

Article 680 Swimming Pools, Spas, Hot Tubs, Fountains, and Similar Installations Part 2

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680.26 Equipotential Bonding.

(A) Performance. Equipotential bonding is intended to reduce voltage gradients in the area around a permanently installed pool, outdoor spa, or outdoor hot tub by the use of a common bonding grid in accordance with 680.26(B) and (C).

(B) Bonded Parts. The parts of a permanently installed pool, outdoor spa, or outdoor hot tub 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 [250.8(A)]. Figure 680–28



Figure 680-28

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

(1) Concrete Pool, Outdoor Spa, and Outdoor Hot Tub Shells.

(a) Structural Reinforcing Steel. Unencapsulated structural reinforcing steel in concrete shells secured together by steel tie wires. Figure 680–29

(2) Perimeter Surfaces. An equipotential bonding grid must extend 3 ft horizontally beyond the inside walls of a pool, outdoor spa, or outdoor hot tub, including unpaved, paved, and poured concrete surfaces. Figure 680–30

The bonding grid must comply with (a) or (b) and be attached to the conductive pool reinforcing steel at a minimum of four points uniformly spaced around the perimeter of the walls of a pool, outdoor spa, or outdoor hot tub.





Figure 680–30

(a) Structural Reinforcing Steel. Unencapsulated structural reinforcing steel in concrete shells secured together by steel tie wires [680.26(B)(1)(a)]. Figure 680–31

Author's Comment: The 2008 *NEC* doesn't provide any guidance on the installation requirements for structural reinforcing steel when used as a perimeter equipotential bonding grid.

(b) Alternate Means. Equipotential bonding conductor meeting all of the following requirements: Figure 680–32

(1) 8 AWG bare solid copper bonding conductor.







Figure 680-32

- (2) The bonding conductor must follow the contour of the perimeter surface.
- (3) Listed splicing devices.
- (4) Bonding conductor must be 18 to 24 in. from the inside walls of the pool.
- (5) Bonding conductor must be secured within or under the perimeter surface 4 to 6 in. below the subgrade.

(3) Metallic Components. Metallic parts of the pool, outdoor spa, or outdoor hot tub structure must be bonded to the equipotential grid.

(4) Underwater Metal Forming Shells. Metal forming shells and mounting brackets for luminaires and speakers must be bonded to the equipotential grid.

(5) Metal Fittings. Metal fittings sized 4 in. and larger that penetrate into the pool, outdoor spa, or outdoor hot tub structure, such as ladders and handrails must be bonded to the equipotential grid.

(6) Electrical Equipment. Metal parts of electrical equipment associated with the pool, outdoor spa, or outdoor hot tub water circulating system, such as water heaters and pump motors and metal parts of pool covers must be bonded to the equipotential grid. Figure 680–33



Figure 680–33

Exception: Metal parts of listed equipment incorporating an approved system of double insulation are not required to be bonded to the equipotential grid.

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

(b) Pool Water Heaters. Pool water heaters must be grounded and bonded in accordance with equipment instructions.

(7) Metal Wiring Methods and Equipment. Metal-sheathed cables and raceways, metal piping, and all fixed metal parts must be bonded to the equipotential grid.

Exception No. 1: Where separated from the pool, outdoor spa, or outdoor hot tub structure by a permanent barrier.

Exception No. 2: Where located more than 5 ft horizontally of the inside walls of the pool, outdoor spa, or outdoor hot tub structure.

Exception No. 3: Where located more than 12 ft measured vertically above the maximum water level.

(C) Pool Water. A minimum conductive surface area of 9 sq in. must be installed in contact with the pool, outdoor spa, or outdoor hot tub structure water. This water bond is permitted to consist of metal parts that are required to be bonded in 680.26(B). Figure 680–34



Figure 680-34

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, outdoor spa, or outdoor hot tub, unless separated by a permanent barrier.

(2) Wiring Methods. The electric motor and controller circuit must be GFCI protected.

PART III. STORABLE SWIMMING POOLS

680.30 General. Electrical installations for storable pools 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 run with the power-supply conductors in the flexible cord. The cord must also have GFCI protection as an integral part of the attachment plug. Figure 680–35



Figure 680–35

680.32 GFCI-Protected Receptacles. GFCI protection is required for electrical equipment used with storable pools. Figure 680–36

The measured distance is the shortest path a supply cord connected to the receptacle would follow without piercing a floor, wall, ceiling, doorway with hinged or sliding door, window opening, or other effective permanent barrier.

