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, and hydromassage bathtubs. The overriding concern of this article is to keep people and electricity separated.

Article 680 is divided into seven 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 this article carefully so you'll 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 II 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. If they're portable appliances, then Article 422, Parts II and III apply.
- **Part VII. Hydromassage Bathtubs.** Part VII applies to hydromassage bathtubs, but no other parts of Article 680 do.

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], and fountains [680.50].

680.1 Scope

The requirements contained in Article 680 apply to the installation of electric wiring and equipment for swimming pools, hot tubs, spas, fountains, and hydromassage bathtubs. ▸Figure 680–1

Figure 680–1

680.2 Definitions

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

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

Forming Shell. A structure mounted in the wall of permanently installed pools, storable pools, outdoor spas, outdoor hot tubs, or fountains designed to support a wet-niche luminaire. Figure 680–2

Figure 680–2

Fountain. An ornamental pool, display pool, or reflection pool.

Hydromassage Bathtub. A permanently installed bathtub with a recirculating piping system designed to accept, circulate, and discharge water after each use. Figure 680–3

Figure 680–3

Low-Voltage Contact Limit. A voltage not exceeding the following values: Figure 680–4

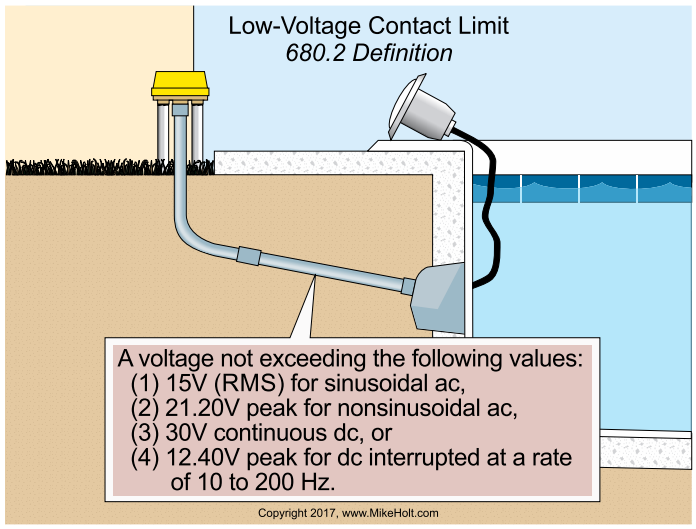


Figure 680–4

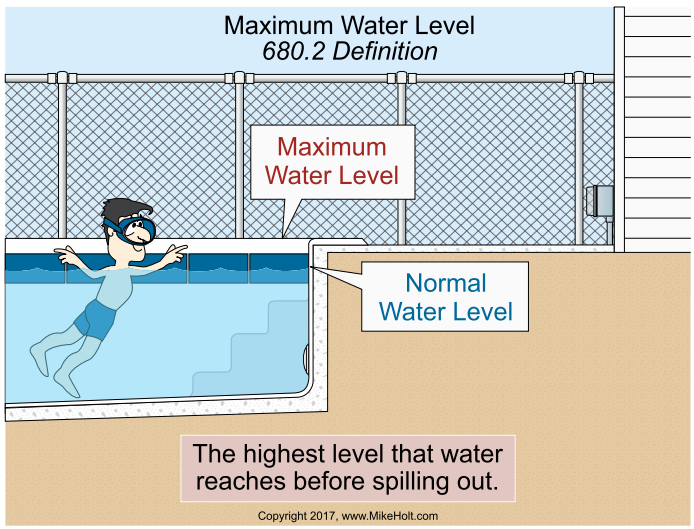
(1) 15V (RMS) for sinusoidal alternating current

(2) 21.20V peak for nonsinusoidal alternating current

(3) 30V for continuous direct current

(4) 12.40V peak for direct current that's interrupted at a rate of 10 to 200 Hz

Maximum Water Level. The highest level that water reaches before it spills out. ▶Figure 680–5



▶Figure 680–5

Permanently Installed Swimming, Wading, Immersion, and Therapeutic Pools. Those constructed in the ground or partially in the ground, and all others capable of holding water in a depth greater than 42 in., and pools installed inside of a building, regardless of water depth, whether or not served by electrical circuits of any nature. ▶Figure 680–6

▶Figure 680–6

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.

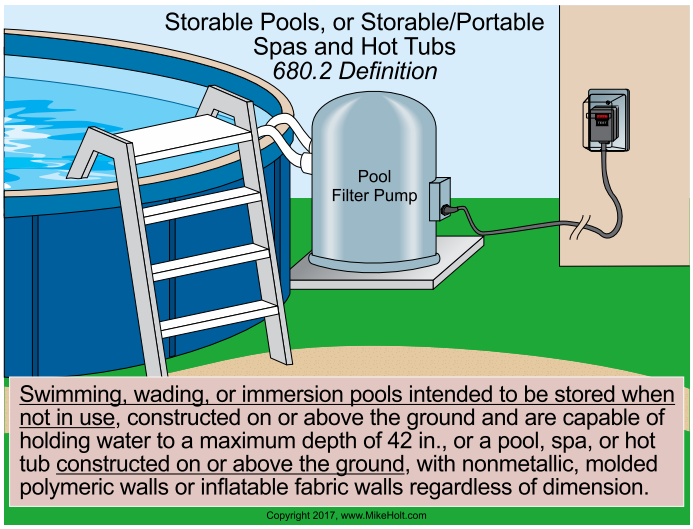
Spa or Hot Tub. A hydromassage pool or tub designed for recreational or therapeutic use typically not drained after each use. ▶Figure 680–7

▶Figure 680–7

Storable Swimming Pool, or Storable/Portable Spas and Hot Tubs. Swimming, wading, or immersion pools intended to be stored when not in use, constructed on or above the ground and are capable of holding water to a maximum depth of 42 in., or a pool, spa, or hot tub constructed on or above the ground, with nonmetallic, molded polymeric walls or inflatable fabric walls regardless of dimension. ▶Figure 680–8

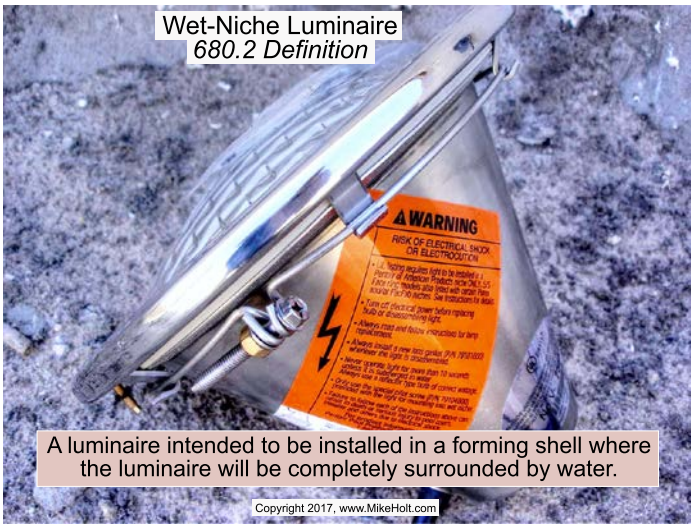
Author's Comment:

- Storable pools are sold as a complete package that consists of the pool walls, vinyl liner, plumbing kit, and pump/filter device. Underwriters Laboratories, Inc. (UL) requires the pump/filter units to have a minimum 25-ft cord to discourage the use of extension cords.



▶Figure 680–8

Wet-Niche Luminaire. A luminaire intended to be installed in a forming shell where the luminaire will be completely surrounded by water. ▶Figure 680–9



▶Figure 680–9

680.4 Approval of Equipment

Electrical equipment installed in the water, walls, or decks of pools, fountains, and similar installations must be listed.

680.7 Grounding and Bonding Terminals

Grounding and bonding terminals must be identified for use in wet and corrosive environments and be listed for direct burial use. ▶Figure 680–10

▶Figure 680–10

680.8 Cord-and-Plug-Connected Equipment

Fixed or stationary equipment other than an underwater luminaire for permanently installed pools can be cord-and-plug-connected to facilitate removal or disconnection for maintenance or repair.

(A) Length. Except for storable pools, the flexible cord must not exceed 3 ft in length.

Author's Comment:

- The *NEC* doesn't specify a maximum flexible cord length for a storable pool pump motor.

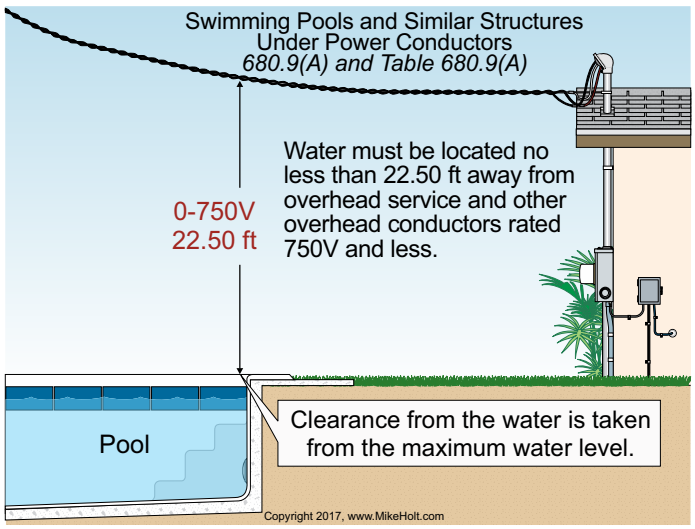
(B) Equipment Grounding Conductor. The flexible cord must have a copper equipment grounding conductor not smaller than 12 AWG and the flexible cord must terminate at a grounding-type attachment plug.

680.9 Overhead Conductor Clearance

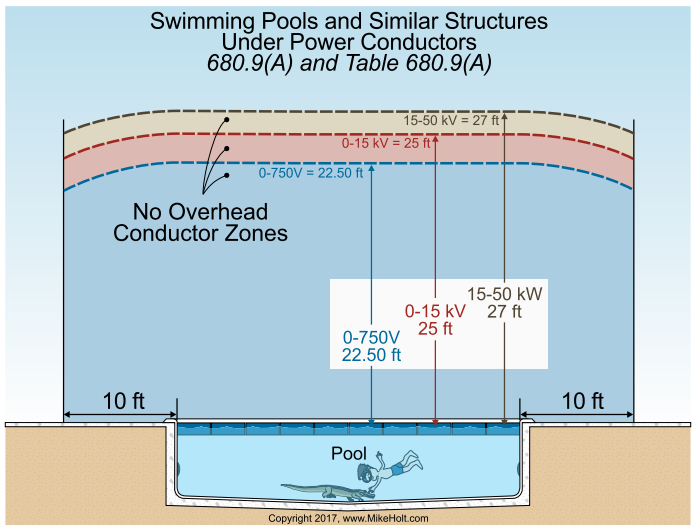
Scan this QR code for a video of Mike explaining this topic; it's a sample from the DVDs that accompany this textbook.

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

(A) Overhead Power Conductors. Permanently installed swimming pools, storable pools, outdoor spas, outdoor hot tubs, fountains, diving structures, observation stands, towers, or platforms near overhead service conductors and other overhead conductors aren't permitted to be placed within the clearances contained in Table 680.9(A). ▶Figure 680–11 and ▶Figure 680–12



▶Figure 680–11

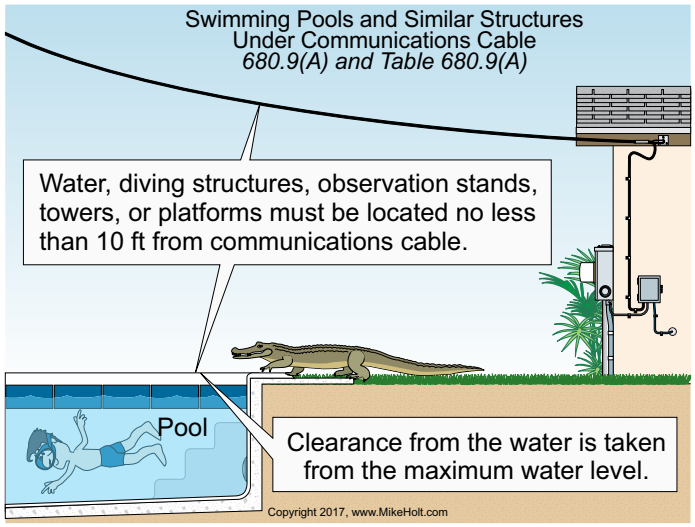


▶Figure 680–12

Author's Comment:

- This rule doesn't prohibit utility-owned overhead service-drop conductors from being installed over a permanently installed pool, storable pool, outdoor spa, outdoor hot tub, or fountain [90.2(B)(5)]. It does prohibit a permanently installed pool, storable pool, outdoor spa, outdoor hot tub, or fountain from being installed under an existing service drop that isn't at least 22½ ft above the water.

