or GFCI Enclosure

(A) Junction Box. If a junction box is connected to a raceway that extends directly to an underwater pool luminaire forming shell, the junction box must comply with the following:

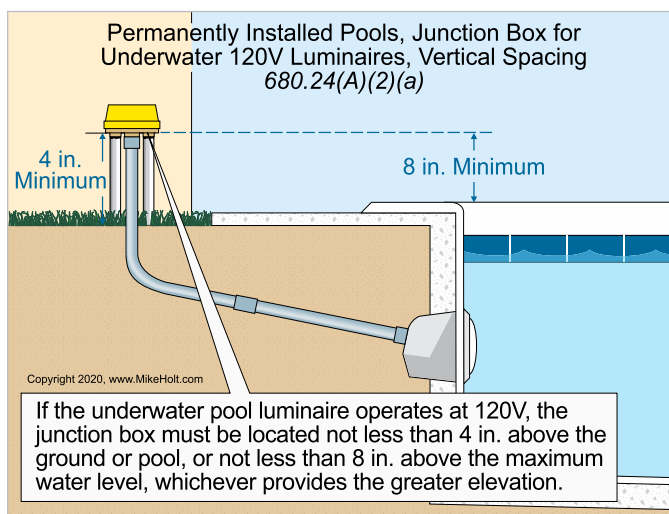
(1) Construction. The junction box must be listed, labeled, and identified as a swimming pool junction box. ▶ **Figure 680-50**

(2) Installation.

(a) Vertical Spacing. If the underwater pool luminaire operates at 120V, the junction box must be located not less than 4 in. above the ground or pool, or not less than 8 in. above the maximum water level, whichever provides the greater elevation. ▶ **Figure 680-51**



▶ **Figure 680-50**



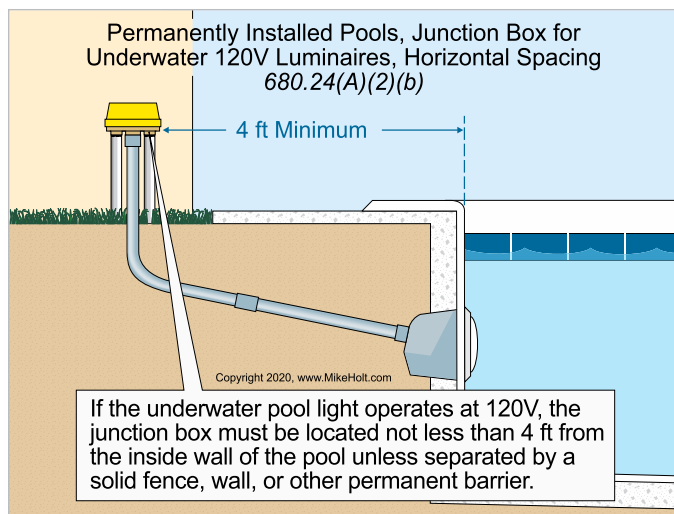
▶ **Figure 680-51**

(b) Horizontal Spacing. If the underwater pool luminaire operates at 120V, the junction box must be located not less than 4 ft from the inside wall of the pool unless separated by a solid fence, wall, or other permanent barrier. ▶ **Figure 680-52**

Author's Comment:

- ▶ The junction box must be supported by two metal conduits threaded wrenchtight into the enclosure according to 314.23(E).

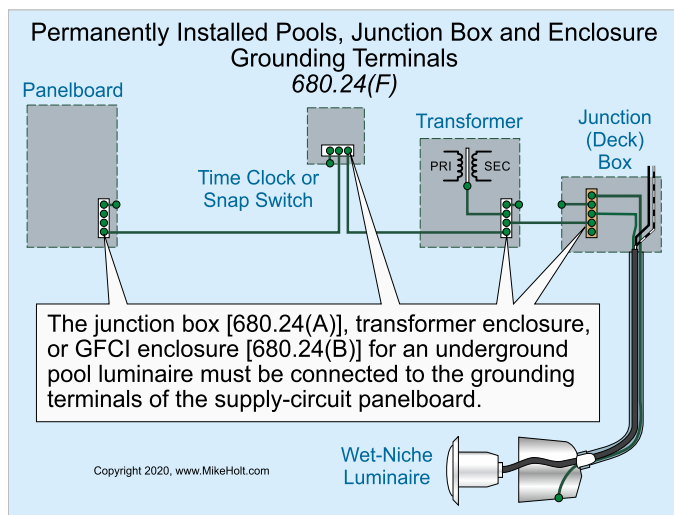
(B) Transformer or GFCI Enclosure. If the enclosure for a transformer or GFCI is connected to a raceway that extends directly to an underwater luminaire forming shell, the enclosure must be listed for this purpose.



► Figure 680-52

(C) Physical Protection. Junction boxes for underwater luminaires are not permitted to be located in a walkway unless afforded protection by being located under diving boards or adjacent to fixed structures.

(F) Grounding. The junction box [680.24(A)], transformer enclosure, or GFCI enclosure [680.24(B)] for an underground pool luminaire must be connected to the grounding terminals of the supply-circuit panelboard. ►Figure 680-53

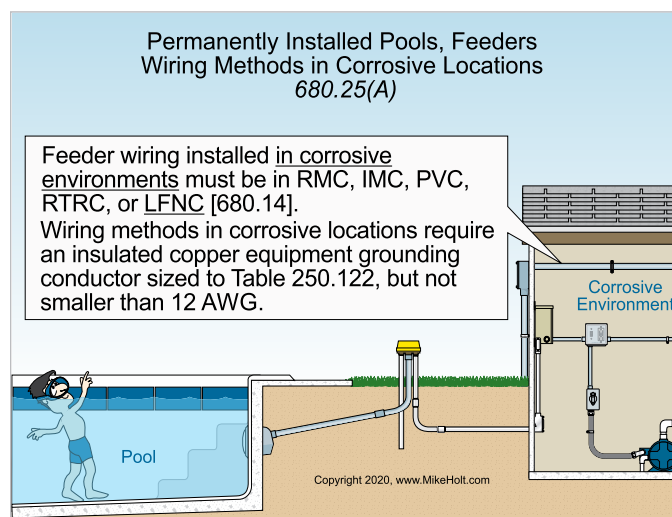


► Figure 680-53

680.25 Feeders

(A) Wiring Methods. Where feeder wiring is installed in corrosive environments, the wiring methods must be rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit, reinforced thermosetting resin conduit, or liquidtight flexible nonmetallic conduit [680.14].

The wiring methods in corrosive environments must have insulated copper equipment grounding conductors sized in accordance with Table 250.122, but not smaller than 12 AWG. ►Figure 680-54



► Figure 680-54

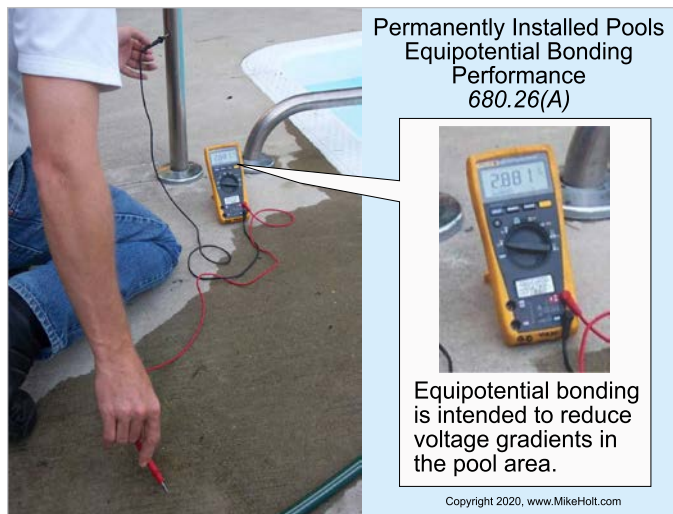
Where installed in noncorrosive environments, any Chapter 3 wiring method is permitted.

