

## **Definitions for swimming pools, fountains, and similar installations in article 680**

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

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

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

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

**Permanently Installed Swimming, Wading, Immersion, and Therapeutic Pools.** Those that are constructed in the ground or partially in the ground, and all others capable of holding water in a depth greater than 1.0 m (42 in.), and all pools installed inside of a building, regardless of water depth, whether or not served by electrical circuits of any nature.

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### **1. A fixture that is sealed from the entry of water that is installed in the floor or wall of pools, spas, or fountains?**

- A. Wet-niche Luminaire
- B. No-niche Luminaire
- C. Dry-niche Luminaire
- D. Through-wall lighting assembly

### **2. A spa or Hot tub that is fabricated at a factory that comes with control equipment, heating, and water-circulating equipment that is intended to use as such.**

- A. Spa or hot tub
- B. Packaged spa or hot tub equipment assembly
- C. Portable equipment
- D. Cord-and-plug-connected equipment

**3. Bathtubs with a recirculating piping system, pump, and associated equipment that is designed to be permanently installed.**

- A. Hydro massage bathtub
- B. Spa or hot tub
- C. Pool
- D. Equipment, fixed

**4. Primarily constructed for their aesthetic value they are either in the ground, on the ground, or in a building and cannot be readily disassembled for storage.**

- A. Permanently Installed Swimming, Wading, Immersion, and Therapeutic Pools
- B. Storable Swimming, Wading, or Immersion Pool
- C. Fountains
- D. Permanently installed decorative fountains and reflection pools

**5. With a purpose of holding water greater than the depth of 1.0 m (42 in.) and pools that are installed inside buildings, regardless of water depth are considered?**

- A. Contained Permanently Installed Swimming, Wading, Immersion, and Therapeutic Pools
- B. Permanently Installed Decorative Fountains and Reflection Pools
- C. Storable Swimming, Wading, or Immersion Pool
- D. Self Therapeutic Tubs or Hydrotherapeutic Tanks

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

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

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

**Storable Swimming, Wading, or Immersion Pool.** Those that are constructed on or above the ground and are capable of holding water to a maximum depth of 1.0 m (42 in.), or a pool with nonmetallic, molded polymeric walls or inflatable fabric walls regardless of dimension.

**Article 680.7 Cord-and-plug-connected equipment.** According to the 2011 code, fixed or stationary equipment other than underwater luminaires, for a permanently installed pool shall be permitted to be connected with a flexible cord and plug to facilitate the removal or disconnection for maintenance or repair

**6. Equipment that is designed to permanently or semi permanently contain water on the basis that it is used for swimming, wading, immersion, or therapeutic purposes.**

- A. Fountains
- B. Spa or hot tub
- C. Pool
- D. Hydro massage bathtub

**7. A unit that is consisting of a therapeutic tub or hydrotherapeutic tank that has all the equipment integral to the unit and was factory fabricated.**

- A. Packaged Spa or Hot Tub Equipment Assembly
- B. Packaged Therapeutic Tub or Hydrotherapeutic Tank Equipment Assembly
- C. Storable Swimming, Wading, or Immersion Pool
- D. Self-Contained Therapeutic Tubs or Hydrotherapeutic Tanks

**8. Generally designed to not have its contents drained or discharged after each use.**

- A. Pool
- B. Spa or hot tub
- C. Fountains
- D. Hydro massage bathtub

**9. Shall not be located in health care facilities but may be used indoors or outdoors for recreational or therapeutic use.**

- A. Spa or hot tub
- B. Fountains
- C. Pools
- D. Forming shell

**10. When constructed above ground and only having a max depth of 1.0 m (42 in) it is defined as a \_\_\_\_\_.**

- A. Spa and hot tubs
- B. Pools
- C. Storable Swimming, Wading, or Immersion Pool
- D. Permanently Installed Swimming, Wading, Immersion, and Therapeutic Pools

**11. Permanently installed pools \_\_\_\_\_ be permitted to be connected with a flexible cord and plug to facilitate the removal or disconnection for maintenance or repair.**

- A. shall
- B. must not
- C. shall not
- D. can not

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**Article 680.10 Underground wiring location.** Article 680 specifically states that underground wiring shall not be permitted under the pool or within the area extending 1.5 m (5 ft.) horizontally from the inside wall of the pool unless this wiring is necessary to supply pool equipment permitted by this article. Where space limitations prevent wiring from being routed a distance 1.5 m (5 ft.) or more from the pool, such wiring shall be permitted where installed in

complete raceway system of rigid metal conduit, intermediate metal conduit, or a nonmetallic raceway system. All metal conduits shall be corrosion resistant and suitable for the location. The minimum cover depth shall be as given in table 680.10.

**Article 680.21 Motors (A) Wiring methods (1) general.** For this section of the code, the branch circuits for pool-associated motors shall be installed in rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit, reinforced thermosetting resin conduit, or type MC Cable listed for the location. Other wiring methods and materials shall be permitted in specific locations or applications as covered in this section. Any wiring method employed shall contain an insulated copper equipment grounding conductor sized in accordance with 250.122 but not smaller than 12 awg.