(B) Communications Systems. Permanently installed pools, storable pools, outdoor spas, outdoor hot tubs, fountains, diving structures, observation stands, towers, or platforms aren't permitted to be placed under, or within, 10 ft of communications cables. ▶Figure 680–13



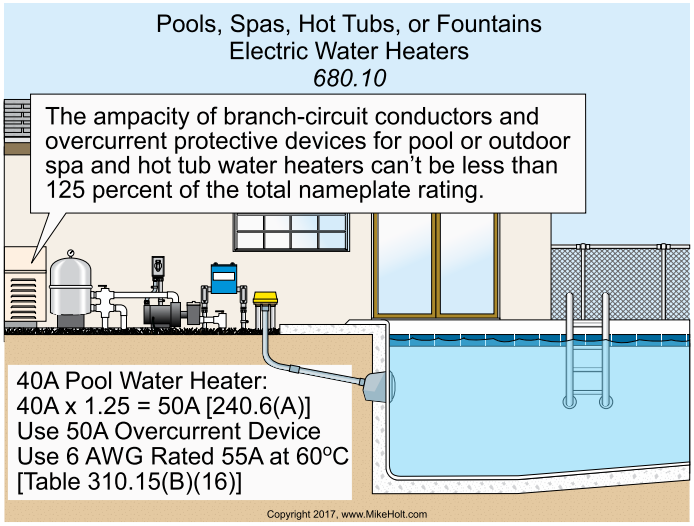
▶Figure 680–13

Author's Comment:

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

680.10 Electric Water Heaters

The ampacity of branch-circuit conductors and overcurrent protection devices for pool or outdoor spa and hot tub water heaters aren't permitted to be less than 125 percent of the total nameplate rating. ▶Figure 680–14



▶Figure 680–14

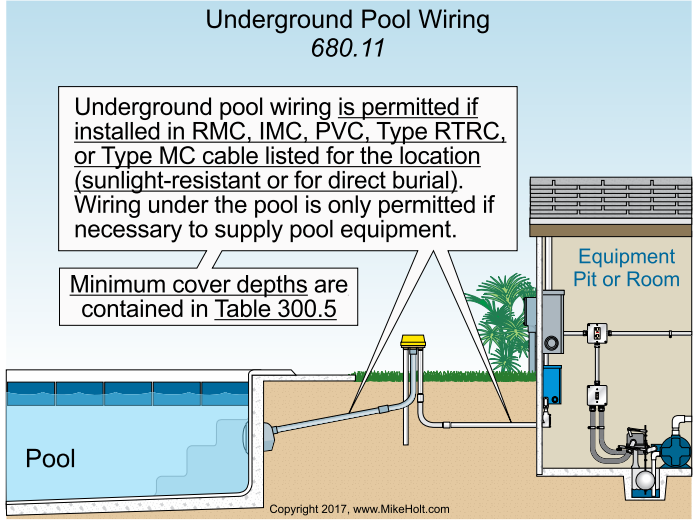
680.11 Underground Wiring

Underground pool wiring must 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 (sunlight-resistant or for direct burial). Wiring under a pool is only permitted if the wiring is necessary to supply pool equipment. Minimum cover depths for underground wiring must comply with the cover requirements contained in Table 300.5. ▶Figure 680–15

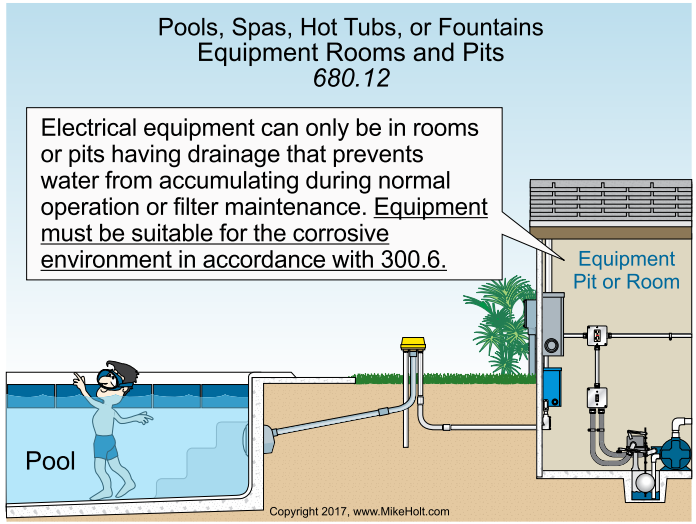
680.12 Equipment Rooms and Pits

Permanently installed pool, storable pool, outdoor spa, outdoor hot tub, or fountain equipment isn't permitted to be located in rooms or pits that don't have drainage that prevents water accumulation during normal operation or filter maintenance.

Equipment must be suitable for the corrosive environment in accordance with 300.6. ▶Figure 680–16



▶Figure 680–15



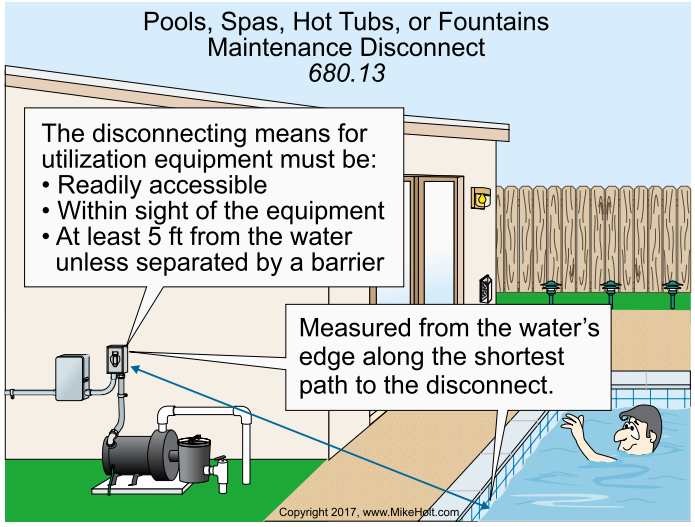
▶Figure 680–16

Note: Chemicals such as chlorine cause severe corrosive and deteriorating effects on electrical connections, equipment, and enclosures. Ventilation of indoor spaces in accordance with ANSI/APSP-11, *Standard for Water Quality in Public Pools and Spas* can reduce the likelihood of the accumulation of corrosive vapors.

680.13 Maintenance Disconnecting Means

A maintenance disconnect is required for the permanently installed pool, storable pool, outdoor spa, outdoor hot tub, or fountain equipment, other than lighting, for these water bodies.

The maintenance disconnect must be readily accessible and located within sight and at least 5 ft from the permanently installed pool, storable pool, outdoor spa, outdoor hot tub, or fountain equipment unless separated from the open water by a permanently installed barrier that provides a 5-ft reach path or greater. This horizontal distance is measured from the water's edge along the shortest path required to reach the disconnect. ▶Figure 680–17



▶Figure 680–17

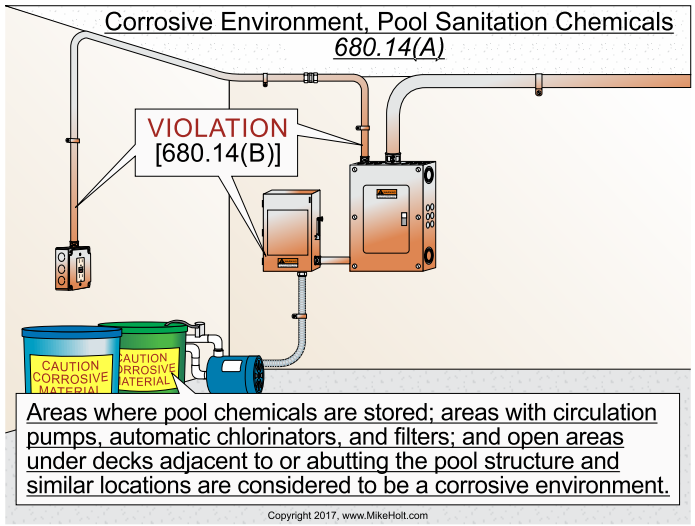
Author's Comment:

- According to Article 100, "Within Sight" means that it's visible and not more than 50 ft from one to the other.

680.14 Corrosive Environment

(A) Corrosive Environment. Areas where pool chemicals are stored; areas with circulation pumps, automatic chlorinators, and filters; and open areas under decks adjacent to or abutting the pool structure are considered to be a corrosive environment. ▶Figure 680–18

(B) Wiring Methods. Wiring methods (boxes and enclosures) in areas described in 680.14(A) must be listed and identified for use; rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit, and reinforced thermosetting resin conduit are permitted in the corrosive environment areas specified in 680.14(A).



▶Figure 680–18

Part II. Permanently Installed Pools

680.20 General

The installation requirements contained in Part I and Part II apply to permanently installed pools.

680.21 Motors

(A) Wiring Methods. The wiring to a pool-associated motor must comply with (A)(1) unless modified by (A)(2), (A)(3), (A)(4), or (A)(5).

(1) General. Where branch-circuit wiring for pool-associated motors is subject to physical damage or exposed to damp, wet, or corrosive locations, rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit, and reinforced thermosetting resin conduit, or Type MC cable listed for the location must be used. ▶Figure 680–19

The wiring methods must contain an insulated copper equipment grounding conductor sized in accordance with 250.122, based on the rating of the circuit overcurrent protection device, but in no case can the equipment grounding conductor be sized smaller than 12 AWG. ▶Figure 680–20

Wiring in dry and noncorrosive locations can be in any wiring method permitted in Chapter 3.

(2) Flexible Connections. Liquidtight flexible metal or liquidtight flexible nonmetallic conduit with listed fittings is permitted.

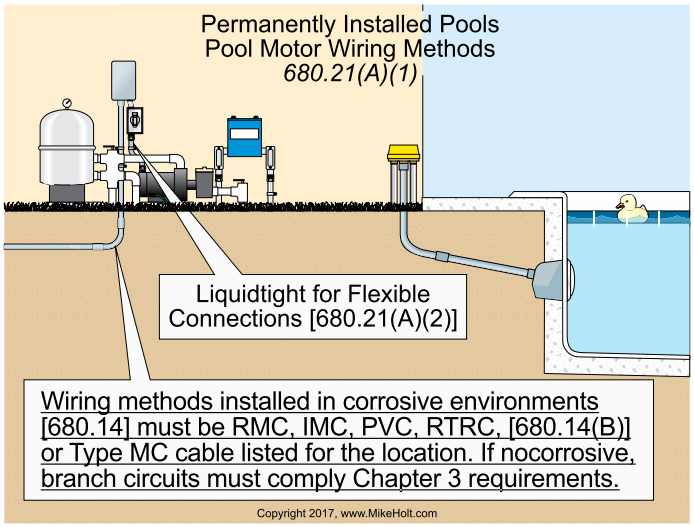


Figure 680–19

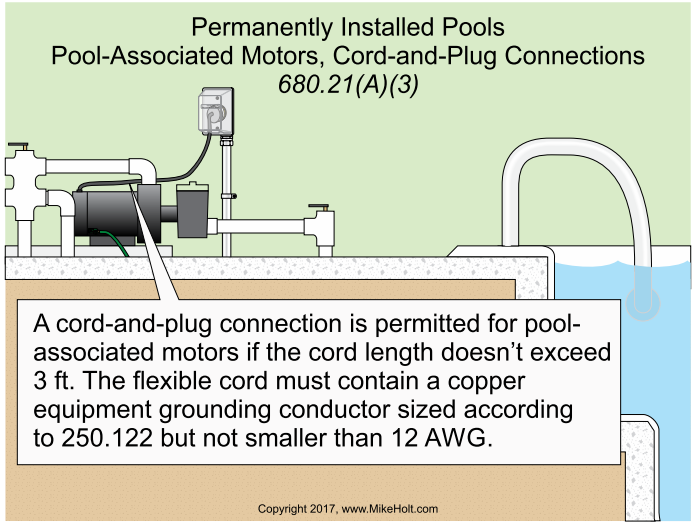


Figure 680–21

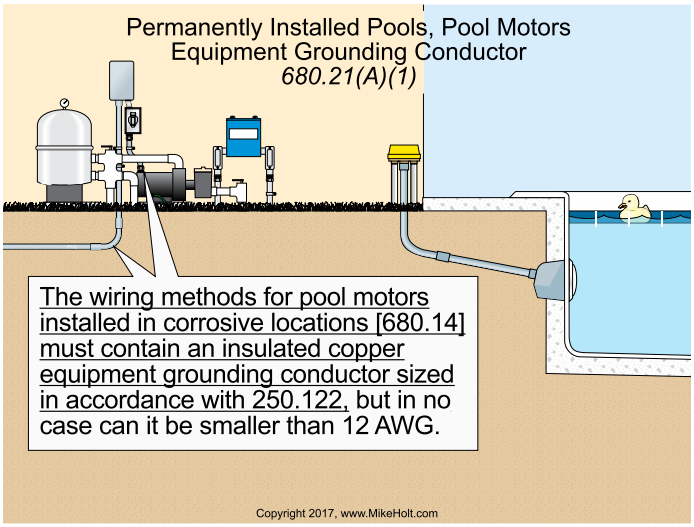


Figure 680–20

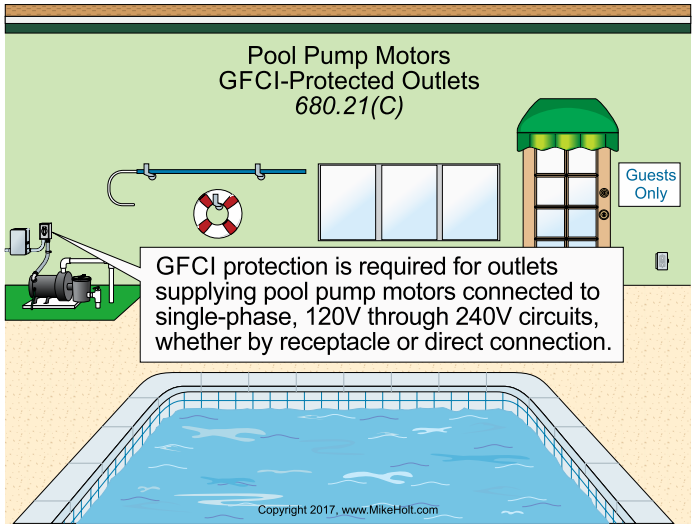


Figure 680–22

(3) Cord-and-Plug Connections. Cords for pool motors are permitted if the length doesn't exceed 3 ft and the cord contains a copper equipment grounding conductor, sized in accordance with 250.122, based on the rating of the overcurrent protection device, but not smaller than 12 AWG. Figure 680–21

(C) GFCI Protection. GFCI protection is required for outlets supplying pool pump motors connected to single-phase, 120V through 240V branch circuits, whether by receptacle or by direct connection. Figure 680–22

680.22 Lighting, Receptacles, and Equipment

(A) Receptacles.