680.26 Equipotential Bonding

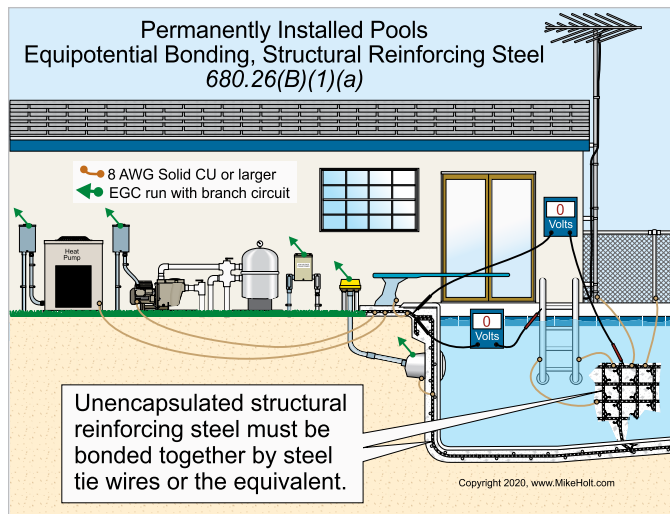
(A) Performance. Equipotential bonding is intended to reduce voltage gradients in the area around a permanently installed pool. ►Figure 680-55

(B) Bonded Parts. The parts of a permanently installed pool listed in (B)(1) through (B)(7) must be bonded together with a solid insulated or bare copper conductor not smaller than 8 AWG using a listed pressure connector, terminal bar, or other listed means in accordance with 250.8(A). ►Figure 680-56

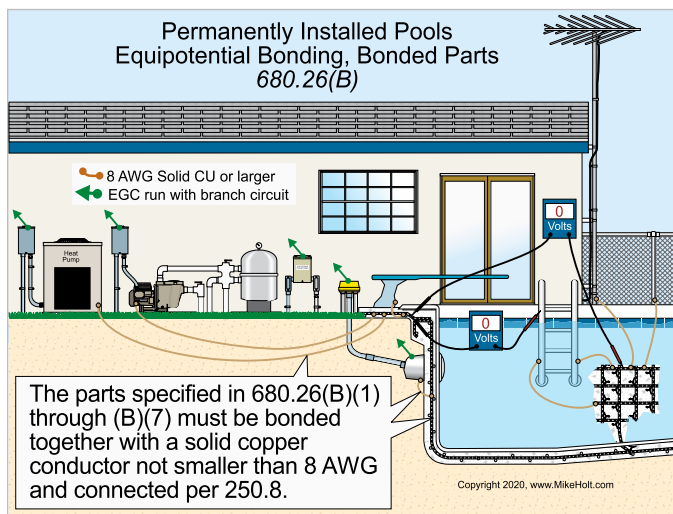
Equipotential bonding is not required to extend (or be attached) to any panelboard, service disconnect, or grounding electrode.



► Figure 680-55



► Figure 680-57



► Figure 680-56

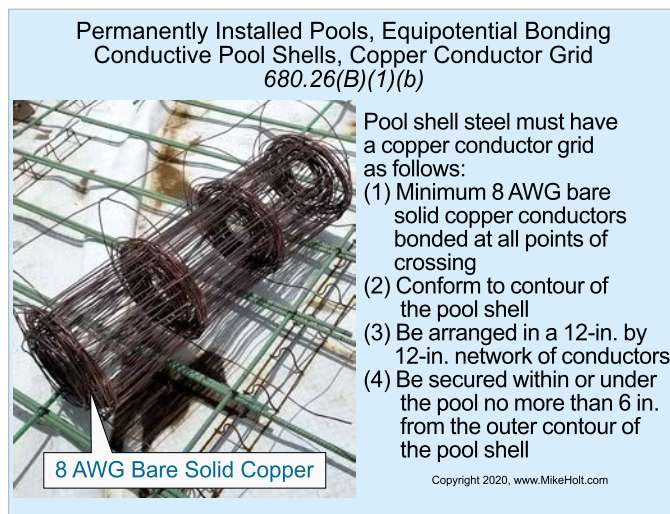
(1) Conductive Pool Shells. Cast-in-place concrete, pneumatically applied or sprayed concrete, and concrete block with painted or plastered coatings are considered conductive materials due to water permeability and porosity. Vinyl liners and fiberglass composite shells are considered nonconductive materials.

Reconstructed pool shells must also comply with this section.

(a) Structural Reinforcing Steel. Unencapsulated structural reinforcing steel must be bonded together by steel tie wires or the equivalent. ► Figure 680-57

Where structural reinforcing steel is encapsulated in a nonconductive compound, a copper conductor grid must be installed in accordance with 680.26(B)(1)(b).

(b) Copper Conductor Grid. A copper conductor grid must comply with all of the following: ► Figure 680-58



► Figure 680-58

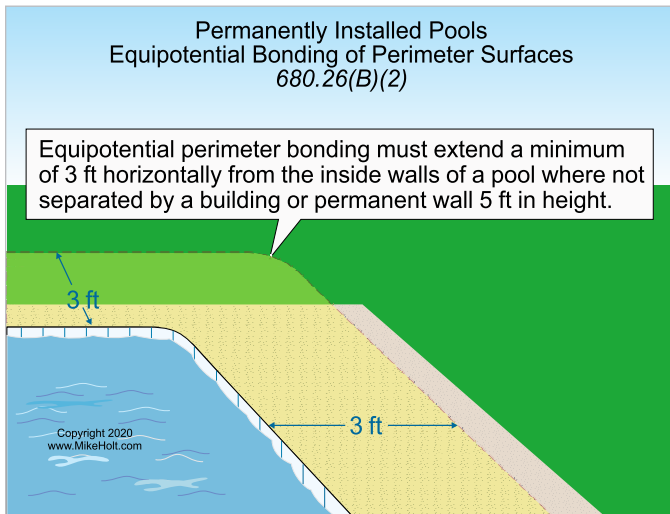
Author's Comment:

- Encapsulated structural reinforcing steel is used to prevent rebar corrosion and (if used) will make the pool shell insulated; therefore, a conductive copper grid is required in order to bond the pool shell.

- (1) Be constructed of a minimum of 8 AWG bare solid copper conductors bonded to each other at all points of crossing in accordance with 250.8, or other approved means.
- (2) Conform to the contour of the pool.

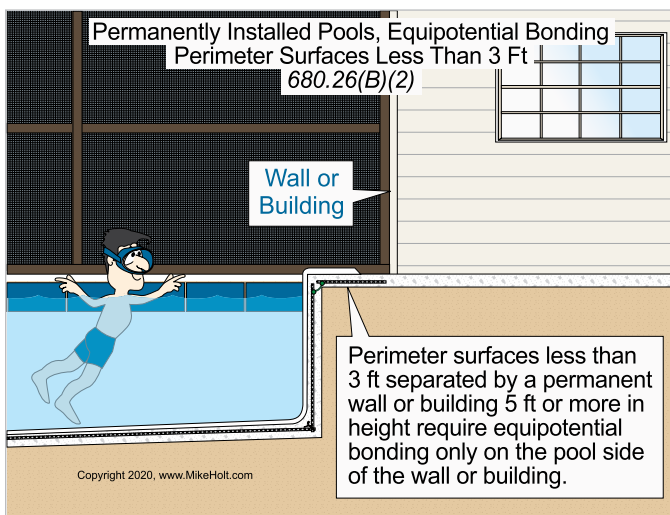
- (3) Be arranged in a 12-in. by 12-in. network of conductors in a uniformly spaced perpendicular grid pattern with a tolerance of 4 in.
- (4) Be secured within or under the pool no more than 6 in. from the outer contour of the pool shell.