**Article 680.22 lighting, receptacles, and equipment (A) receptacles (3) dwelling unit(s).**

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

**680.22 Lighting, Receptacles, and Equipment (B) (1) New Outdoor Installation Clearances.**

Article 680 requires outdoor pool areas, luminaires, lighting outlets, and ceiling suspended (paddle) fans installed above the pool or the area extending 1.5 m (5 ft) horizontally from the inside walls of the pool shall be installed at a height not less than 3.7 m (12 ft) above the maximum water level of the pool.

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**12. Underground wiring \_\_\_\_\_ be permitted under the pool or within the area extending \_\_\_\_\_ horizontally from the inside wall of the pool unless this wiring is necessary to supply pool equipment permitted by this article.**

- A. shall not, 5 ft.
- B. shall not, 6 ft. 6 in
- C. shall, 5 ft.
- D. shall, 6 ft.

**13. The minimum cover depth for raceways around pools shall be as given in table \_\_\_\_\_.**

- A. 680.8
- B. 680.24
- C. 680.21
- D. 680.10

**14. All \_\_\_\_\_ conduits around pools shall be corrosion resistant and suitable for the location.**

- A. flexible
- B. non-metallic
- C. metal
- D. PVC

**15. Any wiring method employed shall contain an insulated copper equipment grounding conductor sized in accordance with \_\_\_\_\_ .**

- A. 250.122
- B. 250.66
- C. 250.32
- D. 250.32 (A)

**16. What is the smallest sized equipment grounding conductor you can use for Article 680?**

- A. 10 awg
- B. 8 awg
- C. 14 awg
- D. 12 awg

**17. The branch circuits for pool-associated motors shall not be installed in which of the following?**

- A. intermediate metal conduit
- B. Electrical metallic tubing
- C. reinforced thermosetting resin conduit
- D. rigid polyvinyl chloride conduit

**18. Where a permanently installed pool is installed at a dwelling unit(s), no fewer than \_\_\_\_\_ 125-volt, 15- or 20-ampere receptacle**

- A. 2
- B. 4
- C. 3
- D. 1

**19. What is the maximum distance the required receptacle can be from the inside of a pool?**

- A. 18 ft.
- B. 20 ft.
- C. 16 ft.
- D. 12 ft.

**20. This receptacle according to article 680.22 shall be located not more than \_\_\_\_\_ above the floor, platform, or grade level serving the pool.**

- A. 6 ft.
- B. 5 ft.
- C. 6 ft. 6in.
- D. 8 ft.

**21. When installing a fan (paddle) above a pool what is the minimum height above the water that fan shall be mounted?**

- A. 1.5 m (5 ft)
- B. 2.3 m (7 ft 6 in)
- C. 3.0 m (10 ft.)
- D. 3.7 m (12 ft)

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**680.22 Lighting, Receptacles, and Equipment (B) (2) Indoor Clearances.** As required in this code for installations in indoor pool areas, the clearances shall be the same as for outdoor areas unless modified as provided in this paragraph. If the branch circuit supplying the equipment is protected by a ground-fault circuit interrupter, the following equipment shall be permitted at a height not less than 2.3 m (7 ft 6 in.) above the maximum pool water level:

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

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

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

**680.22 Lighting, Receptacles, and Equipment (C) Switching Devices.** This part of article 680 discusses Switching devices and where they shall be located around pools. They shall be at least 1.5 m (5 ft.) horizontally from the inside walls of a pool unless separated from the pool by a solid

fence, wall, or other permanent barrier. Alternatively, a switch that is listed as being acceptable for use within 1.5 m (5 ft) shall be permitted.

**680.23 Underwater luminaires (A)(2) Transformers and Power Supplies.** Article 680 requires that transformers and power supplies used for the supply of underwater luminaires, together with the transformer or power supply enclosure, shall be listed for swimming pool and spa use. The transformer or power supply shall incorporate either a transformer of the isolated winding type, with an ungrounded secondary that has a grounded metal barrier between the primary and secondary windings, or one that incorporates an approved system of double insulation between the primary and secondary windings.

**680.23 Underwater luminaires (A) (3) GFCI Protection, Relamping.** In this section of article 680, a ground-fault circuit interrupter shall be installed in the branch circuit supplying luminaires operating at more than the low voltage contact limit such that there is no shock hazard during relamping. The installation of the ground-fault circuit interrupter shall be such that there is no shock hazard with any likely fault condition combination that involves a person in a conductive path from any ungrounded part of the branch circuit or the luminaire to ground.

**680.23 Underwater luminaires (A) (5) Location, Wall-Mounted Luminaires.** This part of article 680 talks about mounting Luminaires in walls and shall be installed with the top of the luminaire lens not less than 450 mm (18 in.) below the normal water level of the pool, unless the luminaire is listed and identified for use at lesser depths. No luminaire shall be installed less than 100 mm (4 in.) below the normal water level of the pool.

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**22. If the circuits are GFCI protected and you are installing totally enclosed luminaires in indoor pool areas, clearances shall be not less than a height of \_\_\_\_\_ above max pool water level**

- A. 2.3 m (7 ft 6 in)
- B. 1.5 m (5 ft)
- C. 4.4 m (14.5 ft)
- D. 3.7 m (12 ft.)