Author's Comment: This requirement mirrors the requirements contained in 680.25(A)(5) and (6) for permanently installed pools.





680.34 Receptacle Locations. Receptacles must not be located less than 6 ft from the inside walls of a storable pool. The receptacle distance is measured as the shortest path an appliance cord would follow without passing through a wall, doorway, or window. Figure 680–37



Figure 680-37

PART IV. SPAS AND HOT TUBS

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

680.41 Emergency Switch for Spas and Hot Tubs. In other than a single-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, but adjacent to and within sight of the spa or hot tub. Figure 680–38





Author's Comments:

- Either the maintenance disconnecting means required by 680.12 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. Electrical installations for outdoor spas or hot tubs must comply with Parts I and II of this article, except as permitted for (B) or (C).

(B) Bonding. Bonding is permitted by mounting equipment to a metal frame or base. Metal bands that secure wooden staves aren't required to be bonded.

(C) Interior Wiring for Outdoor Spas or Hot Tubs. Any Chapter 3 wiring method containing a copper equipment grounding conductor insulated or enclosed within the outer sheath of the wiring method and not smaller than 12 AWG is permitted in the interior of a one-family dwelling for the connection to 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.

Wiring to an underwater light must comply with 680.23 or 680.33.

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 can be connected by any of the wiring methods contained in Chapter 3.

Exception: Listed packaged units rated 20A or less can be cord-and-plug-connected.

(A) Receptacles. At least one 15A or 20A, 125V receptacle must be located at least 6 ft, but not more than 10 ft, from the inside wall of the spa or hot tub. Figure 680–39



Figure 680-39

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

(2) GFCI-Protected Receptacles. Receptacles rated 30A or less at 125V, located within 10 ft of the inside walls of an indoor spa or hot tub, must be GFCI protected. Figure 680–40



Figure 680–40

(3) Spa or Hot Tub Receptacle. Receptacles that provide power for an indoor spa or hot tub must be GFCI protected.

(4) Measurements. In determining the above dimensions, the distance to be measured must be the shortest path that the supply cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, doorway with hinged or sliding door, window opening, or other effective permanent barrier.

(B) Luminaires and Ceiling Fans.

(1) Elevation. Luminaires and ceiling fans within 5 ft, measured horizontally, from the inside walls of the indoor spa or hot tub must be:

- (a) Not less than 12 ft above an indoor spa or hot tub where no GFCI protection is provided.
- (b) Not less than 7½ ft above an indoor spa or hot tub where GFCI protection is provided.
- (c) Luminaires and ceiling fans can be mounted less than 7¹/₂ ft above an indoor spa or hot tub, if GFCI protection is provided and the installation meets either of the following requirements:
- (1) Recessed luminaires with a glass or plastic lens, nonmetallic or electrically isolated metal trim, and suitable for use in damp locations.

Author's Comment: See the definition of "Location, Damp" in Article 100.

(2) Surface-mounted luminaires with a glass or plastic globe, a nonmetallic body, or a metallic body isolated from contact, and suitable for use in damp locations.

(C) Switches. Switches must be located not less than 5 ft, measured horizontally, from the inside walls of the indoor spa or hot tub. Figure 680–41



Figure 680-41

(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.
- (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.

Exception No. 1: Nonelectrical equipment, such as towel bars or mirror frames, which aren't connected to metallic piping, aren't required to be bonded.

Exception No. 2: Metal parts of a listed self-contained spa or hot tub.

(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) Threaded metal piping and fittings

- (2) Metal-to-metal mounting to a common frame or base
- (3) A solid copper conductor not smaller than 8 AWG

680.44 GFCI Protection. The outlet that supplies a selfcontained indoor spa or hot tub, a packaged spa or hot tub equipment assembly, or a field-assembled spa or hot tub must be GFCI protected. Because this rule applies to all outlets and not just receptacle outlets, a hard-wired indoor spa or hot tub would require GFCI protection. See the definition of "Outlet" in Article 100. Figure 680–42



field-assembled spa or hot tub must be GFCI protected.

Figure 680–42

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 all 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].

(A) Listed Units. Additional GFCI protection isn't required for a listed self-contained spa or hot tub unit or listed 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 680–43





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

(C) Combination Pool and Spa or Hot Tub. GFCI protection isn't required for equipment that supplies a combination pool/hot tub or spa assembly.