(1) Required Receptacle Location. At least one 15A or 20A, 125V receptacle 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 6½ ft above the floor, platform, or grade level serving the permanently installed pool. Figure 680–23

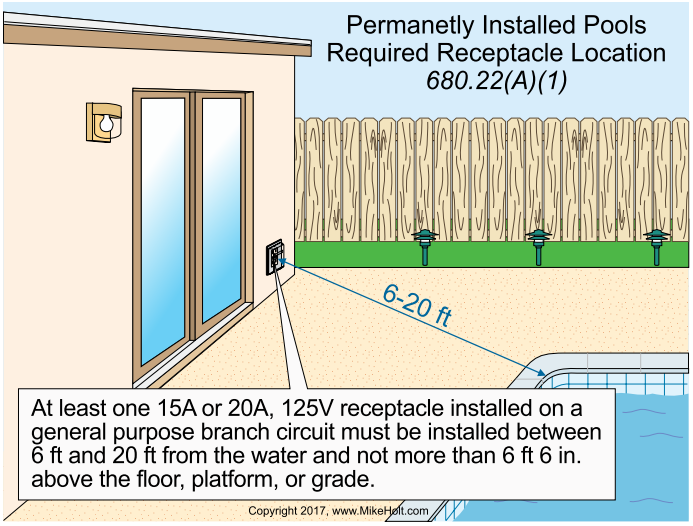


Figure 680–23

(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, be GFCI protected, and be of the grounding type. Figure 680–24

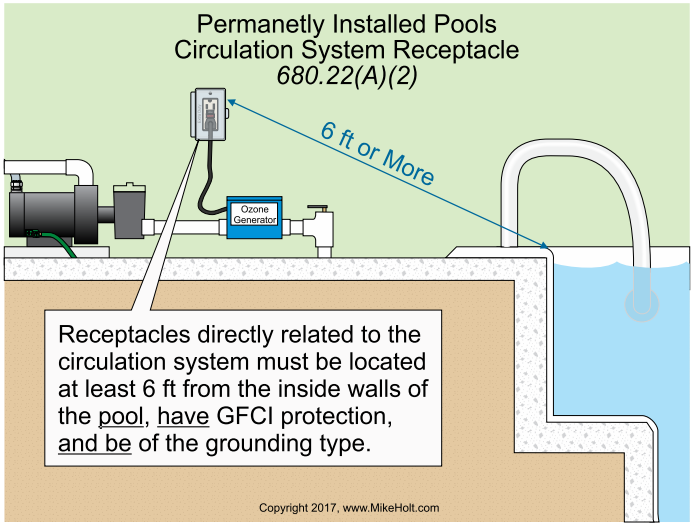


Figure 680–24

(3) Other Receptacles. Receptacles not for motors or other loads directly related to the circulation system must be not less than 6 ft from the inside walls of a permanently installed pool. Figure 680–25

(4) GFCI-Protected Receptacles. 15A and 20A, 125V receptacles located within 20 ft from the inside walls of a permanently installed pool must be GFCI protected. Figure 680–26

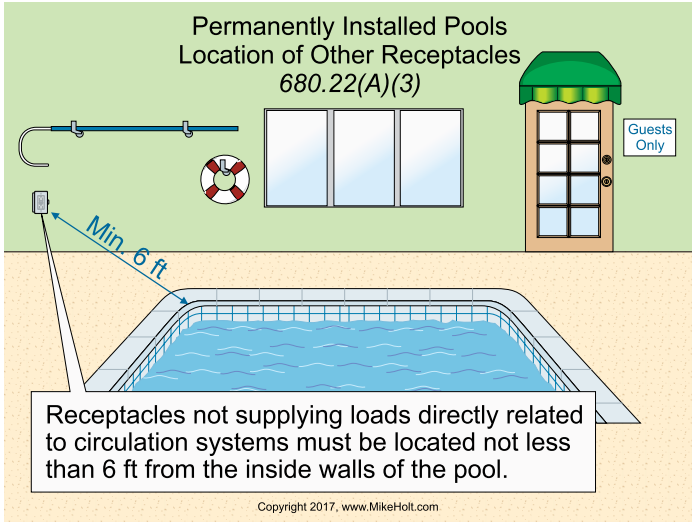


Figure 680–25

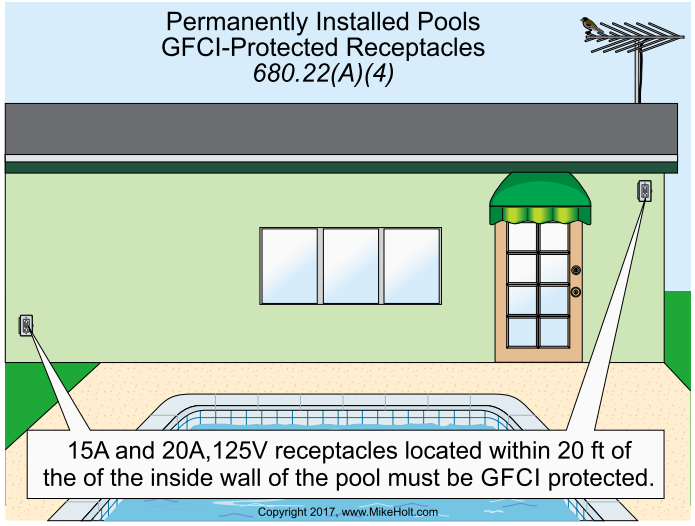


Figure 680–26

Author's Comment:

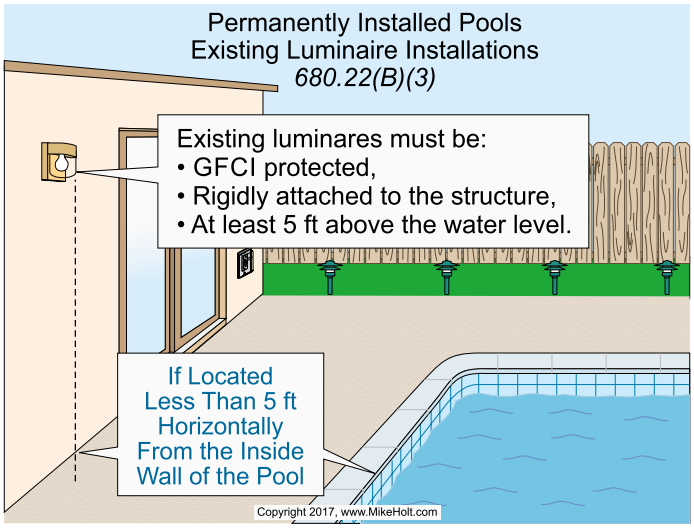
- Outdoor dwelling unit receptacles must be GFCI protected, regardless of the distance from a permanently installed pool [210.8(A)(3)].
- 15A and 20A, 125V receptacles for nondwelling units located outdoors require GFCI protection [210.8(B)(4)].

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

(B) Luminaires and Ceiling Fans.

(1) New Outdoor Installations. Luminaires and ceiling fans installed above the water, or the area extending within 5 ft horizontally from the inside walls of a permanently installed pool, aren't permitted to be less than 12 ft above the maximum water level.

(3) Existing Installations. Existing luminaires located less than 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, must be rigidly attached to the existing structure, and must be GFCI protected. ▶Figure 680–27



▶Figure 680–27

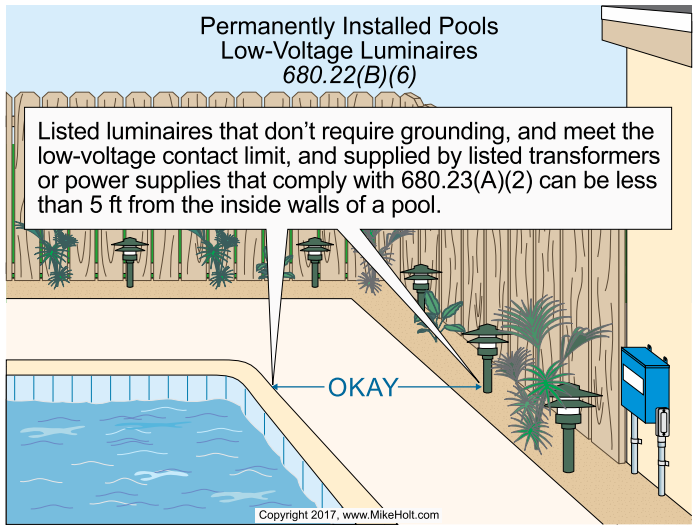
(4) Adjacent Areas. New luminaires installed between 5 ft and 10 ft horizontally from the inside walls of a permanently installed pool must be GFCI protected, unless installed not less than 5 ft above the maximum water level and rigidly attached to the existing structure adjacent to or enclosing the permanently installed pool.

(6) Low-Voltage Luminaires. Listed luminaires that don't require grounding, and that meet the low-voltage contact limit, and supplied by listed transformers or power supplies that comply with 680.223(A)(2), can be less than 5 ft from the inside walls of the pool. ▶Figure 680–28

Author's Comment:

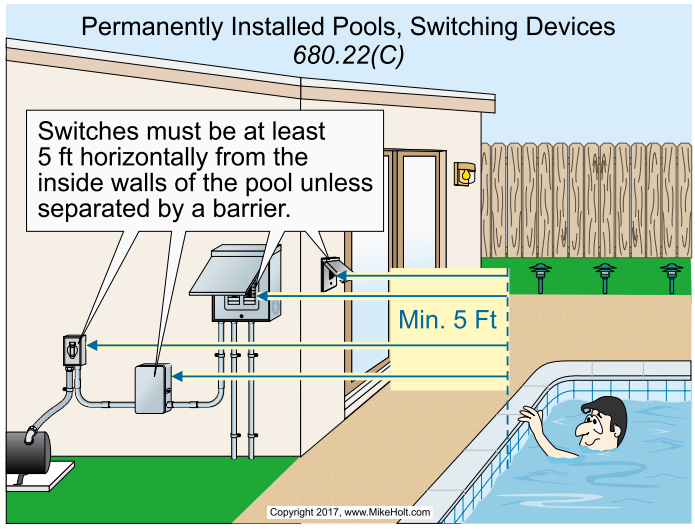
- The "Low-Voltage Contact Limit" is defined in 680.2.

(7) Low-Voltage Gas-Fired Luminaires, 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 don't exceed the low-voltage contact limit can be located less than 5 ft from the inside walls of the pool. Metal parts of the equipment must be bonded in accordance with 680.26(B); metal gas piping must be bonded in accordance with 250.140(B) and 250.26(B)(7).



▶Figure 680–28

(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, unless the switching device is listed as being acceptable for use within 5 ft. ▶Figure 680–29



▶Figure 680–29

(D) Other Outlets. Other outlets aren't permitted to be located less than 10 ft from the inside walls of a permanently installed pool. The receptacle distance is measured as the shortest path an appliance flexible cord would follow without passing through a wall, doorway, or window [680.22(A)(5)].

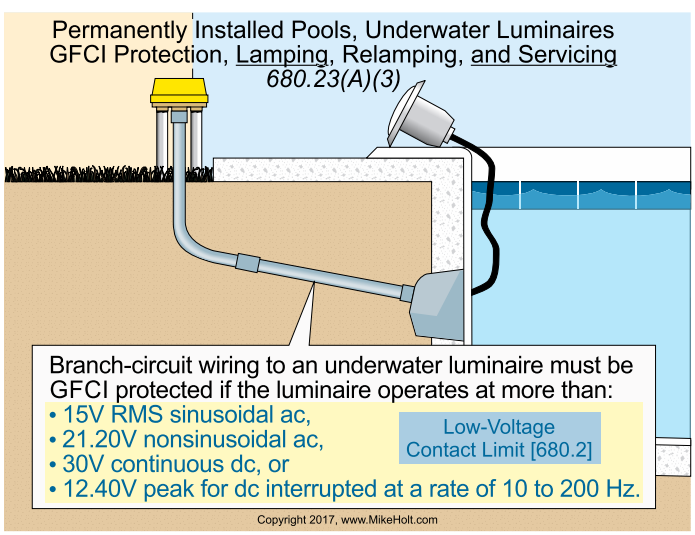
Note: Examples of other outlets may include remote-control, signaling, fire alarm, and communications circuits.

680.23 Underwater Luminaires

(A) General.

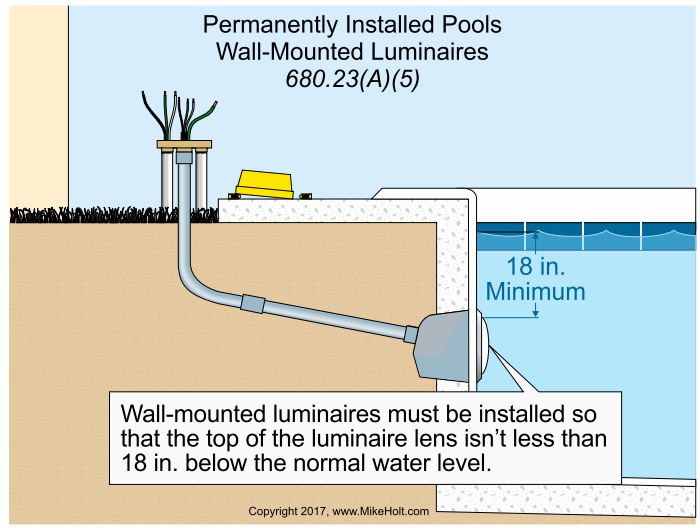
(2) Transformers and Power Supplies. Transformers and power supplies for underwater luminaires must be listed, labeled, and identified for swimming pool use.

(3) GFCI Protection, Lamping, Relamping, and Servicing. Branch circuits that supply underwater luminaires operating at voltages greater than 15V for sinusoidal alternating current, 21.20V peak for nonsinusoidal alternating current, 30V for continuous direct current, and 12.40V peak for direct current interrupted at a rate of 10 to 200 Hz or less [680.2 Low-Voltage Contact Limit] must be GFCI protected. ▶Figure 680—30



▶Figure 680–30

(5) Wall-Mounted Luminaires. Underwater luminaires must be installed so that the top of the luminaire lens isn't less than 18 in. below the normal water level. ▶Figure 680–31



▶Figure 680–31

(B) Wet-Niche Underwater Luminaires.

(1) Forming Shells. Forming shells for wet-niche underwater luminaires must be equipped with provisions for raceway entries. Forming shells used with PVC conduit systems must include provisions for terminating an 8 AWG copper conductor.

(2) Wiring to the Forming Shell. The raceway that extends directly to the underwater pool wet-niche forming shell must comply with (a) or (b).

(a) Metal Raceway. Brass or corrosion-resistant rigid metal conduit approved by the authority having jurisdiction.

(b) Nonmetallic Raceway. A nonmetallic raceway to the forming shell must contain an 8 AWG insulated (solid or stranded) copper bonding jumper that terminates to the forming shell and junction box unless a listed low-voltage lighting system not requiring grounding is used. ▶Figure 680–32

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.

(6) Servicing. The forming shell location and length of flexible cord in the forming shell must allow for personnel to place the removed luminaire on the deck or other dry location for maintenance. The luminaire maintenance location must be accessible without entering or going in the pool water. ▶Figure 680–33

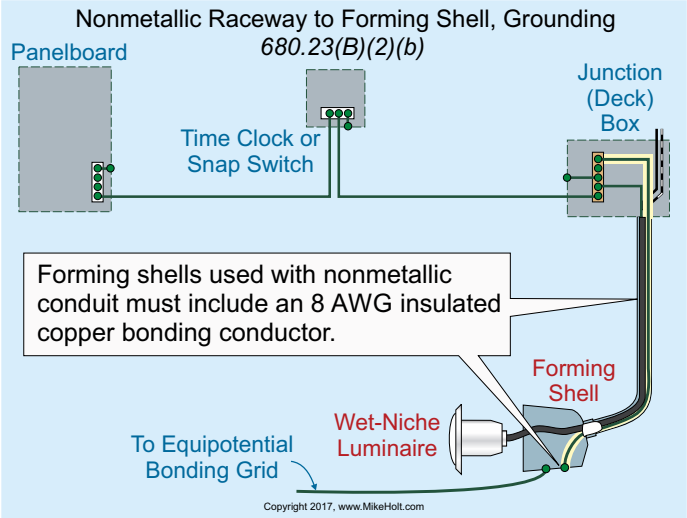


Figure 680–32

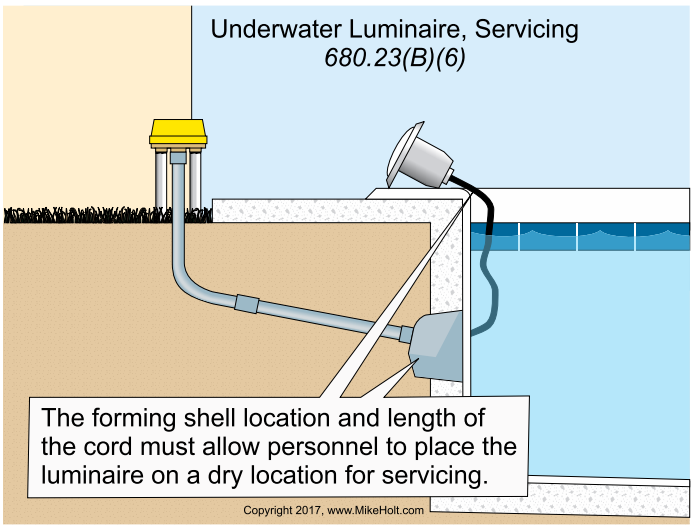


Figure 680–33

Author's Comment:

- While it may be necessary to enter the pool water, possibly with underwater breathing apparatus in some cases, the flexible cord must be long enough to allow the luminaire to be brought out and placed on a deck or other dry location where the relamping, maintenance, or inspection can take place without entering the pool water.