**23. When installing luminaires and lighting outlets in existing locations, they shall be \_\_\_\_\_ attached and protected with a \_\_\_\_\_.**

- A. securely, AFCI
- B. rigidly, GFCI
- C. rigidly, AFCI
- D. securely, GFCI

**24. In the area extending between 1.5 m (5 ft) and 3.0 m (10 ft) horizontally from the inside of a pool and installed less than 1.5 m (5 ft) above max water level the luminaires shall be protected by?**

- A. AFCI
- B. Damage
- C. Contact
- D. GFCI

**25. When installing a switching device around a pool it must be at least 1.5 m (5 ft) horizontally from the inside of a pool unless separated from the pool by?**

- A. a building
- B. permanent barrier
- C. grass
- D. benches

**26. According to article 680 there are two types of transformers/power supplies that shall be used, one that incorporates and approved system of double insulation between the primary and secondary windings or a \_\_\_\_\_?**

- A. transformer of the isolated winding type, with an grounded secondary that has a ungrounded metal barrier between the primary and secondary windings
- B. transformer of the isolated winding type, with an grounded secondary that has a ungrounded nonmetallic barrier between the primary and secondary windings
- C. transformer of the isolated winding type, with an ungrounded secondary that has a grounded metal barrier between the primary and secondary windings
- D. none of the above

**27. When relamping underwater luminaires at more than the low voltage contact limit what shall be installed to make sure there is a no shock hazard?**

- A. double insulated luminaires
- B. AFCI
- C. GFCI
- D.all of the above

**28. What is the minimum amount that the top of the luminaire lens can be above the normal water level of the pool, unless listed and identified for a lesser depth?**

- A. 24 in.
- B. 18 in.
- C. 36 in.
- D. 12 in.

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**680.23 Underwater luminaires (B) Wet-Niche Luminaires (1) Forming Shells.** When using forming shells in article 680, they shall be installed for the mounting of all wet-niche underwater luminaires and shall be equipped with provisions for conduit entries. Metal parts of the luminaire and forming shell in contact with the pool water shall be of brass or other approved corrosion-resistant metal. All forming shells used with nonmetallic conduit systems, other than those that

are part of a listed low-voltage lighting system not requiring grounding, shall include provisions for terminating an 8 AWG copper conductor.

**680.23 Underwater luminaires (B) Wet-Niche Luminaires (2) Wiring Extending Directly to the Forming Shell.** Article 680 describes that Conduits shall be installed from the forming shell to a junction box or other enclosure conforming to the requirements in 680.24. Conduit shall be rigid metal, intermediate metal, liquidtight flexible nonmetallic, or rigid nonmetallic.

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

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

**680.23 Underwater luminaires (B) Wet-Niche Luminaires (3) Equipment Grounding Provisions for Cords.** Other than listed low-voltage lighting systems not requiring grounding wet-niche luminaires that are supplied by a flexible cord or cable shall have all exposed non-current carrying metal parts grounded by an insulated copper equipment grounding conductor that is an integral part of the cord or cable. This grounding conductor shall be connected to a grounding terminal in the supply junction box, transformer enclosure, or other enclosure. The grounding conductor shall not be smaller than the supply conductors and not smaller than 16 AWG.

**680.23 Underwater luminaires (B) Wet-Niche Luminaires (4) Luminaire Grounding Terminations.** According to Article 680, the end of the flexible-cord jacket and the flexible-cord conductor terminations within a luminaire shall be covered with, or encapsulated in, a suitable potting compound to prevent the entry of water into the luminaire through the cord or its conductors. If present, the grounding connection within a luminaire shall be similarly treated to protect such connection from the deteriorating effect of pool water in the event of water entry into the luminaire.

**680.23 Underwater luminaires (B) Wet-Niche Luminaires (5) Luminaire Bonding.** When installing a luminaire in article 680, they shall be bonded to, and secured to, the forming shell by a positive locking device that ensures a low-resistance contact and requires a tool to remove the luminaire from the forming shell. Bonding shall not be required for luminaires that are listed for the application and have no non-current-carrying metal parts.

**680.23 Underwater luminaires (B) Wet-Niche Luminaires (6) Servicing.** In this section of article 680 it describes all wet-niche luminaires that shall be removable from the water for inspection, relamping, or other maintenance. The forming shell location and length of cord in the forming shell shall permit personnel to place the removed luminaire on the deck or other dry location for such maintenance. The luminaire maintenance location shall be accessible without entering or going in the pool water.

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**29. When mounting all wet-niche underwater luminaires they shall be equipped with conduit entries and this shall be installed also?**

- A. forming shells
- B. green ground screw
- C. GFCI
- D. none of the above

**30. If using nonmetallic conduit for a wet niche luminaire system it shall include provisions for terminating an \_\_\_ AWG copper conductor.**

- A. 12
- B. 10
- C. 14
- D. 8

**31. When installing \_\_\_\_\_ they shall be installed from the forming shell to a junction box per the requirements of 680.24.**

- A. wiring
- B. conduits
- C. a ground
- D. luminaries

**32. Where installing nonmetallic conduits, grounding for wet-niche luminaire is required with an 8 AWG unless this is used?**

- A. grounding type fixture
- B. non-metallic junction box
- C. listed low-voltage lighting system
- D. none of the above

**33. Which of the following is not an accepted means for connecting an equipment grounding conductor for wet-niche luminaires that are supplied by a flexible cord or cable?**