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.

Author's Comment: Fountain. An ornamental, display, or reflection pool [680.2].

680.51 Luminaires, Submersible Pumps, and Other Submersible Equipment.

(A) GFCI Protection for Fountain Equipment. The branch circuit that supplies luminaires, submersible pumps, and other submersible equipment must be GFCI protected, unless the equipment is listed for not more than 15V and is supplied by a listed pool transformer that complies with 680.23(A)(2).

(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 680–44



Figure 680–44

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

680.56 Cord-and-Plug-Connected Equipment.

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

(B) Cord Type. Flexible cords immersed in or exposed to water must be of the hard-service type, as designated in Table 400.4, and must be marked "Water-Resistant."

680.57 Signs in or Adjacent to Fountains.

(B) GFCI Protection of Sign Equipment. Each circuit that supplies a sign installed within a fountain, or within 10 ft of the fountain edge, must be GFCI protected [680.57(A)]. Figure 680–45



be GFCI protected [680.57(A)]

Figure 680-45

680.58 GFCI-Protected Receptacles. GFCI protection is required for all 15A and 20A, 125V through 250V receptacles located within 20 ft of the inside walls of a fountain. Figure 680-46



Figure 680-46

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: Hydromassage Bathtub. 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 all receptacles rated 30A or less at 125V located within 6 ft of the inside walls of a hydromassage bathtub. Figure 680-47



Figure 680–47

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.

Author's Comment: A hydromassage bathtub is treated like a regular bathtub. For example, a 5 ft clearance isn't required for switches or receptacles, and the fixtures must be installed in accordance with 410.4(D). Figure 680–48



Figure 680-48

680.73 Accessibility. Electrical equipment for hydromassage bathtubs must be capable of being removed or exposed without damaging the building structure or finish.

680.74 Equipotential Bonding. If the building contains a metal piping system, it must be bonded, with a solid copper conductor not smaller than 8 AWG, to the circulating pump if it's not double insulated.

The equipotential hydromassage bonding jumper is not required to be bonded to any remote panelboard, service equipment, or electrode. Figure 680–49



Figure 680-49

RTICLE

580 Practice Questions

ARTICLE 680. SWIMMING POOLS, SPAS, HOT TUBS, FOUNTAINS, AND SIMILAR INSTALLATIONS—PRACTICE QUESTIONS

- 1. A spa or hot tub is a hydromassage pool or tub and is not designed to have the contents drained or discharged after each use.
 - (a) True
 - (b) False
- 2. Insulated overhead utility service conductors that are cabled together with a bare messenger and operate at not over 750 volts-to-ground shall maintain a _____ clear-ance in any direction to the water level.
 - (a) 14 ft
 (b) 16 ft
 (c) 20 ft
 (d) 22¹/₂ ft
- 3. All electric pool water heaters shall have the heating elements not exceed _____.
 - (a) 20A
 (b) 35A
 (c) 48A
 (d) 60A
- 4. Electric swimming pool equipment can be installed in pits where drainage adequately prevents water accumulation during abnormal operation.
 - (a) True(b) False
- 5. Grounding-type GFCI-protected receptacles of the single and locking type for motors related to the circulation and sanitation system of a pool can be located not less than _____ from the inside walls of the pool.

(a) 3 ft

- (b) 6 ft
- (c) 8 ft (d) 12 ft

 Circuits rated 15A or 20A, 125V or 250V supplying pool pump motors for a permanently installed pool shall be ______ whether the pump is cord-and-plug-connected or direct connected.

(a) AFCI protected(b) GFCI protected(c) a or b(d) a and b

- 7. A pool transformer used for the supply of underwater luminaires, together with the transformer enclosure, shall _____.
 - (a) be of the isolated-winding type with an ungrounded secondary
 - (b) have a grounded metal barrier between the primary and secondary windings
 - (c) be listed for the purpose
 - (d) all of these
- When PVC conduit extends from the pool light forming shell to a pool junction box, an 8 AWG _____ conductor shall be installed in the raceway.
 - (a) solid bare
 - (b) solid insulated
 - (c) stranded insulated
 - (d) b or c
- 9. EMT where installed on buildings, is permitted to contain branch-circuit wiring for underwater pool luminaires.
 - (a) True
 - (b) False
- 10. The junction box connected to a conduit that extends to the forming shell of the luminaire that operates at over 15V shall be located not less than _____ above the ground level or pool deck.
 - (a) 4 in.
 (b) 6 in.
 (c) 8 in.
 (d) 12 in.