(F) Branch-Circuit Wiring.

(1) General. Where branch-circuit wiring for underwater luminaires is installed in corrosive environments as described in 680.14, the wiring methods must comply with 680.14(B) or be liquidtight flexible nonmetallic conduit. The wiring methods must contain an insulated copper equipment grounding conductor sized in accordance with 250.122, based on the rating of the overcurrent protection device, but in no case can it be smaller than 12 AWG. Figure 680–34

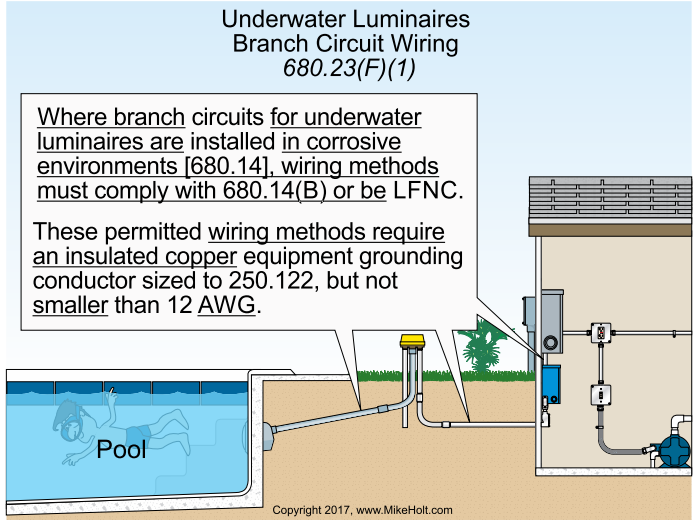


Figure 680–34

In noncorrosive environments, any Chapter 3 wiring method is permitted.

Ex: If connecting to transformers or power supplies for pool lights, liquidtight flexible metal conduit is permitted in individual lengths not exceeding 6 ft.

(2) Equipment Grounding Conductor. For other than listed low-voltage luminaires not requiring grounding, branch-circuit conductors for an underwater luminaire must contain an insulated copper equipment grounding conductor sized in accordance with Table 250.122, based on the rating of the overcurrent protection device, but not smaller than 12 AWG. Figure 680–35

The circuit equipment grounding conductor for the underwater luminaire isn't permitted to be spliced, except as permitted in (a) or (b).

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

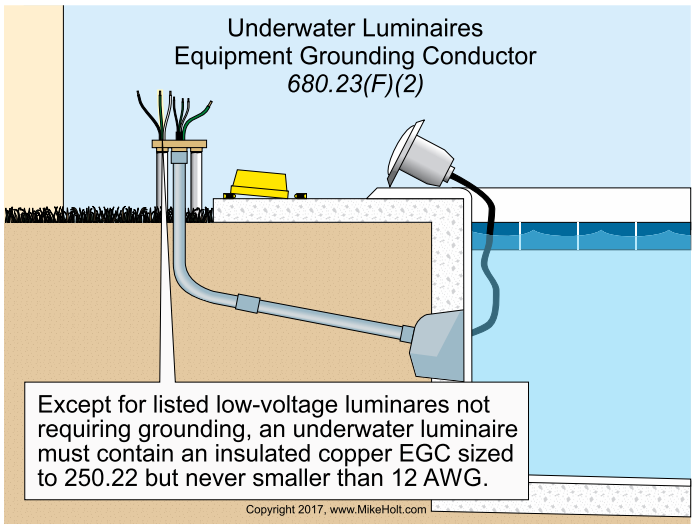


Figure 680–35

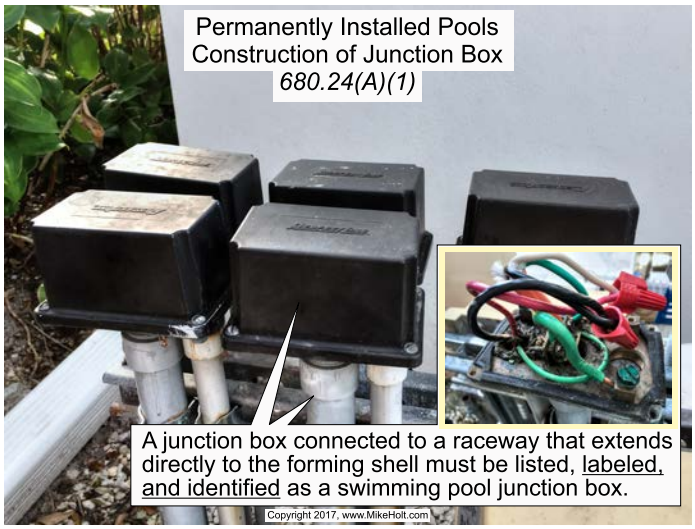


Figure 680–36

(b) The circuit equipment grounding conductor can terminate at the grounding terminal of a listed pool transformer that meets the requirements of 680.23(A)(2).

(3) Conductors. The branch-circuit conductors on the load side of a GFCI or transformer that complies with 680.23(A)(8) for underwater luminaires must not occupy raceways or enclosures with other conductors unless one of the following conditions apply:

(1) The other conductors are GFCI protected.

(2) The conductor is an equipment grounding conductor as required by 680.23(B)(2)(b).

(3) The other conductors supply a feed-through type GFCI.

(4) The other conductors are GFCI protected within the panelboard.

680.24 Junction Box, Transformer, or GFCI Enclosure

(A) Junction Box. The junction box (deck box) that connects directly to an underwater permanently installed pool luminaire forming shell must comply with the following:

(1) Construction. The junction box must be listed, labeled, and identified as a swimming pool junction box, and must be: Figure 680–36

(1) Equipped with threaded entries or a nonmetallic hub,

(2) Constructed of copper, brass, or corrosion-resistant material approved by the authority having jurisdiction, and

(3) Provide electrical continuity between metal raceways and grounding terminals within the junction box.

Author's Comment:

- In addition, the junction box must be provided with at least one grounding terminal more than the number of raceway entries [680.24(D)], and the junction box must have a strain relief for the flexible cord [680.24(E)].

(2) Installation.

(a) Vertical Spacing. If the luminaire operates at over 15V for sinusoidal alternating current, 21.20V peak for nonsinusoidal alternating current, 30V for continuous direct current, or 12.40V peak for direct current interrupted at a rate of 10 to 200 Hz [680.2 Low-Voltage Contact Limit], the junction box must be located not less than 4 in. above the ground or permanently installed pool, or not less than 8 in. above the maximum water level, whichever provides the greater elevation. Figure 680–37

(b) Horizontal Spacing. If the luminaire operates at over 15V for sinusoidal alternating current, 21.20V peak for nonsinusoidal alternating current, 30V for continuous direct current, or 12.40V peak for direct current interrupted at a rate of 10 to 200 Hz [680.2 Low-Voltage Contact Limit], the junction box must be located not less than 4 ft from the inside wall of the permanently installed pool, unless separated by a solid fence, wall, or other permanent barrier. Figure 680–38

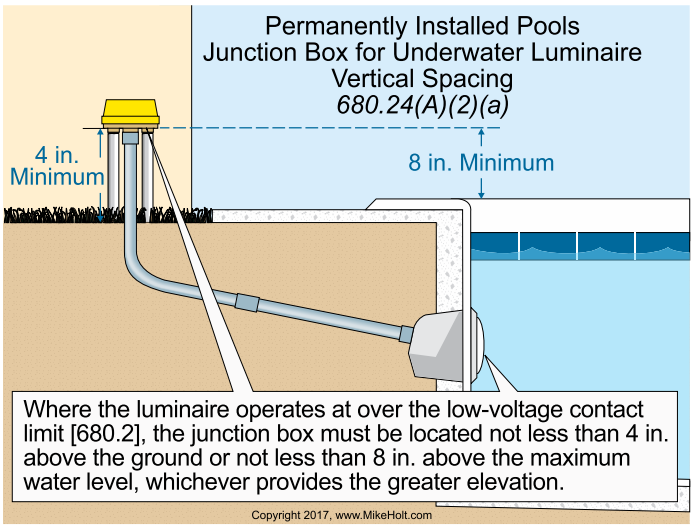


Figure 680–37

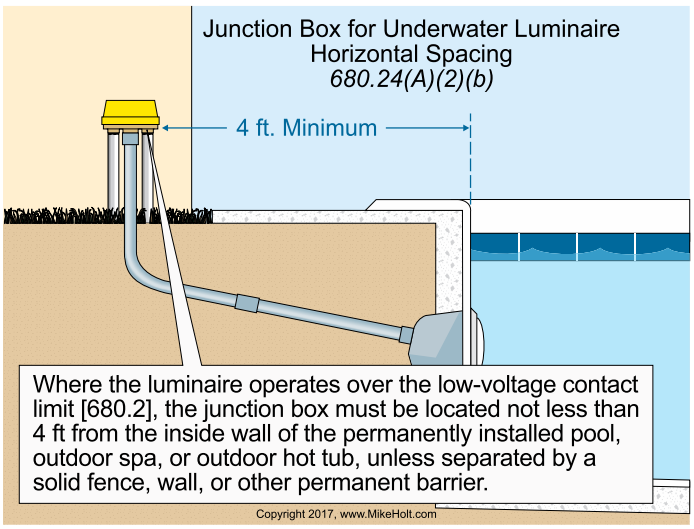


Figure 680–38

Author's Comment:

- The junction box must be supported by two metal conduits threaded wrenchtight into the enclosure according to 314.23(E). Figure 680–39

(c) Flush Deck Box. For a lighting system operating at 15V for sinusoidal alternating current, 21.20V peak for nonsinusoidal alternating current, 30V for continuous direct current, or 12.40V peak for direct current interrupted at a rate of 10 to 200 Hz or less [680.2 Low-Voltage Contact Limit], a flush deck box is permitted if both of the following apply:

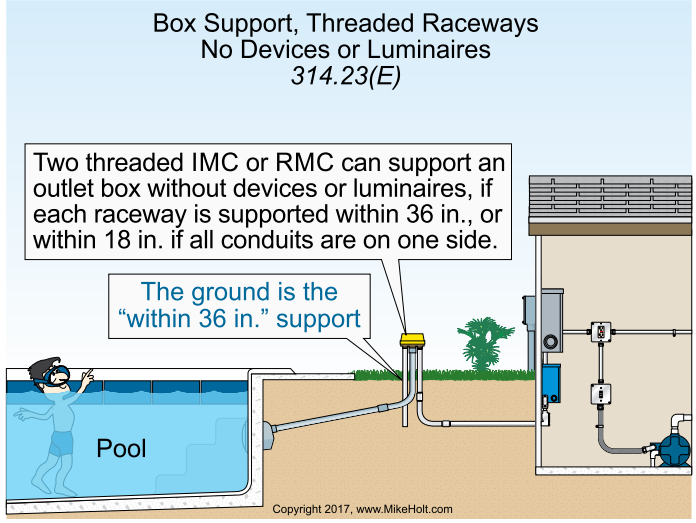


Figure 680–39

(1) An approved potting compound prevents the entrance of moisture.

(2) The flush deck box is located not less than 4 ft from the inside wall of the pool.

(B) Transformer or GFCI Enclosure. If the enclosure for a transformer or GFCI is connected to a raceway that extends directly to an underwater permanently installed pool luminaire forming shell, the enclosure must comply with the following:

(1) Construction. The enclosure must be listed for the purpose, and be:

(1) Equipped with threaded entries or a nonmetallic hub,

(2) Constructed of copper, brass, or corrosion-resistant material approved by the authority having jurisdiction, and

(4) Provided with electrical continuity between metal raceways and the grounding terminals of the enclosure.

Author's Comment:

- See the definitions of "Labeled" and "Listed" in Article 100.

(C) Physical Protection. Junction boxes for underwater pool luminaires that are mounted above the grade of the surrounding finished walkway aren't permitted to be located in the walkway unless afforded protection by being located under diving boards or adjacent to fixed structures.

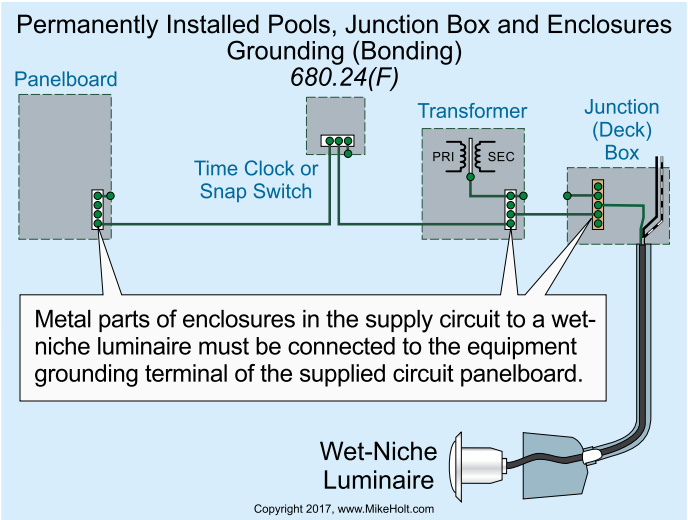
(D) Equipment Grounding Terminals. The junction box for an underwater permanently installed pool luminaire must be provided with at least one more grounding terminal than the number of raceway entries.

Author's Comment:

- There are typically four grounding terminals in the junction box and three raceway entries.

(E) Strain Relief. The termination of a flexible cord that supplies an underwater permanently installed pool luminaire must be provided with a strain relief.