- A. grounding terminal
- B. transformer enclose
- C. split-bolt
- D. supply junction box

**34. What must be done with flexible-cord jackets and conductors of a wet-niche luminaire that are terminated within the luminaire itself to prevent water from entering?**

- A. encapsulated in, a suitable potting compound
- B. taped
- C. nothing required
- D. glue

**35. According to 680.23 what circumstance would allow a person to not bond the luminaire?**

- A. listed with appropriate UL paperwork
- B. listed and has no non-current carrying metal parts
- C. up to the individual installing the fixture
- D. there is no circumstances that would allow this

**36. When servicing wet-niche luminaires for inspection, relamping and general maintenance the cord length must be long enough to do what?**

- A. change the lamp
- B. no special instructions
- C. move to a deck or dry location
- D. service the fixture

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**680.23 Underwater luminaires (C) Dry-Niche Luminaires. (1) Construction.** A dry-niche luminaire shall have provision for drainage of water. Other than listed low voltage luminaires not requiring grounding, a dry-niche luminaire shall have means for accommodating one equipment grounding conductor for each conduit entry.

**680.23 Underwater luminaires (C) Dry-Niche Luminaires. (2) Junction Box.** Article 680 states that junction boxes shall not be required but, if used, shall not be required to be elevated or located as specified in 680.24(A)(2) if the luminaire is specifically identified for the purpose.

**680.23 Underwater luminaires (D) No-Niche Luminaires.** According to article 680, a no-niche luminaire shall meet the construction requirements of 680.23(B)(3) and be installed in accordance with the requirements of 680.23(B). Where connection to a forming shell is specified, the connection shall be to the mounting bracket.

**680.23 Underwater luminaires (E) Through-Wall Lighting Assembly.** This part of article 680 discusses through-wall lighting assemblies. They shall be equipped with a threaded entry or hub, or a nonmetallic hub, for the purpose of accommodating the termination of the supply conduit. A through wall lighting assembly shall meet the construction requirements of 680.23(B)(3) and be installed in accordance with the requirements of 680.23. Where connection to a forming shell is specified, the connection shall be to the conduit termination point.

**680.23(F) Branch-Circuit Wiring (1) Wiring Methods.** This section of article 680 has to do with branch-circuit wiring on the supply side of enclosures and junction boxes connected to conduits run to wet-niche and no-niche luminaires, and the field wiring compartments of dry-

niche luminaires, shall be installed using rigid metal conduit, intermediate metal conduit, liquid tight flexible nonmetallic conduit, rigid polyvinyl chloride conduit, or reinforced thermosetting resin conduit. Where installed on buildings, electrical metallic tubing shall be permitted, and where installed within buildings, electrical nonmetallic tubing, Type MC cable, electrical metallic tubing, or Type AC cable shall be permitted. In all cases, an insulated equipment grounding conductor sized in accordance with Table 250.122 but not less than 12 AWG shall be required.

*Exception: Where connecting to transformers for pool lights, liquidtight flexible metal conduit shall be permitted. The length shall not exceed 1.8 m (6 ft) for any one length or exceed 3.0 m (10 ft) in total*

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**37. Is it required to use an equipment grounding conductor for a listed low voltage dry-niche luminaire?**

- A. sometimes
- B. always
- C. maybe
- D. no

**38. For the installation of dry-niche luminaires a junction box is required to be installed?**

- A. true
- B. false

**39. When using no-niche luminaires they must be installed according the requirements of article?**

- A. 680.23 (A)
- B. 680.23 (B)
- C. 680.24 (A)
- D. 680.24 (A) (2)

**40. When installing through-wall lighting assemblies for dry-niche luminaires it shall meet the construction requirements of section?**

- A. 680.23 (A)
- B. 680.22 (B)
- C. 680.23 (E)
- D. 680.23 (B) (3)

**41. According to article 680.23, when shall it be permissible to use type AC cable on the supply side of enclosures and junction box connected to wet-niche and no-niche luminaires?**

- A. installed within buildings
- B. when encased in concrete
- C. when protected from moisture
- D. never

**42. The total length permitted for liquid tight flexible conduit connected to a transformer that feeds pool lights according to article 680.23 is?**

- A. 1.8 m (6ft)
- B. 3.0 m (10 ft)
- C. 1.5 m (5 ft)
- D. 3.7 m (12 ft)

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

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

(a) If more than one underwater luminaire is supplied by the same branch circuit, the equipment grounding conductor, installed between the junction boxes, transformer enclosures, or other enclosures in the supply circuit to wet-niche luminaires, or between the field-wiring compartments of dry-niche luminaires, shall be permitted to be terminated on grounding terminals.

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

**680.23(F) Branch-Circuit Wiring (3) Conductors.** According to article 680, conductors on the load side of a ground fault circuit interrupter or of a transformer, used to comply with the provisions of 680.23(A)(8), shall not occupy raceways, boxes, or enclosures containing other conductors unless one of the following conditions applies:

- (1) The other conductors are protected by ground-fault circuit interrupters.
- (2) The other conductors are grounding conductors.
- (3) The other conductors are supply conductors to a feed through-type ground-fault circuit interrupter.