(2) Perimeter Surfaces. Equipotential perimeter bonding must extend a minimum of 3 ft horizontally from the inside walls of a pool where not separated by a building or permanent wall 5 ft in height. ▶Figure 680-59



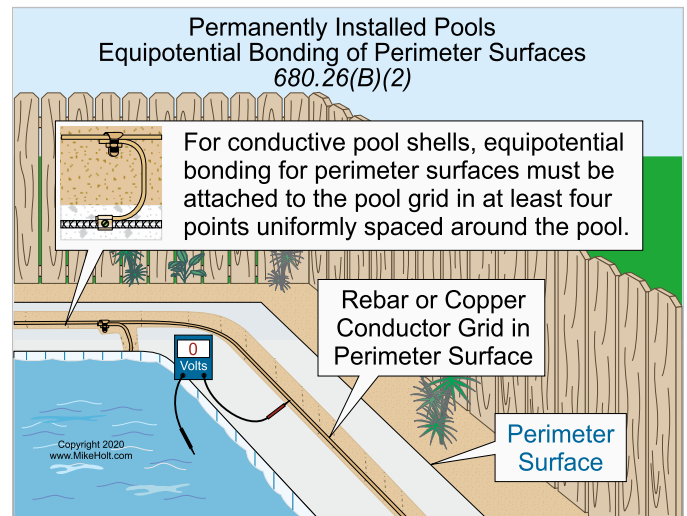
▶Figure 680-59

Perimeter surfaces less than 3 ft separated by a permanent wall or building 5 ft or more in height require equipotential bonding only on the pool side of the wall or building ▶Figure 680-60



▶Figure 680-60

For conductive pool shells, equipotential bonding for perimeter surfaces must be attached to the concrete pool reinforcing steel or copper conductor grid at a minimum of four points uniformly spaced around the perimeter of the pool and be one of the following: ▶Figure 680-61



▶Figure 680-61

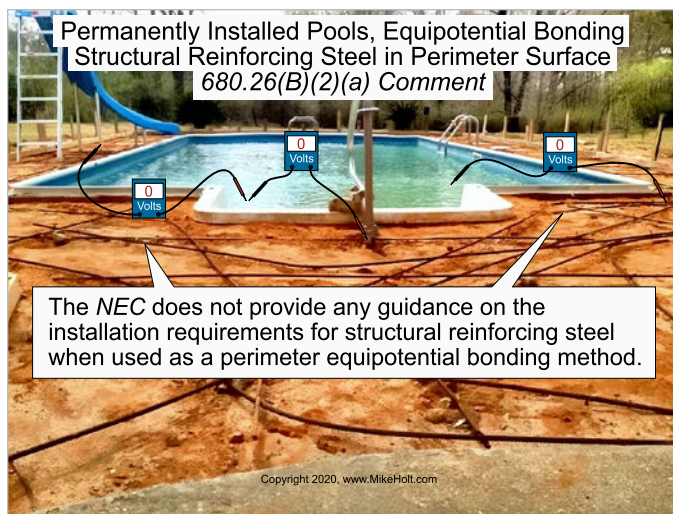
(a) Structural Reinforcing Steel. Unencapsulated structural reinforcing steel bonded together by steel tie wires or the equivalent in accordance with 680.26(B)(1)(a). ▶Figure 680-62



▶Figure 680-62

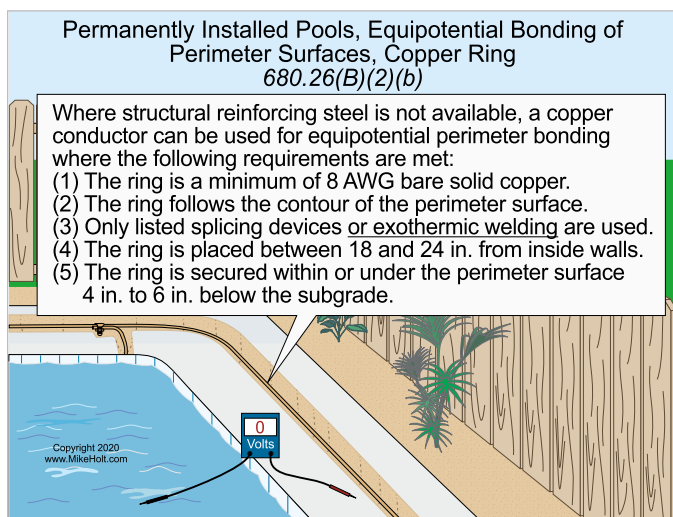
Author's Comment:

- ▶ The *NEC* does not provide any guidance on the installation requirements for structural reinforcing steel when used as a perimeter surface equipotential bonding method. ▶Figure 680-63



▶ Figure 680-63

(b) Copper Ring. Where structural reinforcing steel is not available or is encapsulated in a nonconductive compound, a copper conductor can be used for equipotential perimeter bonding where the following requirements are met: ▶ Figure 680-64



▶ Figure 680-64

- (1) The copper ring is constructed of 8 AWG bare solid copper or larger.
- (2) The copper ring conductor follows the contour of the perimeter surface.
- (3) Only listed splicing devices or exothermic welding are used.
- (4) The copper ring conductor is placed between 18 in. and 24 in. from the inside walls of the pool.
- (5) The copper ring conductor is secured within or under the perimeter surface 4 in. to 6 in. below the subgrade.

(c) Copper Grid. Where structural reinforcing steel is not available or is encapsulated in a nonconductive compound as an alternate method to a copper ring, a copper grid can be used for perimeter bonding where all the following requirements are met:

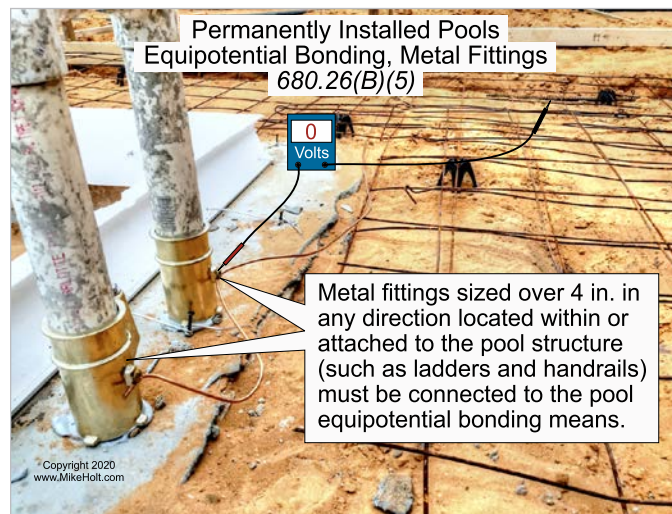
- (1) The copper grid is constructed of 8 AWG solid bare copper and arranged in a 12-in. by 12-in. network of conductors in a uniformly spaced perpendicular grid pattern with a tolerance of 4 in. in accordance with 680.26(B)(1)(b)(3).
- (2) The copper grid follows the contour of the perimeter surface extending 3 ft horizontally beyond the inside walls of the pool.
- (3) Only listed splicing devices or exothermic welding are used.
- (4) The copper grid is secured within or under the deck or unpaved surfaces between 4 in. and 6 in. below the subgrade.

(3) Metallic Components. Metallic parts of the pool structure must be bonded together.

(4) Underwater Lighting. All metal forming shells must be bonded.