(F) Grounding. The metal parts of a junction box, transformer enclosure, or other enclosure in the supply circuit to a wet-niche luminaire must be connected to the equipment grounding terminal of the supplied circuit panelboard. ▶Figure 680–40



▶Figure 680–40

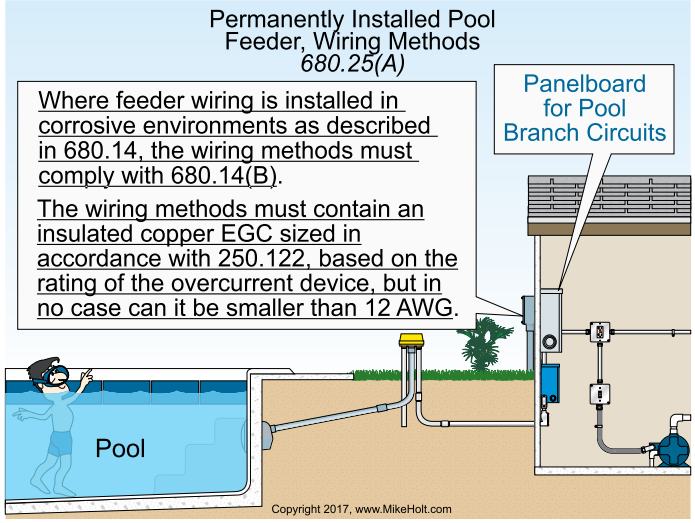
680.25 Feeders

(A) Wiring Methods. Where feeder wiring is installed in corrosive environments as described in 680.14, the wiring methods must comply with 680.14(B) or be liquidtight flexible nonmetallic conduit. The wiring methods must contain an insulated copper equipment grounding conductor sized in accordance with 250.122, based on the rating of the overcurrent protection device, but in no case can it be smaller than 12 AWG. ▶Figure 680–41

In noncorrosive environments, any Chapter 3 wiring method is permitted.

Author's Comment:

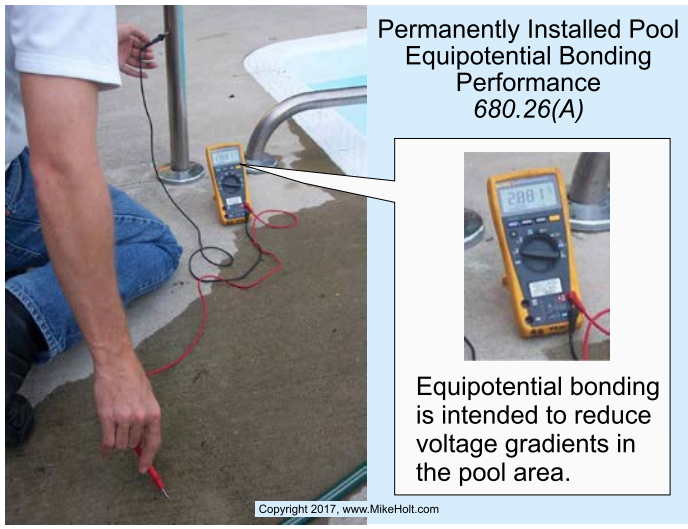
- The bonding requirements of this section don't apply to spas and hot tubs [680.42].



▶Figure 680–41

680.26 Equipotential Bonding

(A) Performance. The required equipotential bonding is intended to reduce voltage gradients in the area around a permanently installed pool. ▶Figure 680–42



▶Figure 680–42

(B) Bonded Parts. The parts of a permanently installed pool listed in (B)(1) through (B)(7) must be bonded together with a solid copper conductor not smaller than 8 AWG with listed pressure connectors, terminal bars, exothermic welding, or other listed means in accordance with 250.8(A). ▶Figure 680–43 and ▶Figure 680–44

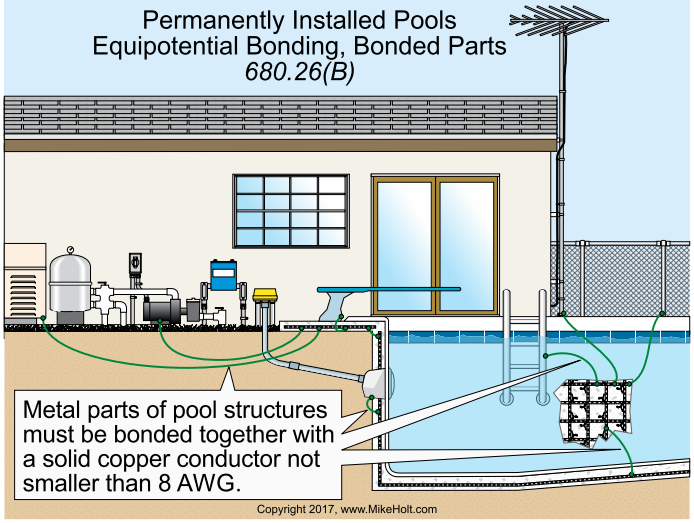


Figure 680–43

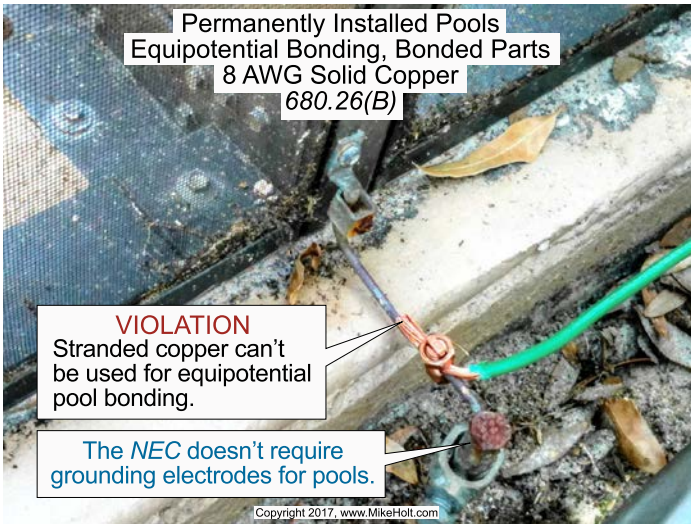


Figure 680–44

Equipotential bonding isn't required to extend to or be attached to any panelboard, service equipment, or grounding electrode.

(1) Concrete Pool Shells. Bonding of concrete pool shells must be in accordance with 680.25(B)(1)(a) or (B)(1)(b).

(a) Structural Reinforcing Steel. Unencapsulated (bare) structural reinforcing steel bonded together by steel tie wires or the equivalent. 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). Figure 680–45

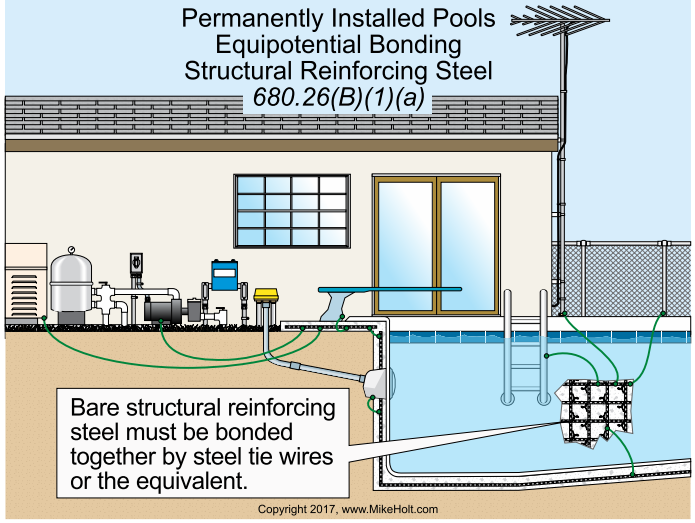


Figure 680–45

(b) Copper Conductor Grid. A copper conductor grid must comply with (b)(1) through (b)(4).

(1) Minimum 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 bonding must extend a minimum of 3 ft horizontally beyond the inside walls of a pool, where not separated from the pool by a permanent wall or building of 5 ft in height. Figure 680–46 and Figure 680–47

Bonding of perimeter surfaces must be in accordance with 680.26(B)(2)(a) or (2)(b) and be attached to the concrete pool reinforcing steel or copper conductor grid at a minimum of four (4) points uniformly spaced around the perimeter of the pool. Figure 680–48

(a) Structural Reinforcing Steel. Structural reinforcing steel bonded together by steel tie wires or the equivalent in accordance with 680.26(B)(1)(a). Figure 680–49

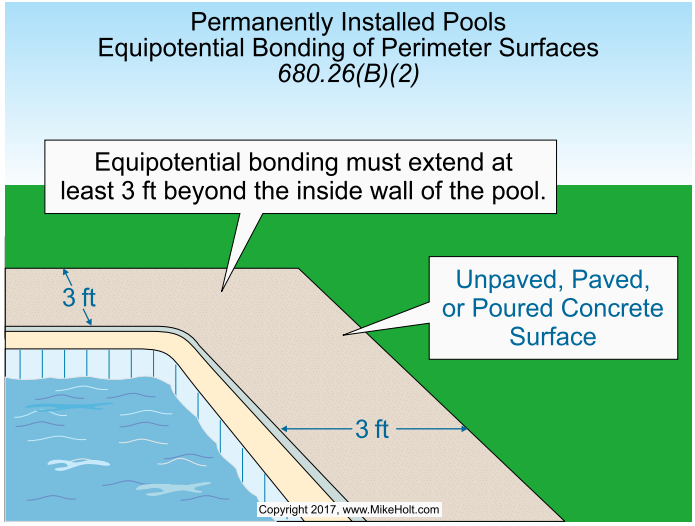


Figure 680–46

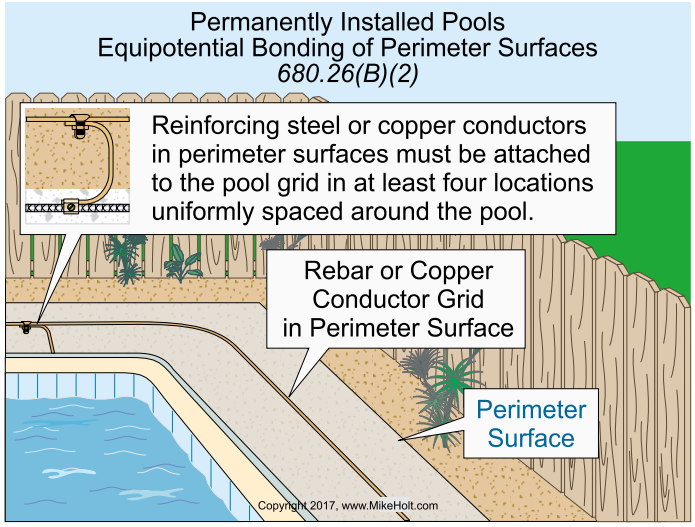


Figure 680–48

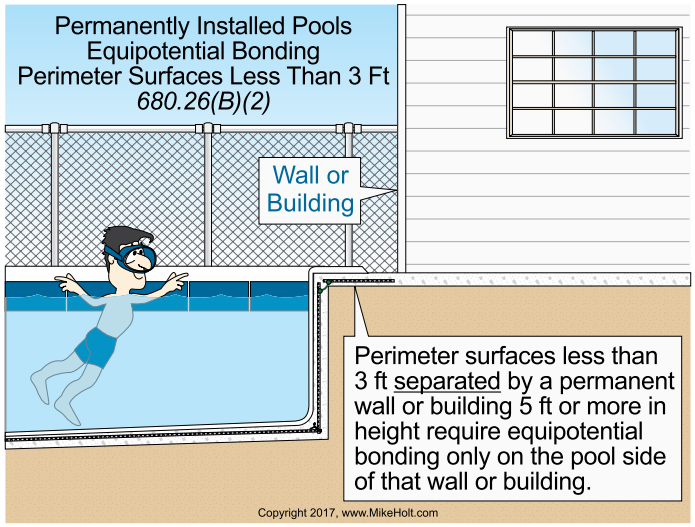


Figure 680–47

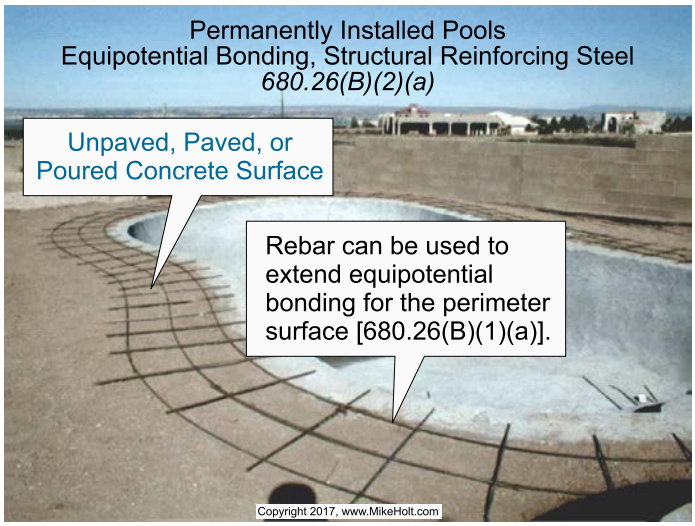


Figure 680–49

Author's Comment:

- The *NEC* doesn't provide any guidance on the installation requirements for structural reinforcing steel when used as a perimeter equipotential bonding method. Figure 680–50

(b) Alternative Means. Where structural reinforcing steel isn't available (or is encapsulated in a nonconductive compound such as epoxy), equipotential bonding meeting all of the following requirements must be installed: Figure 680–51

(1) The bonding conductor must be 8 AWG bare solid copper.

(2) The bonding conductor must follow the contour of the perimeter surface.

(3) Listed splicing devices must be used.

(4) The required conductor must be located between 18 in. and 24 in. from the inside walls of the pool.

(5) The bonding conductor must be secured in or under the deck or unpaved surface within 4 in. to 6 in. below the subgrade.

(3) Metallic Components. Metallic parts of the pool structure must be bonded to the equipotential grid.