(4) Ground-fault circuit interrupters shall be permitted in a panelboard that contains circuits protected by other than ground-fault circuit interrupters.

**680.24 Junction Boxes and Electrical Enclosures for Transformers or Ground-Fault Circuit Interrupters (A) Junction Boxes (1) Construction.** This part of article 680 describes the construction of junction boxes that shall be listed as a swimming pool junction box and shall comply with the following conditions:

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

**680.24 Junction Boxes and Electrical Enclosures for Transformers or Ground-Fault Circuit Interrupters. (A) Junction Boxes (2) Installation.** This part of 680.24 describes the installation of junction boxes around pools and bodies of water. Where the luminaire operates over the low voltage contact limit, the junction box location shall comply with (A)(2)(a) and (A)(2)(b). Where the luminaire operates at the low voltage contact limit or less, the junction box location shall be permitted to comply with (A)(2)(c).

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

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

(c) *Flush Deck Box.* If used on a lighting system operating at the low voltage contact limit or less, a flush deck box shall be permitted if both of the following conditions are met:

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

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**43. According to article 680.23 other than listed low-voltage luminaires, what would be the occasion where an equipment grounding conductor would not be required.**

- A. field-wiring compartments of luminaires
- B. use of a GFCI
- C. never
- D. transformer enclosure

**44. What is allowable if supplying more than one underwater luminaire and supplied by the same branch circuit according to article 680.23?**

- A. reducing the size of the equipment grounding conductor
- B. nothing
- C. equipment ground permitted to be terminated
- D. both A and C

**45. When conductors are connected to the load side of a GFCI according to article 680.23, they must comply with the provisions of?**

- A. 680.23 (B) (4)
- B. 680.22 (A)
- C. no special provisions
- D. 680.23 (A) (8)

**46. Which of the following is not part of the conditions when using junction boxes as enclosures for transformers or GFCI with regards to article 680?**

- A. having a weather proof seal, locking, and be listed
- B. equipped with threaded entries or hubs or nonmetallic hub
- C. be of an approved corrosion-resistant material
- D. continuity between every connected metal conduit

**47. There are two specifications for the installation junction boxes for luminaires, over low voltage contact and under low voltage contact. When installing less than the low voltage contact it shall comply with?**

- A. 680.24 (A) (2) (a)
- B. 680.24 (A) (2) (c)
- C. 680.24 (A) (2) (b)
- D. 680.24 (A) (2) (d)

**48. When installing a junction box that is a flush deck box, what is the minimum distance that is can be mounted from the inside wall of the pool?**

- A. 3.0 m (10 ft)
- B. 100 mm (8 in)
- C. 1.2 m (4 ft)
- D. No minimum requirement

**49. What is the minimum vertical distance required for an over the low limit voltage contact luminaire junction box mounted above the max pool level?**

- A. 200 mm (8 in)
- B. 100 mm (4 in)
- C. 400 mm (16 in)
- D. 50 mm (2 in)

**680.24 Junction Boxes and Electrical Enclosures for Transformers or Ground-Fault Circuit Interrupters (C) Protection.** Junction boxes and enclosures mounted above the grade of the finished walkway around the pool shall not be located in the walkway unless afforded additional protection, such as by location under diving boards, adjacent to fixed structures, and the like.

**680.24 Junction Boxes and Electrical Enclosures for Transformers or Ground-Fault Circuit Interrupters (D) Grounding Terminals.** Junction boxes, transformer and power-supply enclosures, and ground-fault circuit interrupter enclosures connected to a conduit that extends directly to a forming shell or mounting bracket of a no-niche luminaire shall be provided with a number of grounding terminals that shall be no fewer than one more than the number of conduit entries.

**680.24 Junction Boxes and Electrical Enclosures for Transformers or Ground-Fault Circuit Interrupters (E) Strain Relief.** According to Article 680, the terminations of a flexible cord of an underwater luminaire within a junction box, transformer or power-supply enclosure, ground-fault circuit interrupter, or other enclosure shall be provided with a strain relief.

**680.24 Junction Boxes and Electrical Enclosures for Transformers or Ground-Fault Circuit Interrupters (F) Grounding.** In this section of Article 680, the equipment grounding conductor terminals of a junction box, transformer enclosure, or other enclosure in the supply circuit to a wet-niche or no-niche luminaire and the field-wiring chamber of a dry-niche luminaire shall be connected to the equipment grounding terminal of the panelboard. This terminal shall be directly connected to the panelboard enclosure.

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

**680.25 feeders (A) Wiring Methods (1) Feeders.** This section of Article 680 describes the wiring methods of feeders. They shall be installed in rigid metal conduit or intermediate metal conduit. The following wiring methods shall be permitted if not subject to physical damage:

- (1) Liquidtight flexible nonmetallic conduit
- (2) Rigid polyvinyl chloride conduit
- (3) Reinforced thermosetting resin conduit
- (4) Electrical metallic tubing where installed on or within a building
- (5) Electrical nonmetallic tubing where installed within a building
- (6) Type MC cable where installed within a building and if not subject to corrosive environment

*Exception: An existing feeder between an existing remote panelboard and service equipment shall be permitted to run in flexible metal conduit or an approved cable assembly that includes*