Ex: Listed low-voltage lighting with nonmetallic forming shells are not required to be bonded.

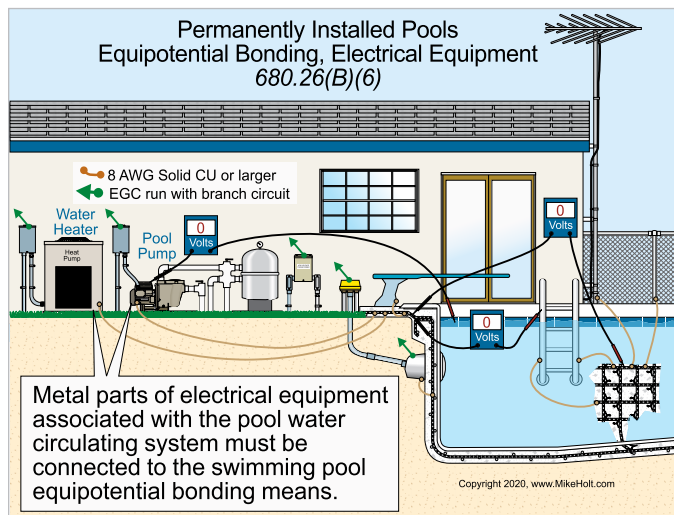
(5) Metal Fittings. Metal fittings sized over 4 in. in any direction and located within or attached to the pool structure (such as ladders and handrails) must be connected to the swimming pool equipotential bonding means. ▶ Figure 680-65



▶ Figure 680-65

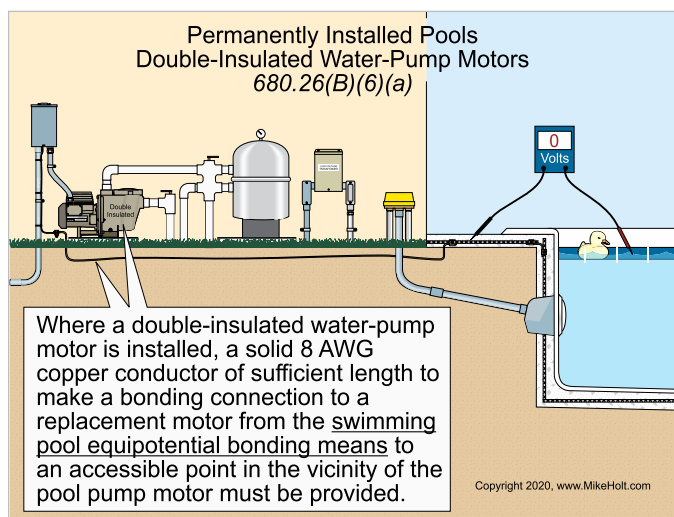
Metallic pool cover anchors 1 in. or less in any dimension and 2 in. or less in length are not required to be bonded to the equipotential bonding means.

(6) Electrical Equipment. Metal parts of electrical equipment associated with the pool water circulating system such as pool heaters, pump motors, and metal parts of pool covers must be connected to the swimming pool equipotential bonding means. ▶Figure 680-66



▶Figure 680-66

(a) Double-Insulated Water-Pump Motors. Where a double-insulated water-pump motor is installed, a solid 8 AWG copper conductor of sufficient length to make a bonding connection to a replacement motor from the swimming pool equipotential bonding means to an accessible point in the vicinity of the pool pump motor must be provided. ▶Figure 680-67



▶Figure 680-67

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

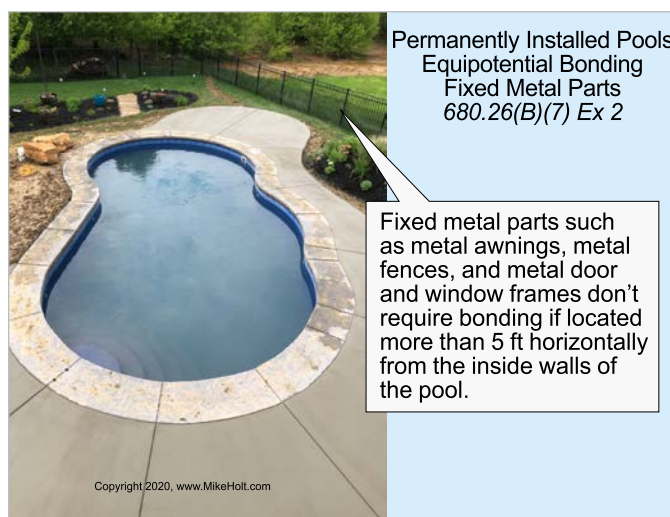
(7) Fixed Metal Parts. Fixed metal parts such as metal-sheathed cables and raceways, metal piping, metal awnings, metal fences, and metal door and window frames located within 5 ft horizontally [680.26(B)(7) Ex 2] and 12 ft vertically [680.26(B)(7) Ex 3] from the inside wall of the pool, must be connected to the swimming pool equipotential bonding means. ▶Figure 680-68



▶Figure 680-68

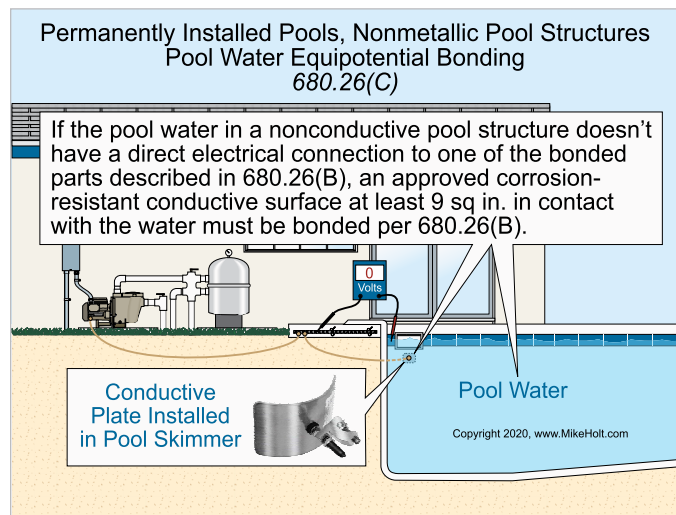
Ex 1: Those separated from the pool by a permanent barrier that prevents contact by a person are not required to be bonded.

Ex 2: Those separated by a distance greater than 5 ft horizontally from the inside walls of the pool are not be required to be bonded. ▶Figure 680-69



▶Figure 680-69

(C) Pool Water. If the pool water in a nonconductive pool structure (vinyl or fiberglass) does not have a direct electrical connection to one of the bonded parts described in 680.26(B), an approved corrosion-resistant conductive surface that is at least 9 sq in. in contact with the water must be bonded in accordance with 680.26(B). ▶Figure 680-70



▶Figure 680-70

680.27 Specialized Equipment

(B) Electrically Operated Covers.

(1) Motors and Controllers. The electric motors, controllers, and wiring for an electrically operated cover must be located not less than 5 ft from the inside wall of a permanently installed pool unless separated by a permanent barrier.

(2) GFCI Protection. The branch circuit serving the electric motor and controller circuit must be GFCI protected.

680.28 Gas-Fired Water Heaters

Circuits serving gas-fired swimming pool water heaters operating at 120V must be GFCI protected.