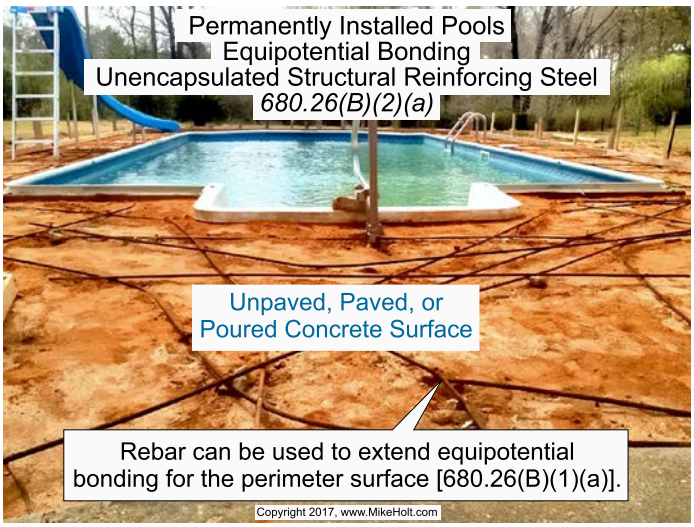


Figure 680–50

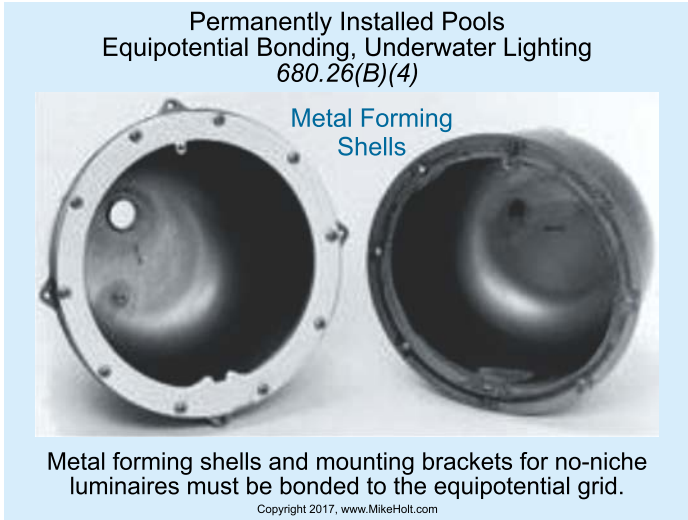


Figure 680–52

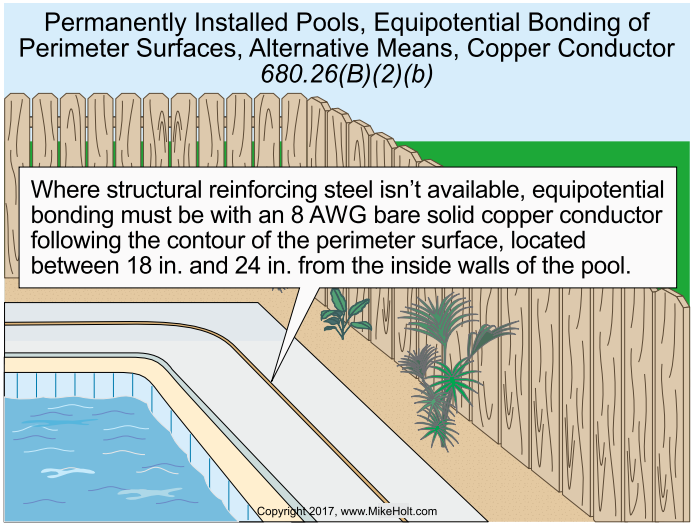


Figure 680–51

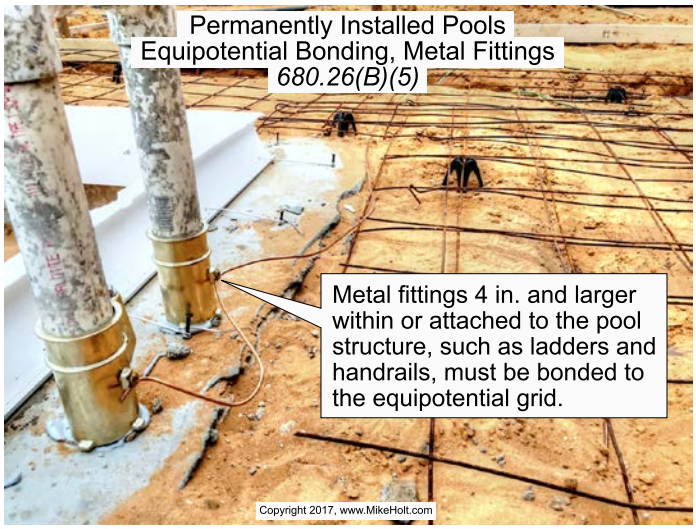


Figure 680–53

(4) Underwater Metal Forming Shells. Metal forming shells must be bonded to the equipotential grid. Figure 680–52

(5) Metal Fittings. Metal fittings 4 in. and larger located within or attached to the pool structure, such as ladders and handrails, must be bonded to the equipotential grid. Figure 680–53

(6) Electrical Equipment. Metal parts of electrical equipment associated with the pool water circulating system, such as water heaters, pump motors, and metal parts of pool covers must be bonded to the equipotential grid. Figure 680–54

Ex: Metal parts of listed double-insulated equipment aren't required to be bonded.

(a) Double-Insulated Water-Pump Motors. If a double-insulated water-pump motor is installed, a solid 8 AWG copper bonding conductor must be provided for a replacement motor.

(7) Fixed Metal Parts. Fixed metal parts must be bonded to the equipotential grid, including but not limited to, metal-sheathed cables and raceways, metal piping, metal awnings, metal fences, and metal door and window frames. Figure 680–55

Ex 1: If separated from the pool structure by a permanent barrier that prevents contact by a person.

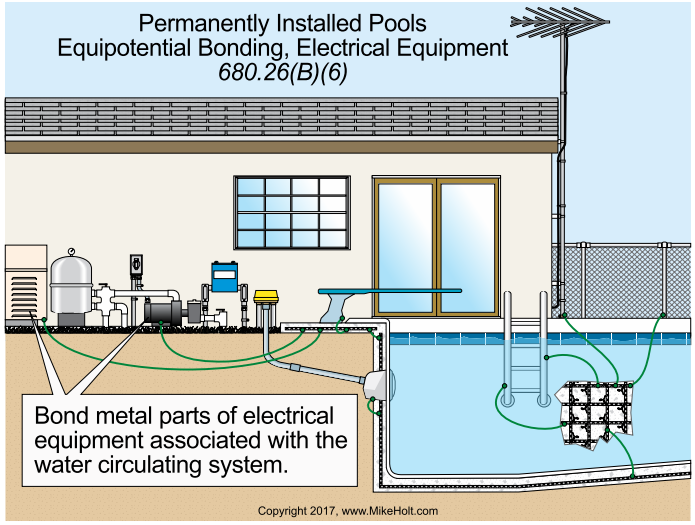


Figure 680–54

Figure 680–55

Ex 2: If located more than 5 ft horizontally from the inside walls of the pool structure. Figure 680–56

Ex 3: If located more than 12 ft measured vertically above the maximum water level.

(C) Pool Water. If the pool water doesn't have an electrical connection to one of the bonded parts described in 680.26(B), an approved corrosion-resistant conductive surface that's at least 9 sq in. must be in contact with the water. The corrosion-resistance conductive surface must be bonded in accordance with 680.26(B), and be located in an area where it won't be dislodged or damaged during normal pool usage. Figure 680–57

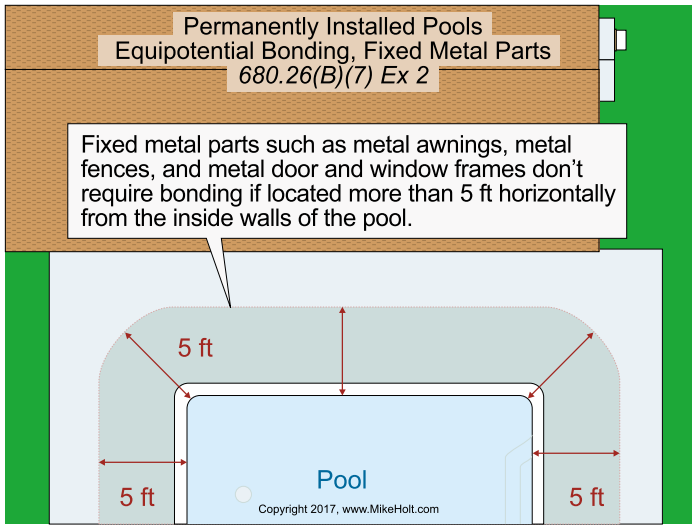


Figure 680–56

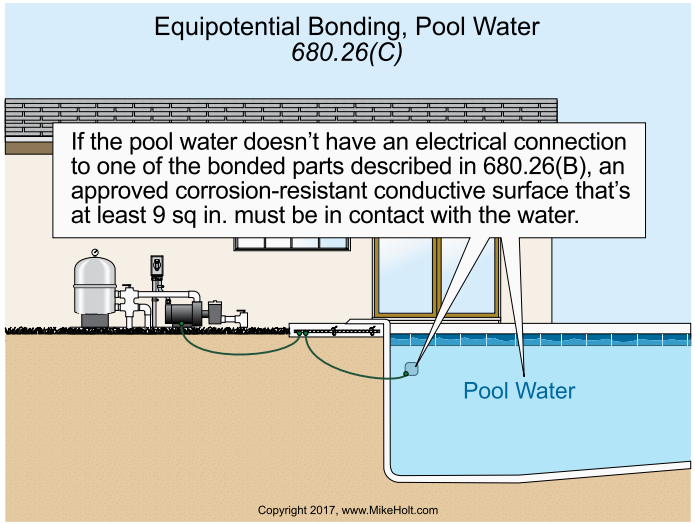


Figure 680–57

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 voltages greater than 15V for sinusoidal alternating current, 21.20V peak for nonsinusoidal alternating current, 30V for continuous direct current, or 12.40V peak for direct current interrupted at a rate of 10 to 200 Hz [680.2 Low-Voltage Contact Limit], must be GFCI protected.

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

680.30 General

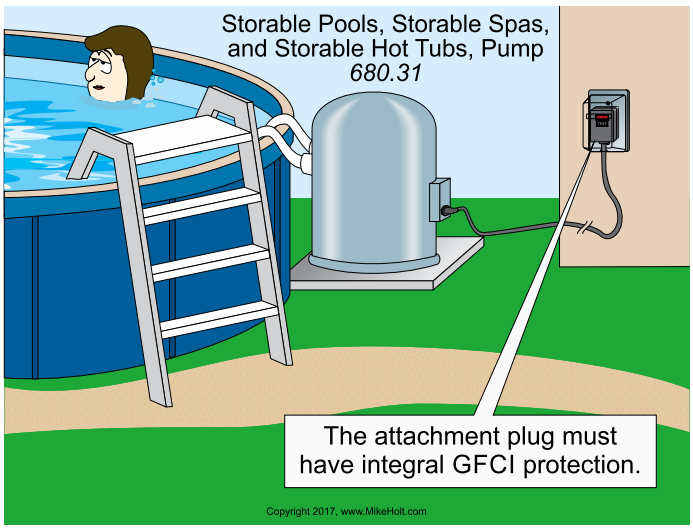
Electrical installations for storable pools, storable spas, and storable hot tubs must also comply with Part I of Article 680.

Author's Comment:

- The requirements contained in Part I of Article 680 include the locations of switches, receptacles, and luminaires.

680.31 Pumps

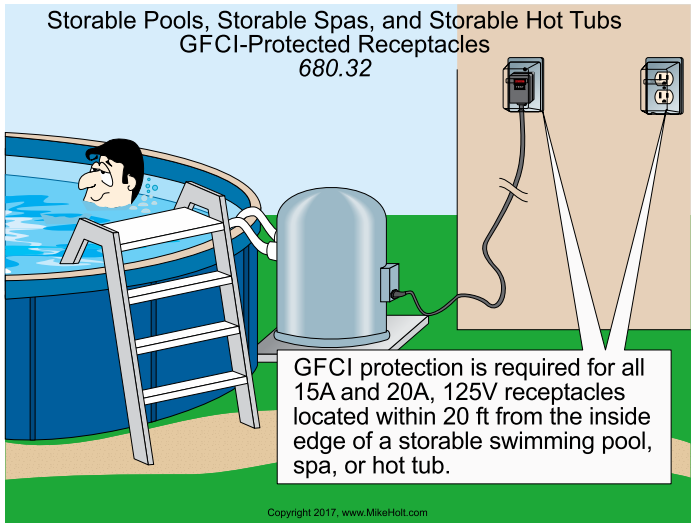
Cord-connected pool pumps must be double insulated and have a means to ground the internal metal parts to an equipment grounding conductor installed with the power-supply conductors in the flexible cord. The flexible cord must also have GFCI protection as an integral part of the attachment plug. ▶Figure 680–58



▶Figure 680–58

680.32 GFCI-Protected Receptacles

GFCI protection is required for electrical equipment associated with storable pools, and is also required for all 15A and 20A, 125V receptacles within 20 ft from the inside wall of a storable pool, storable spa, or storable hot tub. ▶Figure 680–59



▶Figure 680–59

680.34 Receptacle Locations

Receptacles aren't permitted to 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 an appliance flexible cord would follow without passing through a wall, doorway, or window. ▶Figure 680–60

Part IV. Spas and Hot Tubs

680.40 General

Electrical installations for spas and hot tubs must comply with Part I as well.

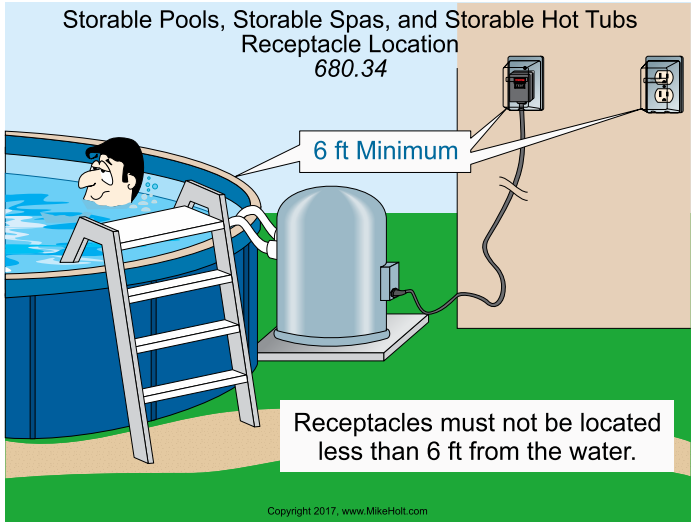


Figure 680–60

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 must be supplied. 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 680–61

Figure 680–61

Author's Comment:

- Either the maintenance disconnect [680.13], or a pushbutton that controls a relay located in accordance with this section can be used to meet the emergency shutoff requirement.
- 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.

680.42 Outdoor Installations

(B) Equipotential Bonding. Equipotential bonding of perimeter surfaces in accordance with 680.26(B)(2) isn't required for outdoor spas and hot tubs if:

(1) The spa or hot tub is listed, labeled, and identified as a self-contained spa or hot tub for aboveground use. Figure 680–62

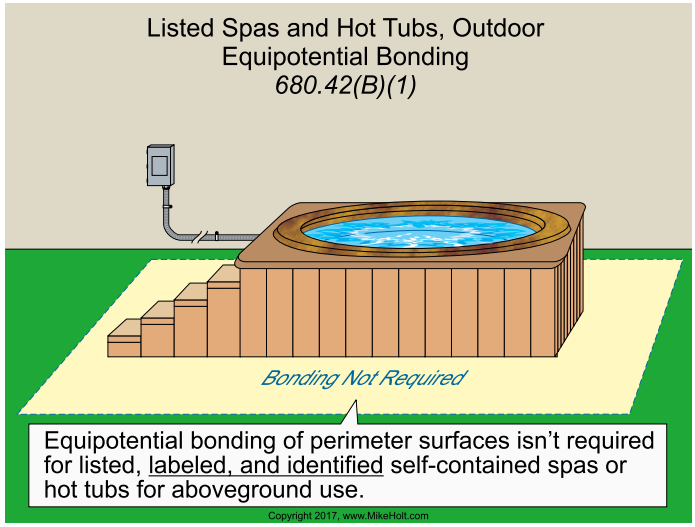


Figure 680–62

(2) The spa or hot tub is not identified as suitable for indoor use.