*an equipment grounding conductor within its outer sheath. The equipment grounding conductor shall comply with 250.24(A)(5).*

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**50. According to article 680, is it acceptable to mount an above the grade junction box for GFCI's under a diving board?**

- A. yes
- B. no

**51. What is the requirement for grounding terminals for transformer or GFCI enclosures that extend to a forming shell or mounting bracket of a no-niche luminaire?**

- A. at least eight
- B. at least one for each conduit entry
- C. one more than the number of conduit entries
- D. none of the above

**52. When using a flexible cord of an underwater luminaire within an enclosure what must be used?**

- A. strain relief
- B. forming shell
- C. approved lugs
- D. both a and c

**53. When grounding electrical enclosures, the terminals of an enclosure shall be connected to the equipment ground terminal of the?**

- A. conduit hub
- B. ground bar
- C. panelboard
- D. luminaire

**54. When any feeder on the supply side of panelboards supplying branch circuits for pool equipment it is covered in what part of article 680?**

- A. III
- B. II
- C. I
- D. IV

**55. When feeders are subject to physical damage, the allowable raceways are?**

- A. schedule 80 PVC
- B. electrical metallic tubing
- C. rigid metal conduit
- D. both a and b

**56. According to Article 680.25 when not subject to physical damage, which of the following is an acceptable raceway?**

- A. type AC cable
- B. flexible metal conduit
- C. high density polyethylene conduit
- D. electrical metallic tubing

**57. According to Article 680.25, is it ever acceptable to run flexible metal conduit for feeders?**

- A. yes
  - B. no
- 

**680.25 feeders (A) Wiring Methods (2) Aluminum Conduit.** Aluminum conduit shall not be permitted in the pool area where subject to corrosion.

**680.25 feeders (B) Grounding.** According to Article 680, an equipment grounding conductor shall be installed with the feeder conductors between the grounding terminal of the pool equipment panelboard and the grounding terminal of the applicable service equipment or source of a separately derived system. For other than (1) existing feeders covered in 680.25(A), exception, or (2) feeders to separate buildings that do not utilize an insulated equipment grounding conductor in accordance with 680.25(B)(2), this equipment grounding conductor shall be insulated.

**680.25 feeders (B) Grounding (1) Size.** In this part of Article 680, it describes grounded conductors and how they shall be sized in accordance with 250.122 but not smaller than 12 AWG. On separately derived systems, this conductor shall be sized in accordance with 250.30(A)(3) but not smaller than 8 AWG.

**680.25 feeders (B) Grounding (2) Separate Buildings.** According to Article 680, a feeder to a separate building or structure shall be permitted to supply swimming pool equipment branch circuits, or feeders supplying swimming pool equipment branch circuits, if the grounding arrangements in the separate building meet the requirements in 250.32(B). Where installed in other than existing feeders covered in 680.25(A), Exception, a separate equipment grounding conductor shall be an insulated conductor.

**680.26 Equipotential Bonding (A) Performance.** In Article 680, the equipotential bonding required by this section shall be installed to reduce voltage gradients in the pool area.

**680.26 Equipotential Bonding (B) Bonded Parts.** The parts specified in 680.26(B)(1) through (B)(7) shall be bonded together using solid copper conductors, insulated covered, or bare, not smaller than 8 AWG or with rigid metal conduit of brass or other identified corrosion-resistant metal. Connections to bonded parts shall be made in accordance with 250.8. An 8 AWG or larger

solid copper bonding conductor provided to reduce voltage gradients in the pool area shall not be required to be extended or attached to remote panelboards, service equipment, or electrodes.

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**58. When running aluminum conduit around pools what is the special exception to the rule?**

- A. no exception to the rule
- B. must be bonded
- C. must use anti-oxidation for anti-corrosion
- D. approved sealant

**59. What is the special provision for an equipment grounding conductor for feeders to a separate building that do not utilize an insulated equipment grounding conductor?**

- A. no special provision
- B. shall be insulated
- C. minimum #6 AWG
- D. must be bonded

**60. When sizing grounding for a separately derived system, it shall be sized in accordance with?**

- A. 250.122
- B. 250.66
- C. 250.102 (C) (1)
- D. 250.30 (A) (3)

**61. When feeding from a separate building it shall be permitted to supply swimming pool equipment branch circuits if what meets the requirements of 250.32 (B)?**

- A. UL listing
- B. grounding arrangements
- C. luminaires
- D. all of the above

**62. What is the reasoning for the equipotential bonding in pool area for Article 680?**

- A. to complete the bonding system
- B. not required
- C. reduce voltage gradients
- D. to have a clear and present path to ground

**63. If you are using #6 AWG solid copper bonding conductor to reduce voltage gradients, it is not required to be extended to?**

- A. remote panelboards
- B. luminaires
- C. the forming shell
- D. both b and c

**64. When making connections to boned parts, they shall be in accordance with?**

- A. 250.66
- B. 250.122
- C. 250.32
- D. 250.8

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**680.26 Equipotential Bonding (B) Bonded Parts (1) Conductive Pool Shells.** In this part of 680, it describes bonding to conductive pool shells that shall be provided as specified in 680.26(B)(1)(a) or (B)(1)(b). Poured concrete, pneumatically applied or sprayed concrete, and concrete block with painted or plastered coatings shall all be considered conductive materials due to water permeability and porosity. Vinyl liners and fiberglass composite shells shall be considered to be nonconductive materials.