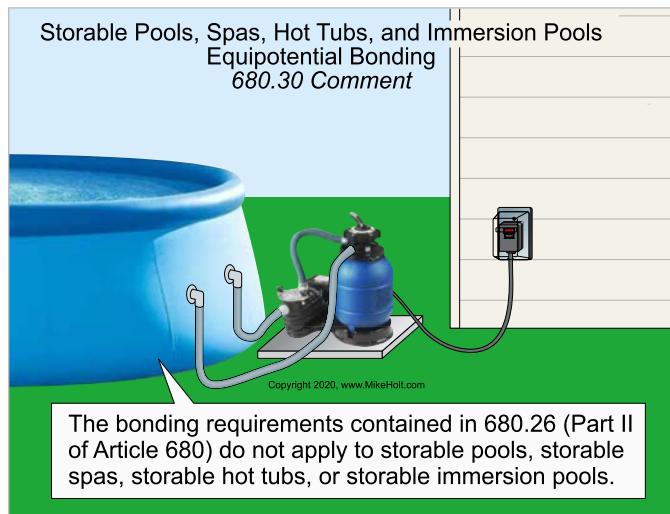
Part III. Storable Pools, Spas, Hot Tubs, and Immersion Pools

680.30 General

Electrical installations for storable pools, storable spas, storable hot tubs, or storable immersion pools must comply with Part I as well as Part III of Article 680.

Author's Comment:

- ▶ The requirements contained in Part I of Article 680 include definitions, cord-and-plug-connected equipment, overhead conductor clearances, and the locations of maintenance disconnects.
- ▶ The bonding requirements contained in 680.26 (Part II of Article 680) do not apply to storable pools, storable spas, storable hot tubs, or storable immersion pools. ▶Figure 680-71



▶Figure 680-71

680.31 Pumps

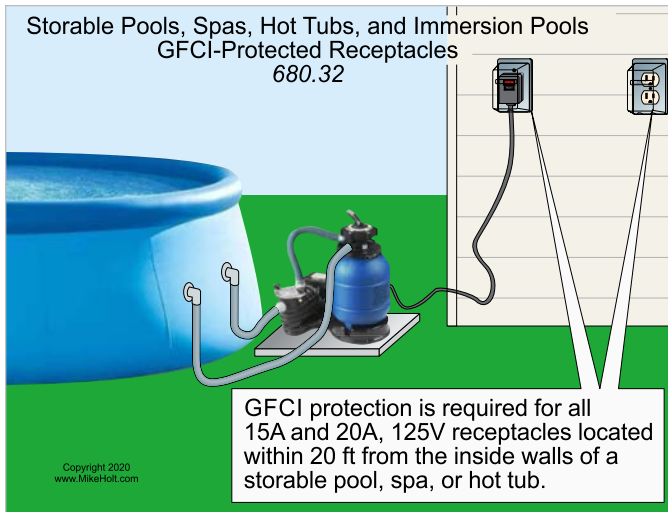
A cord-connected pool filter pump must incorporate an approved system of double insulation or its equivalent and be provided with means for the termination of an equipment grounding conductor for the noncurrent-carrying metal parts of the pump.

An equipment grounding conductor must be run with the power-supply conductors in the flexible cord.

Cord-connected pool filter pumps must be provided with GFCI protection that is an integral part of the attachment plug or located in the power-supply cord within 12 in. of the attachment plug.

680.32 GFCI Protection

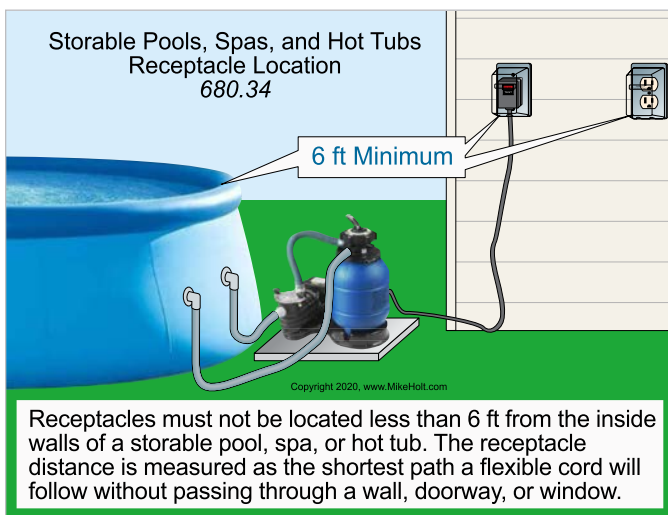
GFCI protection is required for electrical equipment associated with storable pools, and all 15A and 20A, 125V receptacles located within 20 ft from the inside walls of a storable pool, storable spa, or storable hot tub. ▶Figure 680-72



► Figure 680-72

680.34 Receptacle Locations

Receptacles must not be located less than 6 ft from the inside walls of a storable pool, storable spa, or storable hot tub. The receptacle distance is measured as the shortest path a flexible cord will follow without passing through a wall, doorway, or window. ►Figure 680-73



► Figure 680-73

680.35 Storable and Portable Immersion Pools

Storable and portable immersion pools must comply with the additional requirements specified in 680.35(A) through (G) of the *Code*.

(A) Cord-Connected Storable and Portable Immersion Pools. If storable and portable immersion pools are rated 20A, single-phase, 120V or less are permitted to be cord connected if they are GFCI protected.

(B) Pumps. A pump not built in the storable or portable immersion pool must be listed and labeled for swimming pool use.

(C) Heaters. If rated 20A and 30A, single-phase, 120V and 250V, the heater must be GFCI protected.

(E) Lighting Outlets. Unless within the low-voltage contact limit, lighting outlets must be located not less than 10 ft from the nearest point of an immersion pool.

(F) Switches. Switches, unless they are part of the unit, must be located not less than 5 feet from immersion pool.

(G) Receptacles. All 50A, 250V or less receptacles within 20 ft of the inside wall of an immersion pool must be GFCI protected.

Part IV. Spas and Hot Tubs, and Permanently Installed Immersion Pools

680.40 General

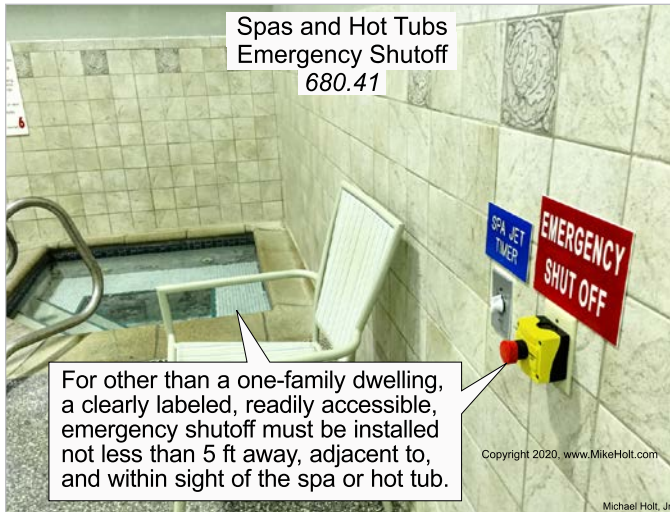
Electrical installations for spas and hot tubs must comply with Part I as well as Part IV of Article 680.