(3) The spa or hot tub is located on or above grade.

(4) If the top rim of the spa or hot tub is at least 28 in. above a perimeter surface located within 30 in. from the spa or hot tub. Figure 680–63

Figure 680–63

(C) Interior Dwelling Unit Wiring for Outdoor Spas or Hot Tubs. Any Chapter 3 wiring method is permitted in the interior of a dwelling unit for the connection to a motor disconnect and the motor, heating, and control loads that are part of a self-contained spa or hot tub, or a packaged spa or hot tub equipment assembly. Figure 680–64

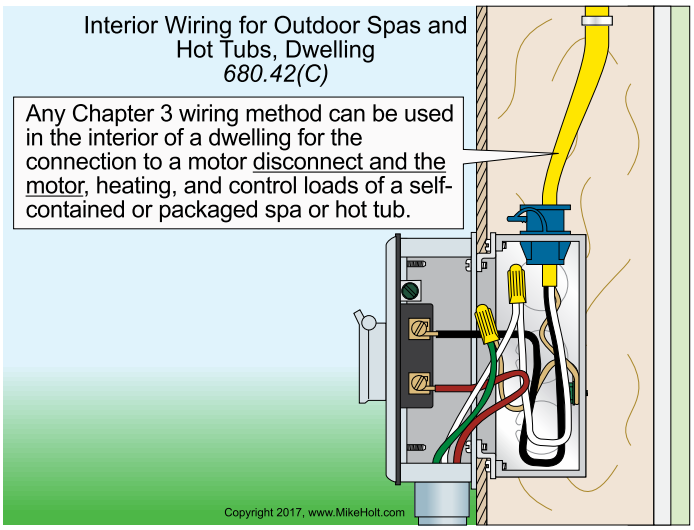


Figure 680–64

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

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

(A) Receptacles. At least one 125V, 15A or 20A 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 680–65

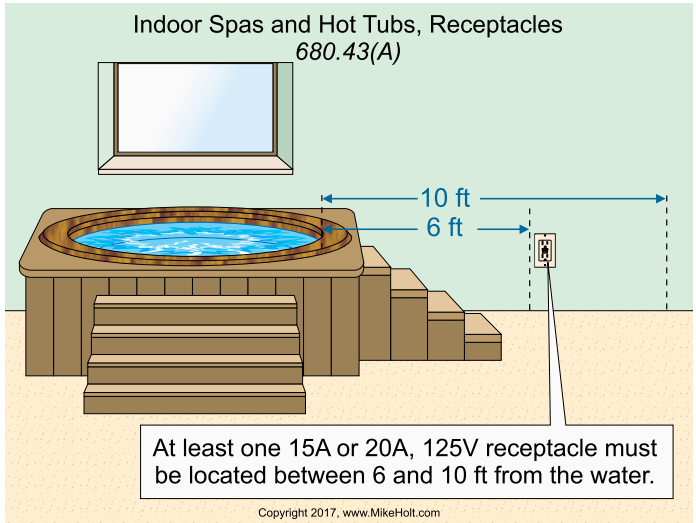


Figure 680–65

(1) Location. Receptacles must be located at least 6 ft measured horizontally from the inside walls of the spa or hot tub.

(2) Protection, General. Receptacles rated 125V, 30A or less and located within 10 ft of the inside walls of a spa or hot tub must be protected by a GFCI. Figure 680–66

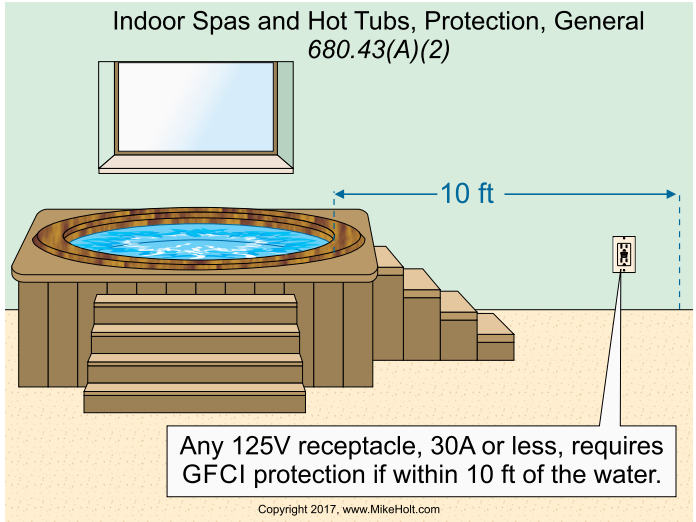
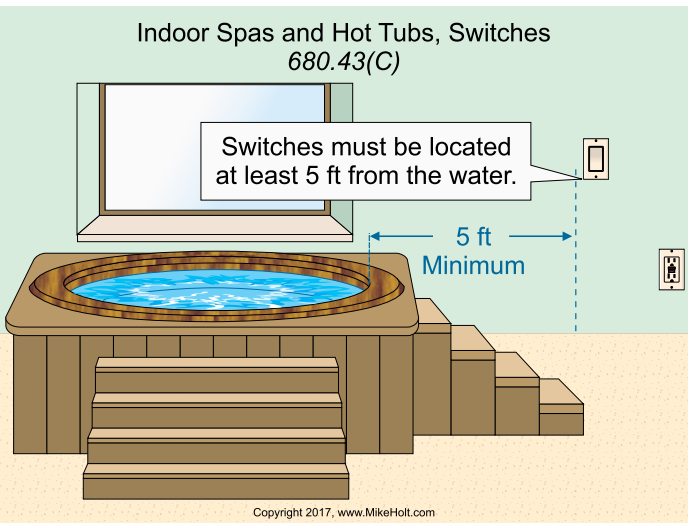


Figure 680–66

(3) Protection, Spa or Hot Tub Supply Receptacle. Receptacles that provide power for a spa or hot tub 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 would follow without piercing a floor, wall, ceiling, doorway with hinged or sliding door, window opening, or other permanent barrier.

(C) Switches. Switches must be located at least 5 ft, measured horizontally, from the inside walls of the spa or hot tub. ▶Figure 680–67



▶Figure 680–67

(D) Bonding. The following parts of an indoor spa or hot tub must be bonded together:

(1) Metal fittings within or attached to the indoor spa or hot tub structure.

(2) Metal parts of electrical equipment associated with the indoor spa or hot tub water circulating system unless part of a listed self-contained spa or hot tub.

(3) Metal raceways and metal piping within 5 ft of the inside walls of the indoor spa or hot tub, and not separated from the indoor spa or hot tub by a permanent barrier.

(4) Metal surfaces within 5 ft of the inside walls of an indoor spa or hot tub not separated from the indoor spa or hot tub area by a permanent barrier.

Ex 1: Nonelectrical equipment, such as towel bars or mirror frames, which aren't connected to metallic piping, aren't required to be bonded.

(E) Methods of Bonding. Metal parts associated with the spa or hot tub as described in 680.43(D) must be bonded by any of the following methods:

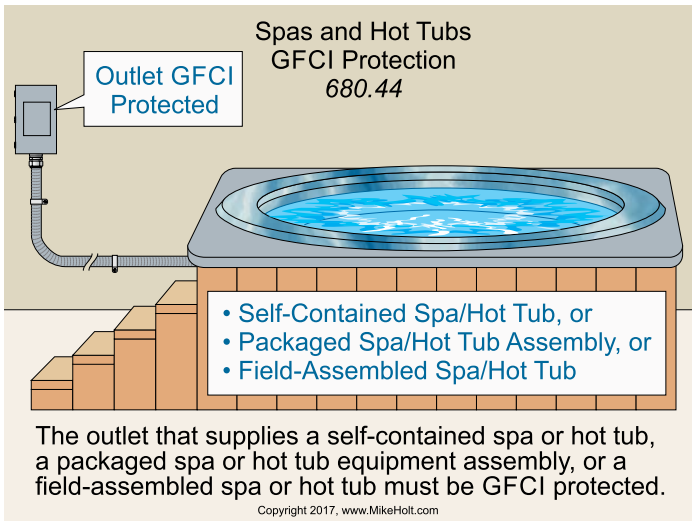
(1) Interconnection of threaded metal piping and fittings

(2) Metal-to-metal mounting to a common frame or base

(3) A solid copper bonding jumper; insulated, covered, or bare, not smaller than 8 AWG

680.44 GFCI Protection

The outlet(s) that supplies a self-contained spa or hot tub, a packaged spa or hot tub equipment assembly, or a field-assembled spa or hot tub must be GFCI protected. ▶Figure 680–68

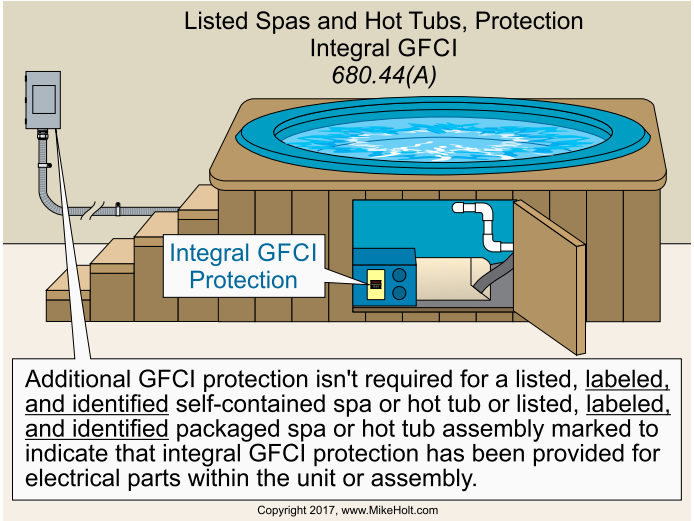


▶Figure 680–68

Author's Comment:

- A self-contained spa or hot tub is a factory-fabricated unit that consists of a spa or hot tub vessel with water circulating, heating, and control equipment integral to the unit. A packaged spa or hot tub equipment assembly is a factory-fabricated unit that consists of water circulating, heating, and control equipment mounted on a common base intended to operate a spa or hot tub [680.2].
- Because this rule applies to all outlets and not just receptacle outlets, a hard-wired indoor spa or hot tub requires GFCI protection. See the definition of "Outlet" in Article 100.

(A) Listed Units. Additional GFCI protection isn't required for a listed, labeled, and identified self-contained spa or hot tub unit or listed, labeled, and identified packaged spa or hot tub assembly marked to indicate that integral GFCI protection has been provided for electrical parts within the unit or assembly. ▶Figure 680–69



▶Figure 680–69

(B) Other Units. GFCI protection isn't required for a field-assembled spa or hot tub rated three-phase, has a voltage rating over 250V, or has a heater load above 50A.

Part V. Fountains

680.50 General

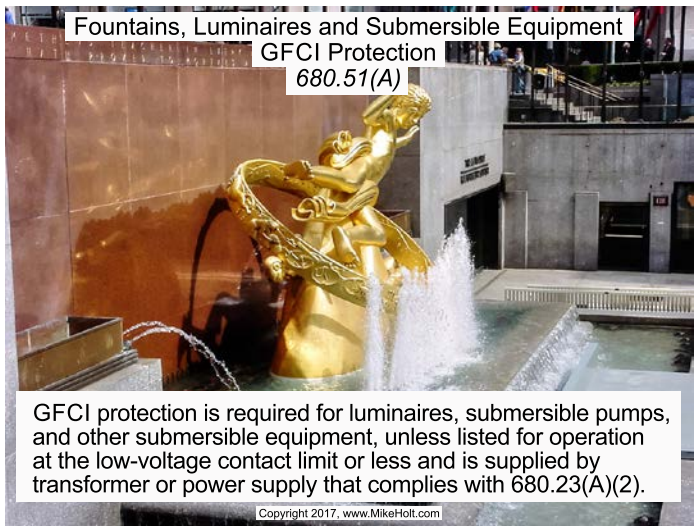
The general installation requirements contained in Part I apply to fountains. In addition, fountains that have water common to a permanently installed pool must comply with Part I and Part II of this article. This part doesn't cover self-contained, portable fountains. Portable fountains must comply with Parts II and III of Article 422.

Author's Comment:

- A "Fountain" is defined as an ornamental, display, or reflection pool [680.2].

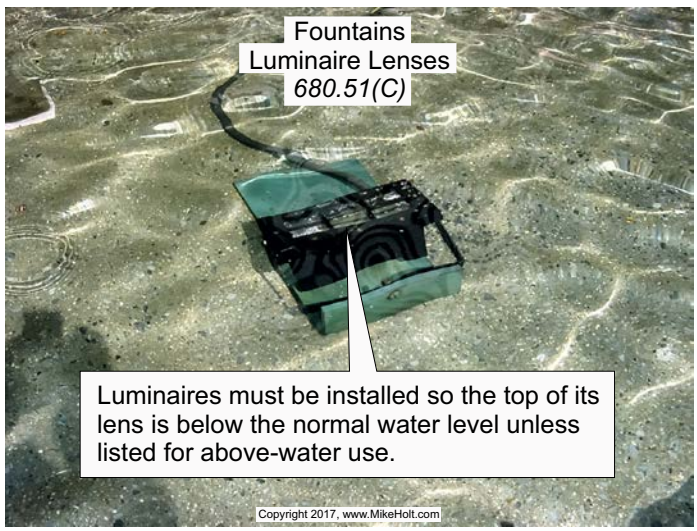
680.51 Luminaires, Submersible Pumps, and Other Submersible Equipment

(A) GFCI protection for Fountain Equipment. GFCI protection is required for luminaires, submersible pumps, and other submersible equipment, unless listed for operation at the low-voltage contact limit or less and is supplied by a transformer or power supply that complies with 680.23(A)(2). ▶Figure 680–70



▶Figure 680–70

(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 680–71



▶Figure 680–71

A luminaire facing upward shall comply with either (1) or (2): ▶Figure 680–72

▶Figure 680–72

(1) Have the lens guarded to prevent contact by any person

(2) Be listed for use without a guard

(E) Cords. The maximum length of each exposed flexible cord in the 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.

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

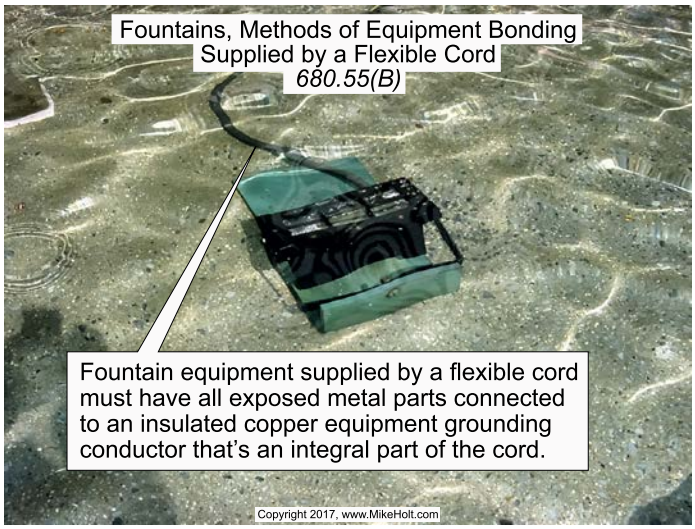
(G) Stability. Equipment must be inherently stable or securely fastened in place.