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

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

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

(2) Conform to the contour of the pool

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

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

**680.26 Equipotential Bonding (B) Bonded Parts (2) Perimeter Surfaces.** According to this section of Article 680, a perimeter surface shall extend for 1 m (3 ft) horizontally beyond the inside walls of the pool and shall include unpaved surfaces, as well as poured concrete surfaces and other types of paving. Perimeter surfaces less than 1 m (3 ft) separated by a permanent wall or building 1.5 m (5 ft) in height or more shall require equipotential bonding on the pool side of the permanent wall or building. Bonding to perimeter surfaces shall be provided as specified in 680.26(B)(2)(a) or (2)(b) and shall be attached to the pool reinforcing steel or copper conductor grid at a minimum of four (4) points uniformly spaced around the perimeter of the pool. For nonconductive pool shells, bonding at four points shall not be required.

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

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

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

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**65. With conductive pool shells what is considered a nonconductive material?**

- A. plastered coatings
- B. fiberglass composite shells
- C. pneumatically applied concrete
- D. all of the above

**66. When steel is encapsulated in a nonconductive compound, a copper conductor grid shall be installed in accordance with?**

- A. 680.26 (B) (1) (a)
- B. 680.26 (B) (1) (b)
- C. 250.8
- D. 680.26 (B) (1)

**67. When constructing a copper grid pattern equipotential bonding, the standard arrangement for the grid pattern is?**

- A. 150-mm (6 in) by 150-mm (6 in)
- B. 450-mm (18 in) by 450-mm (18 in)
- C. 100-mm (4 in) by 100-mm (4 in)
- D. 300-mm (12-in) by 300-mm (12-in)

**68. How many points does the bonding grid to perimeter surfaces need to have?**

- A. 1
- B. 2
- C. 4
- D. none of the above

**69. If you have an unpaved perimeter surface that is 4 ft. wide, what is the minimum that bonding grid must be extended horizontally into this surface according to 680.26?**

- A. 1.5 m (5 ft)
- B. 2.0 m (6 ft)
- C. .5 m (1.5 ft)
- D. 1.0 m (3 ft)

**70. True or False, when equipotential bonding of perimeter surfaces, must you use a listed splice connector?**

- A. True
- B. False

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

**680.26 Equipotential Bonding (B) Bonded Parts (4) Underwater Lighting.** All metal forming shells and mounting brackets of no-niche luminaires shall be bonded.

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

**680.26 Equipotential Bonding (B) Bonded Parts (5) Metal Fittings.** When dealing with this part of article 680, pay special attention to the requirements. All metal fittings within or attached to the pool structure shall be bonded. Isolated parts that are not over 100 mm (4 in.) in any dimension and do not penetrate into the pool structure more than 25 mm (1 in.) shall not require bonding.

**680.26 Equipotential Bonding (B) Bonded Parts (6) Electrical Equipment.** Metal parts of electrical equipment associated with the pool water circulating system; including pump motors and metal parts of equipment associated with pool covers, including electric motors, shall be bonded.

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

- (a) *Double-Insulated Water Pump Motors.* Where a double-insulated water pump motor is installed under the provisions of this rule, a solid 8 AWG copper conductor of sufficient length to make a bonding connection to a replacement motor shall be extended from the bonding grid to an accessible point in the vicinity of the pool pump motor. Where there is no connection between the swimming pool bonding grid and the equipment grounding system for the premises, this bonding conductor shall be connected to the equipment grounding conductor of the motor circuit.

**680.26 Equipotential Bonding (B) Bonded Parts (7) Fixed Metal Parts.** According to Article 680.26, all fixed metal parts shall be bonded including, but not limited to, metal-sheathed cables and raceways, metal piping, metal awnings, metal fences, and metal door and window frames.

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

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

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

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**71. The reinforcing steel shall not be required to be \_\_\_\_\_ when the steel is encapsulated in a non-conductive compound.**

- A. covered
- B. bonded
- C. intrinsically safe
- D. thermally welded

**72. All metal forming shells and mounting brackets of \_\_\_\_\_ shall be bonded.**

- A. pool lighting
- B. pool and spa motors
- C. isolated receptacles
- D. no-niche luminaires

**73. When equipotential bonding of metal fittings the isolated parts must be of what dimension to meet the requirements for no bonding?**

- A. 100 mm (4 in)
- B. 200 mm (8 in)
- C. 25 mm (1 in)
- D. 50 mm (2 in)

**74. Which of the following metal parts of electrical equipment with regards to pool areas shall be bonded?**

- A. pool covers
- B. electric motors
- C. water circulating system
- D. All of the above

**75. What is the reasoning for making the bonding connection of a double insulated water pump motor for pools go from the bonding grid to the vicinity of the double insulated water pump motor?**

- A. so it reaches the grid easily
- B. so it's easily moved
- C. so it's long enough for a replacement motor
- D. none of the above

**76. Which of the following does not fall under the bonding of fixed metal parts around pools?**

- A. metal piping
- B. metal doors
- C. metal awnings
- D. flexible metal conduit

**77. When greater than 1.5 m (5 ft) horizontally of the inside walls of fixed metal parts of a pool shall not be required to be?**

- A. bonded
- B. system tied to the ground grid
- C. connected to the equipment grounding conductor
- D. tied to the equipment bonding jumper

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**680.26 Equipotential Bonding (C) Pool Water.** This part of Article 680 describes the bonding the water itself. An intentional bond of a minimum conductive surface area of 5800 mm<sup>2</sup> (9 in.<sup>2</sup>) shall be installed in contact with the pool water. This bond shall be permitted to consist of parts that are required to be bonded in 680.26(B).