680.41 Emergency Switch for Spas and Hot Tubs

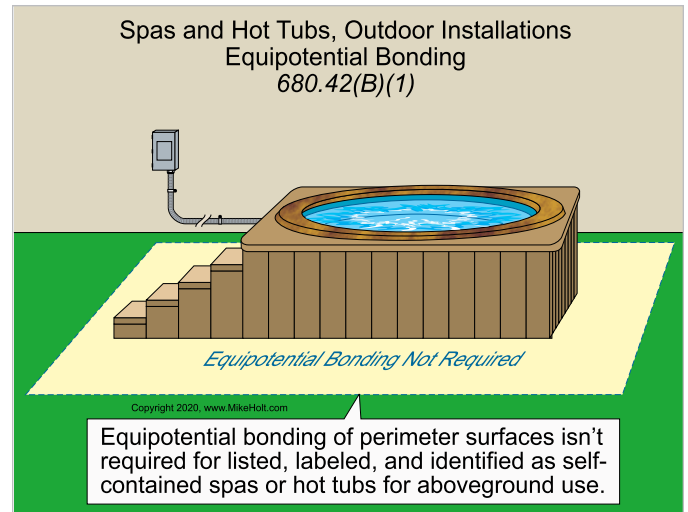
In other than a one-family dwelling, a clearly labeled emergency spa or hot tub water recirculation and jet system shutoff is required. The emergency shutoff must be readily accessible to the users and located not less than 5 ft away, adjacent to, and within sight of the spa or hot tub. ►Figure 680-74

Author's Comment:

- Either the maintenance disconnect [680.13] or a push-button that controls a relay located in accordance with this section can be used to meet the emergency shutoff requirement. ►Figure 680-75
- The purpose of the emergency shutoff is to protect users. Deaths and injuries have occurred in less than 3 ft of water because individuals became stuck to the water intake opening. This requirement applies to spas and hot tubs installed indoors as well as outdoors.



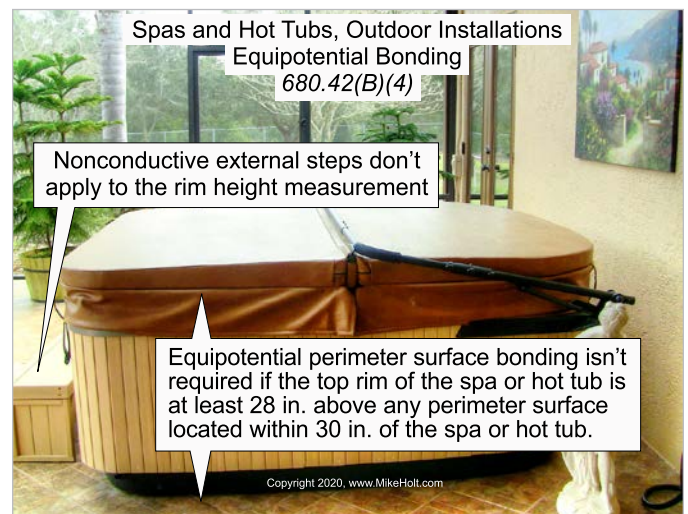
► Figure 680-74



► Figure 680-76



► Figure 680-75



► Figure 680-77

680.42 Outdoor Installations

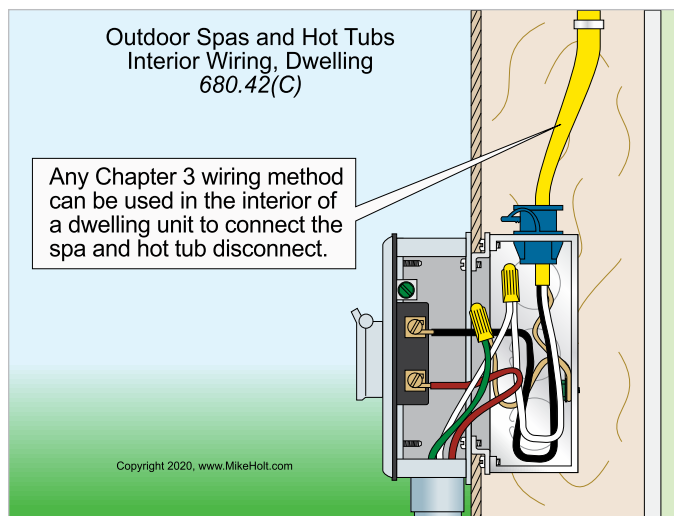
(B) Equipotential Bonding. Equipotential bonding of perimeter surfaces for spas and hot tubs is not required if all the following conditions apply:

- (1) The spa or hot tub is listed, labeled, and identified as a self-contained spa or hot tub for aboveground use. ► Figure 680-76
- (2) The spa or hot tub is not identified as suitable only for indoor use.
- (3) The spa or hot tub is located on or above grade.
- (4) The top rim of the spa or hot tub is at least 28 in. above any perimeter surface located within 30 in. of the spa or hot tub. Nonconductive external steps do not apply to the rim height measurement. ► Figure 680-77

(C) Wiring. Any Chapter 3 wiring method is permitted in the interior of a dwelling unit for the connection to a spa and hot tub disconnect. ► Figure 680-78

680.43 Indoor Installations

Electrical installations for an indoor spa or hot tub must comply with Parts I and II of Article 680 except as modified by this section.

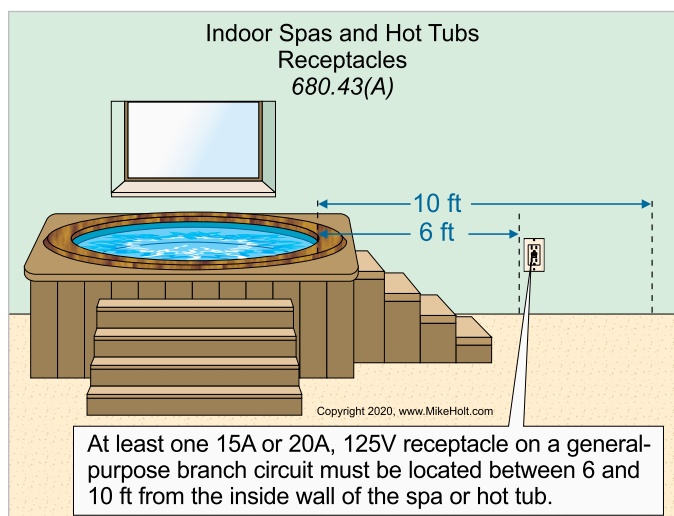


► Figure 680-78

Indoor installations of spas or hot tubs can be connected by any of the wiring methods contained in Chapter 3.

Ex 2: The equipotential bonding requirements for perimeter surfaces contained in 680.26(B)(2) do not apply to a listed self-contained spa or hot tub installed above an indoor finished floor.

(A) Receptacles. At least one 15A or 20A, 125V receptacle on a general-purpose branch circuit must be located not less than 6 ft and not more than 10 ft from the inside wall of a spa or hot tub. ►Figure 680-79



► Figure 680-79

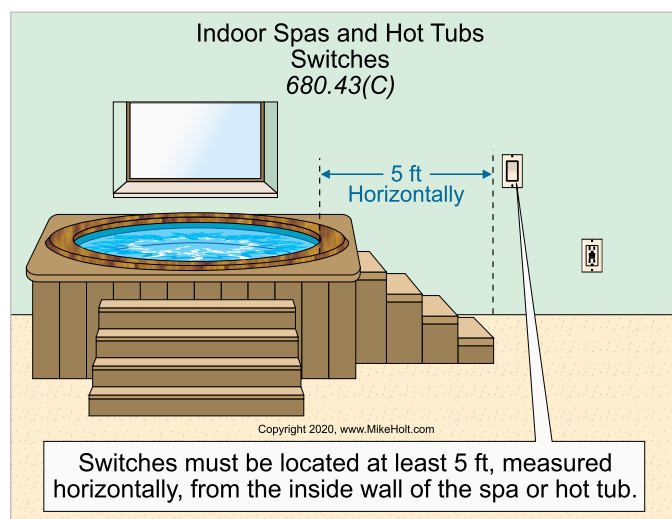
(1) Location. Receptacles must be located not less than 6 ft measured horizontally from the inside walls of the spa or hot tub.

(2) Protection, General. Receptacles rated 30A, 125V or less and located within 10 ft of the inside walls of a spa or hot tub must be GFCI protected.