- 11. The enclosure for a transformer or ground-fault circuit interrupter connected to a conduit that extends directly to a pool light forming shell shall be _____ for this purpose.
 - (a) labeled
 - (b) listed
 - (c) approved
 - (d) a and b
- 12. The feeder to a swimming pool panelboard at a separate building or structure can be supplied with any Chapter 3 wiring method provided the feeder has a separate insulated copper equipment grounding conductor.
 - (a) True
 - (b) False
- 13. The pool structure, including the reinforcing metal of the pool shell and deck, shall be bonded together.
 - (a) True
 - (b) False
- 14. The electric motors, controllers, and wiring for an electrically operated pool cover shall be _____.

(a) located at least 5 ft from the inside wall of the pool(b) separated from the pool by a permanent barrier(c) a and b

- (d) a or b
- 15. Electric equipment, including power-supply cords, used with storable pools shall be _____.
 - (a) AFCI protected
 - (b) GFCI protected
 - (c) a or b
 - (d) none of these
- 16. Listed packaged spa or hot tub equipment assemblies, or self-contained spas or hot tubs installed outdoors, are permitted to have flexible connections using _____.
 - (a) LFMC or LFNC in lengths of not more than 6 ft(b) cords not longer than 15 ft, where GFCI protected(c) a or b(d) none of these
- 17. Receptacles rated 30A or less, 125V within 10 ft of the inside walls of an indoor spa or hot tub, shall be _____.
 - (a) GFCI protected(b) AFCI protected(c) a or b(d) none of these

- Surface-mounted luminaires _____ located over or within 5 ft, measured horizontally, from the inside walls of an indoor spa or hot tub can be installed at less than 7 ft 6 in. above the maximum water level when GFCI protected.
 - (a) with a glass or plastic globe
 - (b) with a nonmetallic body or a metallic body isolated from contact
 - (c) suitable for use in a damp location
 - (d) all of these
- 19. Metal raceways and metal piping within _____ of the inside walls of an indoor spa or hot tub, and not separated from the indoor spa or hot tub by a permanent barrier, shall be bonded.
 - (a) 4 ft
 - (b) 5 ft
 - (c) 7 ft
 - (d) 12 ft
- 20. The branch circuit supplying submersible fountain equipment shall be _____, unless the equipment is listed for operation at not more than 15V.
 - (a) 240V(b) GFCI protected(c) a and b(d) none of these
- 21. Metal piping systems associated with a fountain shall be bonded to the equipment grounding conductor of the
 - (a) branch circuit supplying the fountain
 - (b) bonding grid
 - (c) equipotential plane
 - (d) grounding electrode system
- 22. Flexible cords immersed in or exposed to water in a fountain shall be _____.
 - (a) extra-hard usage type
 - (b) listed with a "W" suffix
 - (c) encased in not less than 2 in. of concrete
 - (d) a and b

- 23. All 15A and 20A, single-phase, 125V through 250V receptacles located within _____ of a fountain edge shall have GFCI protection.
 - (a) 8 ft
 - (b) 10 ft
 - (c) 15 ft
 - (d) 20 ft

- 24. Hydromassage bathtub electrical equipment shall be _____ without damaging the building structure or building finish.
 - (a) readily accessible
 - (b) accessible
 - (c) within sight
 - (d) none of these

680 Answer Key

- 1. (a) 680.2, Spa or Hot Tub
- 2. (d) 680.8 Table
- 3. (c) 680.9
- 4. (a) 680.11
- 5. (b) 680.22(A)(1)
- 6. (b) 680.22(B)
- 7. (d) 680.23(A)(2)
- 8. (d) 680.23(B)(2)(b)
- 9. (a) 680.23(F)(1)
- 10. (a) 680.24(A)(2)(a)
- 11. (d) 680.24(B)(1)
- 12. (b) 680.25(A)
- 13. (a) 680.26(B)(1)
- 14. (d) 680.27(B)(1)
- 15. (b) 680.32
- 16. (c) 680.42(A)(1) and (2)
- 17. (a) 680.43(A)(2)
- 18. (d) 680.43(B)(1)(c)(2)
- 19. (b) 680.43(D)(3)
- 20. (b) 680.51(A)
- 21. (a) 680.53
- 22. (d) 680.56(B)
- 23. (d) 680.58
- 24. (b) 680.73