680.53 Bonding

Metal-piping systems associated with a fountain must be bonded to the circuit equipment grounding conductor of the branch circuit that supplies the fountain equipment.

680.55 Methods of Equipment Grounding

(B) Supplied by a Flexible Cord. Fountain equipment supplied by a flexible cord must have all exposed metal parts connected to an insulated copper equipment grounding conductor that's an integral part of the cord. ▶Figure 680–73



▶Figure 680–73

680.56 Cord-and-Plug-Connected Equipment

(A) GFCI Protection of Cord-and-Plug Equipment. Cord-and-plug-connected fountain equipment must be GFCI protected.

(B) Cord Type. Flexible cords immersed in or exposed to water must be of the extra-hard usage type, as designated in Table 400.4, and must be listed and marked with a "W" suffix.

680.57 Electric Signs in or Adjacent to Fountains

(B) GFCI Protection of Sign Equipment. 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 [680.57(A)]. ▶Figure 680–74

680.58 GFCI Protection for Adjacent Receptacles

GFCI protection is required for 15A and 20A, 125V through 250V receptacles located within 20 ft of the inside walls of a fountain. ▶Figure 680–75

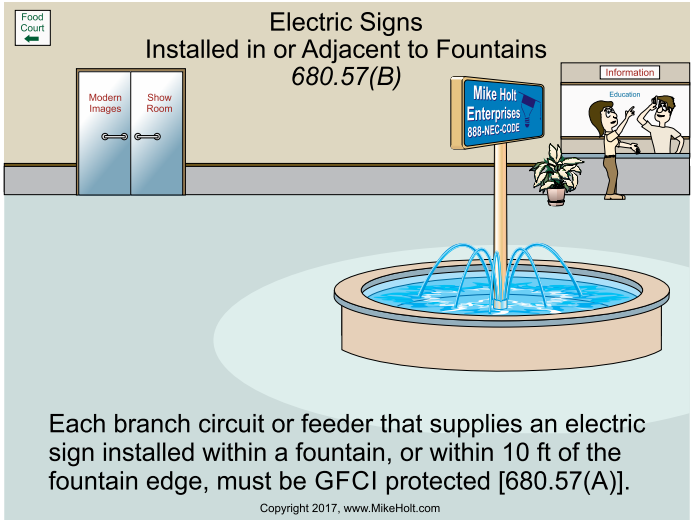


Figure 680–74

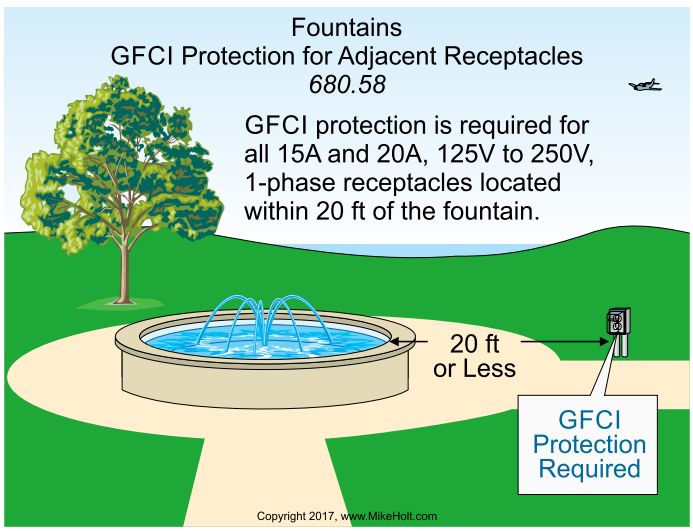


Figure 680–75

Part VII. Hydromassage Bathtubs

680.70 General

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

Author's Comment:

- 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 [680.2].

680.71 GFCI Protection

Hydromassage bathtubs and their associated electrical components must be on an individual branch circuit protected by a readily accessible GFCI. In addition, GFCI protection is required for receptacles rated 30A or less at 125V located within 6 ft of the inside walls of a hydromassage bathtub. Figure 680–76 and Figure 680–77

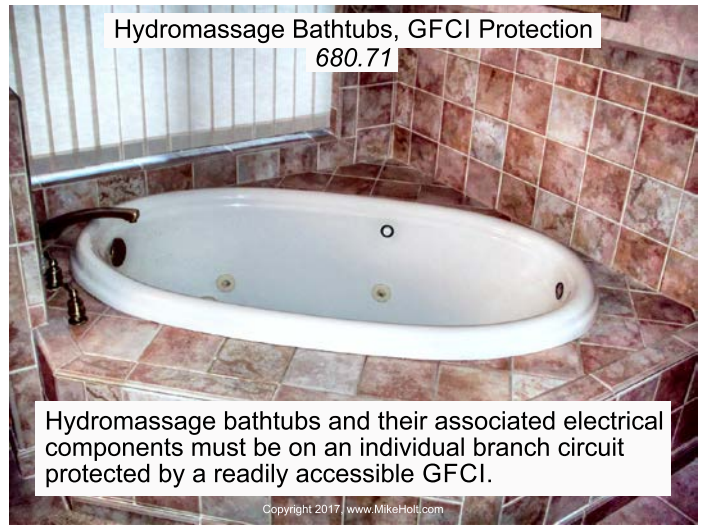


Figure 680–76

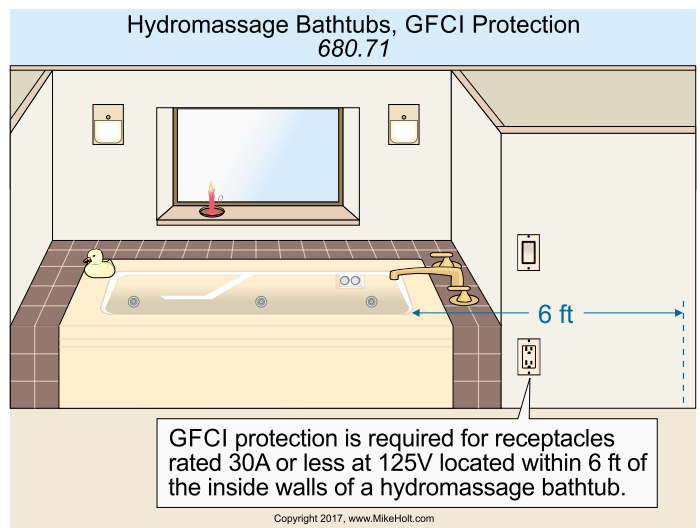


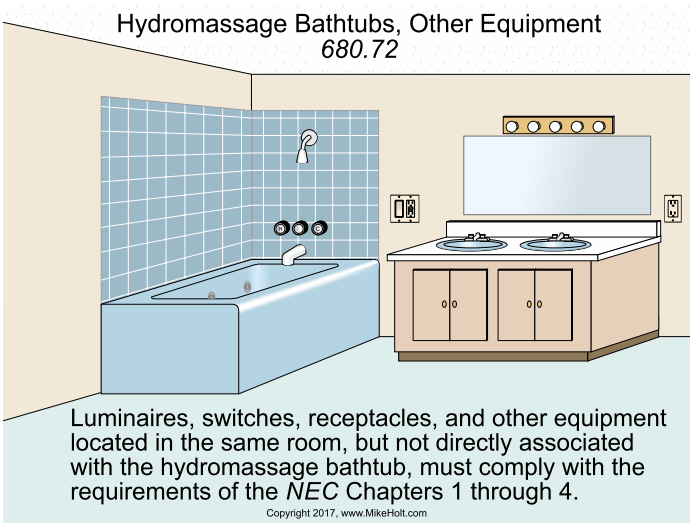
Figure 680–77

Author's Comment:

- The circuit for a hydromassage bathtub must be installed in accordance with the manufacturer's instructions included in the listing and labeling, which will typically include amperage requirements and may require separate circuits for the pump and heater [110.3(B)].

680.72 Other Electrical Equipment

Luminaires, switches, receptacles, and other electrical equipment located in the same room and not directly associated with a hydromassage bathtub must be installed in accordance with Chapters 1 through 4. ▶Figure 680–78



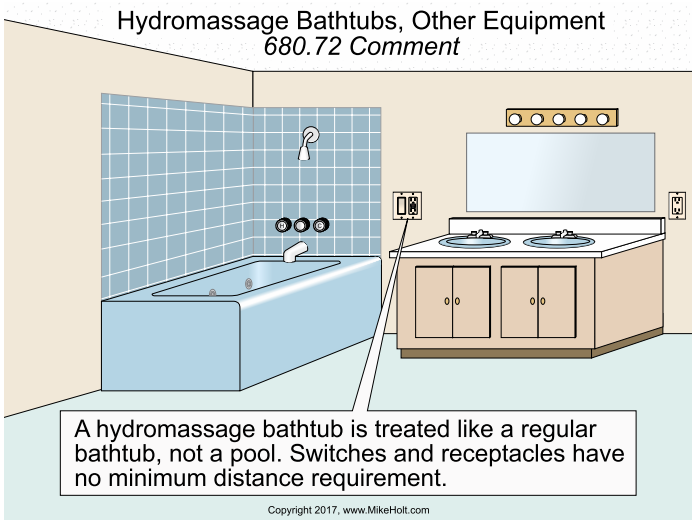
▶Figure 680–78

Author's Comment:

- A hydromassage bathtub is treated like a regular bathtub, not a pool. Switches and receptacles have no minimum distance requirement. ▶Figure 680–79

680.73 Accessibility

Electrical equipment for hydromassage bathtubs must be capable of being removed or exposed without damaging the building structure or finish. 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 within 1 ft of the opening. ▶Figure 680–80



▶Figure 680–79

▶Figure 680–80

680.74 Equipotential Bonding

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

(1) Metal fittings within or attached to the hydromassage tub structure that are in contact with the circulating water.

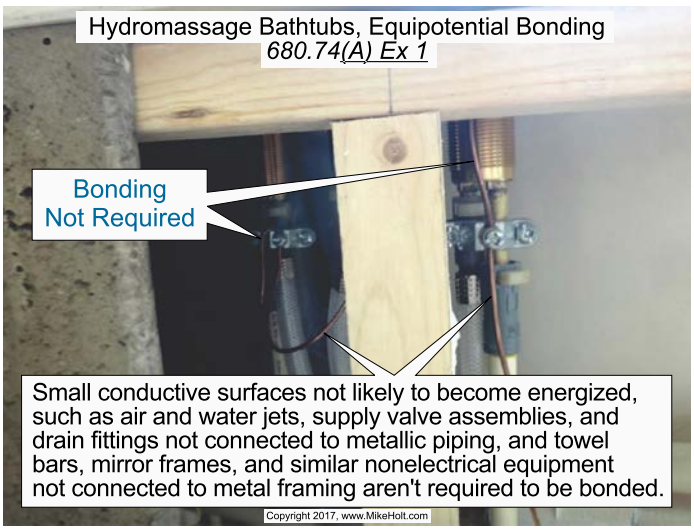
(2) Metal parts of electrical equipment associated with the hydromassage tub water circulating system, including pump and blower motors.

(3) Metal-sheathed cables, metal raceways, and metal piping within 5 ft of the inside walls of the hydromassage tub and not separated from the tub area by a permanent barrier.

(4) Exposed metal surfaces within 5 ft of the inside walls of the hydromassage tub and not separated from the tub by a permanent barrier.

(5) Electrical devices not associated with the hydromassage tubs located within 5 ft from the hydromassage tub.

Ex 1: Small conductive surfaces not likely to become energized, such as air and water jets, supply valve assemblies, and drain fittings not connected to metallic piping, and towel bars, mirror frames, and similar nonelectrical equipment not connected to metal framing aren't required to be bonded. ▶Figure 680–81



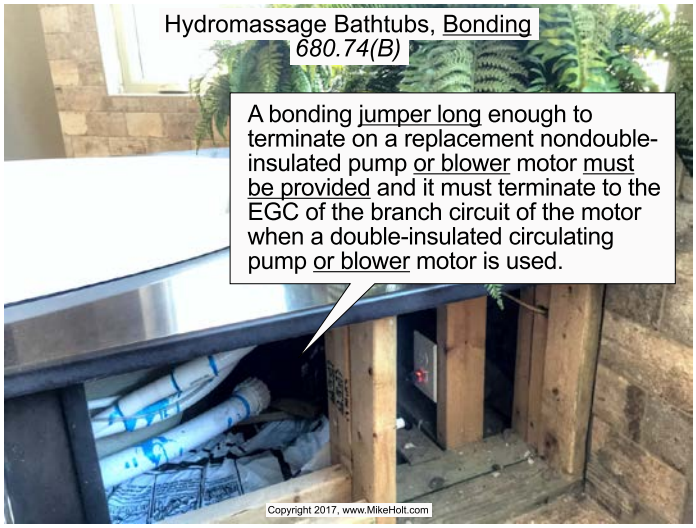
▶Figure 680–81

Ex 2: Double-insulated motors and blowers aren't required to be bonded.

(B) Bonding Conductor. Metal parts required to be bonded by 680.74(A) must be bonded together using a solid copper conductor not smaller than 8 AWG. The bonding jumper isn't required to be extended or attached to any remote panelboard, service equipment, or any electrode. ▶Figure 680–82

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. ▶Figure 680–83

▶Figure 680–82



▶Figure 680–83

Part VIII. Electrically Powered Pool Lifts

680.81 Equipment Approval

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

Ex 1: Lifts where the battery is removed for charging at another location and the battery is rated less than or equal to the low-voltage contact limit.

Ex 2: Solar-operated or solar-recharged lifts where the solar panel is attached to the lift and the battery is rated less than or equal to 24V.

Ex 3: Lifts that are supplied from a source not exceeding the low-voltage contact limit and supplied by listed transformers or power supplies that comply with 680.23(A)(2).

680.82 Protection

Electrically powered pool lifts operating at voltages greater than 15V for sinusoidal alternating current, 21.20V peak for nonsinusoidal alternating current, 30V for continuous direct current, or 12.40V peak for direct current interrupted at a rate of 10 to 200 Hz [680.2 Low-Voltage Contact Limit] must be GFCI protected.

680.83 Bonding

Electrically powered pool lifts must be bonded in accordance with 680.26(B)(5) and (B)(7). ▶Figure 680–84

680.84 Switching Devices

Switches operating at voltages greater than 15V for sinusoidal alternating current, 21.20V peak for nonsinusoidal alternating current, 30V for continuous direct current, or 12.40V peak for direct current interrupted at a rate of 10 to 200 Hz [680.2 Low-Voltage Contact Limit] must comply with 680.22(C).

▶Figure 680–84