(3) Protection, Spa or Hot Tub Supply Receptacle. Receptacles that provide power for spa or hot tub equipment must be GFCI protected.

(4) Measurements. In determining the dimensions in this section, the distance to be measured is the shortest path a cord of an appliance connected to the receptacle will follow without piercing a floor, wall, ceiling, doorway with a hinged or sliding door, window opening, or other type of permanent barrier.

(C) Switches. Switches must be located at least 5 ft, measured horizontally, from the inside wall of the spa or hot tub. ►Figure 680-80

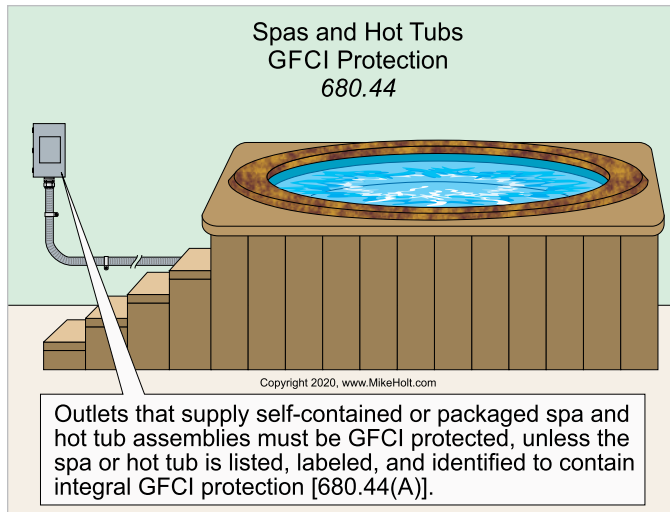


► Figure 680-80

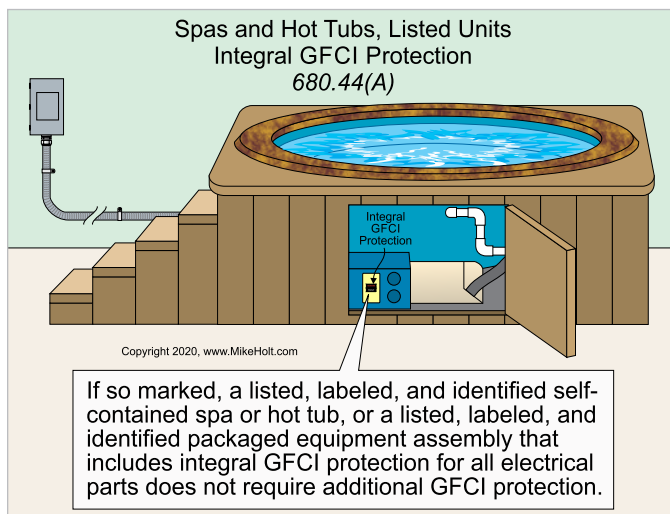
680.44 GFCI Protection

Outlets that supply self-contained or packaged spa and hot tub assemblies must be GFCI protected, unless the spa or hot tub is listed, labeled, and identified to contain integral GFCI protection [680.44(A)]. ►Figure 680-81

(A) Listed Units. If so marked, a listed, labeled, and identified self-contained spa or hot tub, or a listed, labeled, and identified packaged equipment assembly that includes integral GFCI protection for all electrical parts does not require additional GFCI protection. ►Figure 680-82



► Figure 680-81



► Figure 680-82

680.45 Permanently Installed Immersion Pools

Electrical installations at permanently installed immersion pools, whether installed indoors or outdoors, must comply with Parts I, II, and IV of this article except as modified by section 680.45 and must be connected by the wiring methods of Chapter 3 of the *Code*. With regard to the provisions in Part IV of this article, an immersion pool is considered to be a spa or hot tub.

Part V. Fountains

680.50 General

The general installation requirements contained in Part I apply to fountains (including splash pads) intended for recreational use by pedestrians, in addition to those requirements contained in Part V. Part II applies to fountains that have water common to pools.

Author's Comment:

- According to 680.2, a "Fountain" is defined as an ornamental structure or recreational water feature from which one or more jets or streams of water are discharged into the air. They include splash pads, ornamental pools, display pools, and reflection pools.

680.51 Luminaires and Submersible Equipment

(A) GFCI Protection. GFCI protection is required for luminaires, submersible pumps, and other submersible equipment unless listed and supplied by a transformer or power supply that complies with 680.23(A)(2). ►Figure 680-83



► Figure 680-83

(C) Luminaire Lenses. Luminaires must be installed so the top of the luminaire lens is below the normal water level unless listed for above-water use. ►Figure 680-84

(E) Cords. The maximum length of each exposed flexible cord in a fountain is 10 ft. Power-supply cords that extend beyond the fountain perimeter must be enclosed in a wiring enclosure approved by the authority having jurisdiction.



► Figure 680-84

(F) Servicing. Equipment must be capable of being removed from the water for relamping or for normal maintenance.

(G) Stability. Equipment must be inherently stable or be securely fastened in place.

680.54 Connection to an Equipment Grounding Conductor

(A) Connection to Equipment Grounding Conductor. The following equipment must be connected to the circuit equipment grounding conductor:

- (1) Other than listed low-voltage luminaires not requiring grounding, all electrical equipment located within the fountain or within 5 ft of the inside wall of the fountain.
- (2) All electrical equipment associated with the recirculating system of the fountain.
- (3) Panelboards that are not part of the service equipment and supply any electrical equipment associated with the fountain.

Note: See 250.122 for the sizing of these conductors.

(B) Bonding. The following parts must be bonded together and connected to an equipment grounding conductor on a branch circuit supplying the fountain:

- (1) All metal piping systems associated with the fountain
- (2) All metal fittings within or attached to the fountain
- (3) Metal parts of electrical equipment associated with the fountain water-circulating system including pump motors

- (4) Metal raceways within 5 ft of the inside wall or perimeter of the fountain and not separated from it by a permanent barrier
- (5) All metal surfaces within 5 ft of the inside wall or perimeter of the fountain and not separated from it by a permanent barrier
- (6) Electrical devices and controls not associated with the fountain and located less than 5 ft from its inside wall or perimeter

680.55 Methods of Equipment Grounding

(A) Additional Requirements. The grounding requirements of 680.21(A), 680.23(B)(3), 680.23(F)(1) and (2), 680.24(F), and 680.25 apply to fountains.

(B) Supplied by Flexible Cord. Fountain equipment supplied by a flexible cord must have all exposed metal parts connected to an insulated copper equipment grounding conductor that is an integral part of the cord. ► Figure 680-85



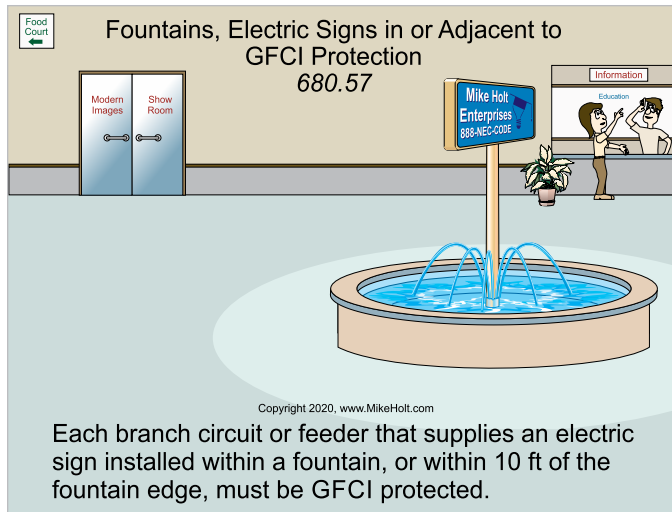
► Figure 680-85

680.56 Cord-and-Plug-Connected Equipment

(A) Ground-Fault Circuit Interrupter. All electrical equipment, including power-supply cords, must be GFCI protected.

680.57 Electric Signs in or Adjacent to Fountains

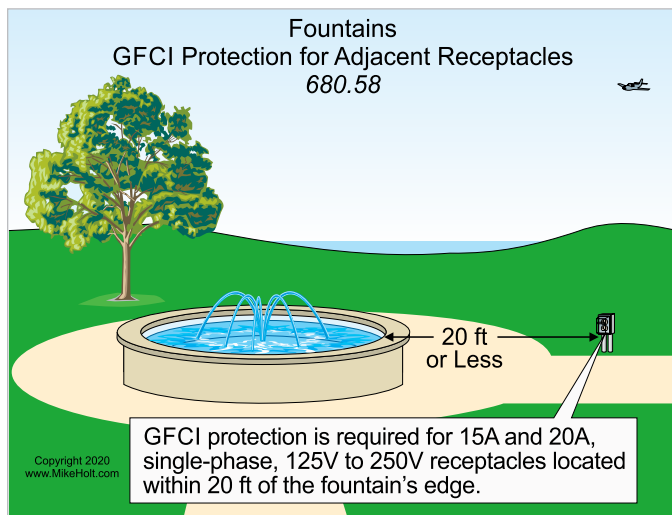
Each branch circuit or feeder that supplies an electric sign installed within a fountain, or within 10 ft of the fountain edge, must be GFCI protected. ► Figure 680-86



► Figure 680-86

680.58 GFCI Protection for Adjacent Receptacles

GFCI protection is required for 15A and 20A, single-phase, 125V through 250V receptacles located within 20 ft of the fountain's edge. ►Figure 680-87



► Figure 680-87

680.59 GFCI Protection for Permanently Installed Nonsubmersible Pumps

Outlets supplying permanently installed nonsubmersible pump motors rated 250V or less and 60A or less must be GFCI protected.

Part VII. Hydromassage Bathtubs

680.70 General

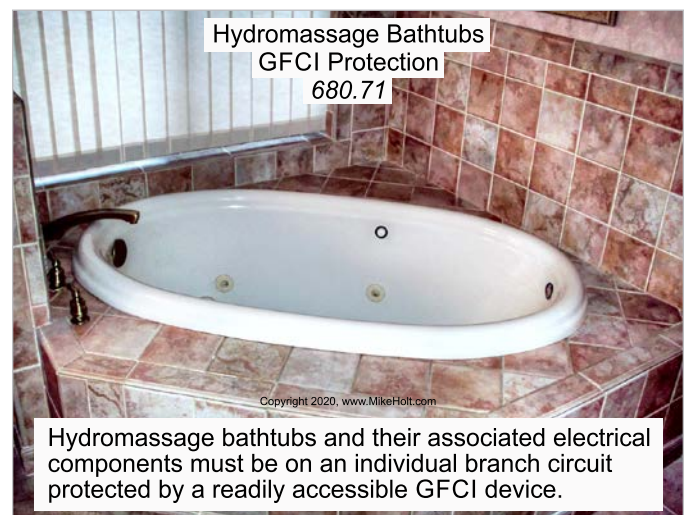
A hydromassage bathtub must only comply with the requirements of Part VII; it is not required to comply with the other parts of this article.

Author's Comment:

- According to 680.2, a "Hydromassage Bathtub" is defined as a permanently installed bathtub with a recirculating piping system designed to accept, circulate, and discharge water after each use.

680.71 GFCI Protection

Hydromassage bathtubs and their associated electrical components must be on an individual branch circuit protected by a readily accessible GFCI device. ►Figure 680-88



► Figure 680-88

680.73 Accessibility

Electrical equipment for hydromassage bathtubs must be capable of being removed or exposed without damaging the building structure or finish. ►Figure 680-89



▶ Figure 680-89

Where the hydromassage bathtub is cord-and-plug-connected and the supply receptacle is only accessible through a service access opening, the receptacle must be installed so its face is in direct view and be located within 1 ft of the opening. ▶ Figure 680-90



▶ Figure 680-90

680.74 Equipotential Bonding

(A) General. The following parts must be bonded together.

- (1) Metal fittings within, or attached to, the hydromassage bathtub structure that are in contact with the circulating water.
- (2) Metal parts of electrical equipment associated with the hydromassage bathtub water circulating system, including pump and blower motors.

- (3) Metal-sheathed cables, metal raceways, and metal piping within 5 ft of the inside walls of the hydromassage bathtub and not separated from its area by a permanent barrier.
- (4) Exposed metal surfaces within 5 ft of the inside walls of the hydromassage bathtub and not separated from it by a permanent barrier.
- (5) Metal parts of electrical devices not associated with the hydromassage bathtub located within 5 ft from the hydromassage bathtub.

Ex 1: Small conductive surfaces not likely to become energized such as air and water jets, supply valve assemblies, drain fittings not connected to metallic piping, towel bars, mirror frames, and similar nonelectrical equipment not connected to metal framing are not required to be bonded.

Ex 2: Double-insulated motors and blowers are not required to be bonded.

(B) Bonding Conductor. Metal parts required to be bonded by 680.74(A) must be bonded together using an insulated or bare solid copper conductor not smaller than 8 AWG. Bonding jumpers are not required to be extended or attached to any remote panelboard, service disconnect, or any electrode.

A bonding jumper long enough to terminate on a replacement nondouble-insulated pump or blower motor must be provided, and it must terminate to the equipment grounding conductor of the branch circuit of the motor when a double-insulated circulating pump or blower motor is used.

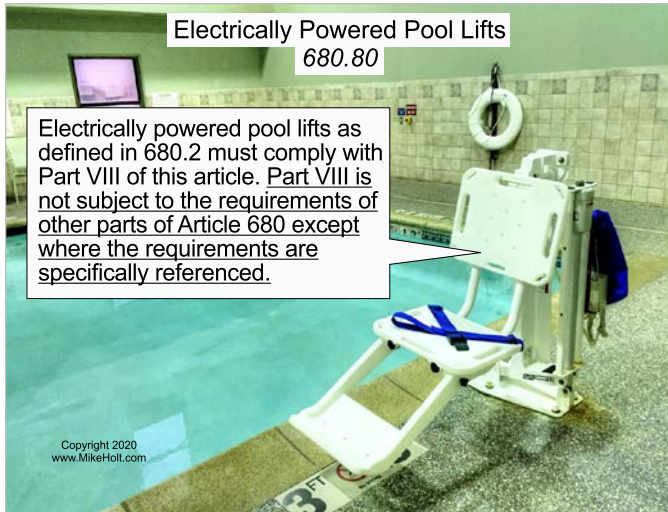
Part VIII. Electrically Powered Pool Lifts

680.80 General

Electrically powered pool lifts as defined in 680.2 must comply with Part VIII of this article. Part VIII is not subject to the requirements of other parts of Article 680 except where the requirements are specifically referenced. ▶ Figure 680-91

680.81 Equipment Approval

Electrically powered pool lifts must be listed, labeled, and identified for pool and spa use.



► Figure 680-91



► Figure 680-92

680.82 Protection

Electrically powered pool lifts must be GFCI protected and comply with 680.5.

680.83 Bonding

Electrically powered pool lifts must be bonded in accordance with 680.26(B)(5) and (B)(7). ► Figure 680-92

680.84 Switching Devices and Receptacles

Switches and switching devices that operate above the low-voltage contact limit must comply with 680.22(C). Receptacles for electrically powered pool lifts that are operated above the low-voltage contact limit must comply with 680.22(A)(3) and (4).

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