**680.27 Specialized Pool Equipment (A) Underwater Audio Equipment (2) Wiring Methods.**

According to Article 680.27, rigid metal conduit of brass or other identified corrosion-resistant metal, liquidtight flexible nonmetallic conduit (LFNC-B), rigid polyvinyl chloride conduit, or reinforced thermosetting resin conduit shall extend from the forming shell to a listed junction box or other enclosure as provided in 680.24. Where rigid polyvinyl chloride conduit, reinforced thermosetting resin conduit, or liquidtight flexible nonmetallic conduit is used, an 8 AWG insulated solid or stranded copper bonding jumper shall be installed in this conduit. The bonding jumper shall be terminated in the forming shell and the junction box. The termination of the 8 AWG bonding jumper in the forming shell shall be covered with, or encapsulated in, a listed potting compound to protect such connection from the possible deteriorating effect of pool water.

**680.27 Specialized Pool Equipment. (A) Underwater Audio Equipment (3) Forming Shell and Metal Screen.** In this part of Article 680.27, the forming shell and metal screen shall be of brass or other approved corrosion resistant metal. All forming shells shall include provisions for terminating an 8 AWG copper conductor.

**680.27 Specialized Pool Equipment (B) Electrically Operated Pool Covers (1) Motors and Controllers.** In this part of Article 680.27, one should pay special attention to the informational notes. The electric motors, controllers, and wiring shall be located not less than 1.5 m (5 ft) from the inside wall of the pool unless separated from the pool by a wall, cover, or other permanent barrier. Electric motors installed below grade level shall be of the totally enclosed type. The

device that controls the operation of the motor for an electrically operated pool cover shall be located such that the operator has full view of the pool.

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

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

Informational Note No. 3: For protection against liquids, see 430.11.

**680.27 Specialized Pool Equipment (B) Electrically Operated Pool Covers (2) Protection.**

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

**680.27 Specialized Pool Equipment (C) Deck Area Heating (1) Unit Heaters.** According to Article 680.27, unit heaters shall be rigidly mounted to the structure and shall be of the totally enclosed or guarded type. Unit heaters shall not be mounted over the pool or within the area extending 1.5 m (5 ft) horizontally from the inside walls of a pool.

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**78. An intentional bond with a conductive surface area shall be of at least \_\_\_\_\_ and shall be in contact with pool water?**

- A. 10600 mm<sup>2</sup> (18 in<sup>2</sup>)
- B. 5800 mm<sup>2</sup> (9 in<sup>2</sup>)
- C. 2900 mm<sup>2</sup> (4.5 in<sup>2</sup>)
- D. None of the listed answers

**79. When installing underwater speakers, they must be mounted in an approved?**

- A. on an approved junction box
- B. meal forming shell
- C. underwater mounting bracket
- D. both a and c

**80. Which of the following is not an approved wiring method for underwater audio equipment with regards to pool areas?**

- A. rigid metal conduit of brass
- B. rigid polyvinyl chloride conduit
- C. liquidtight flexible metal conduit
- D. thermosetting resin conduit

**81. When using reinforced thermosetting resin conduit for a pool area, a solid or stranded copper bonding jumper of what size shall be in the conduit?**

- A. insulated 8 AWG
- B. non-insulated 8 AWG
- C. insulated 6 AWG
- D. non-insulated 6 AWG

**82. Forming shells for underwater audio equipment shall be made of \_\_\_\_\_ or other approved corrosion resistant metal?**

- A. steel
- B. brass
- C. non-metallic construction
- D. any of the above

**83. Unless separated by a wall, what is the minimum that motors and controllers can be from the inside of the pool?**

- A. 1.5 m (5 ft)
- B. 1.2 m (4 ft)
- C. 3.7 m (12 ft)
- D. 1.0 m (3 ft)

**84. According to Article 680.27, what location(s) would you refer to find the requirements for installing cabinets in damp or wet locations?**

- A. 404.4
- B. 430.11
- C. 312.2
- D. 314.2

**85. When connecting an electrically operated pool cover, is it required that it be protected by an GFCI?**

- A. No
- B. Yes
- C. if not permanently mounted below grade
- D. no if remotely mounted

**86. When mounting a unit heater over a pool what is the minimum feet horizontally it can be from the inside of pool walls?**

- A. 5 ft
- B. 12 ft
- C. 10 ft
- D. none of the listed answers

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**680.27 Specialized Pool Equipment (C) Deck Area Heating (2) Permanently Wired Radiant**

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

**III. Storable Pools 680.31 Pumps.** A cord-connected pool filter pump shall incorporate an approved system of double insulation or its equivalent and shall be provided with means for grounding only the internal and non-accessible non-current-carrying metal parts of the appliance. The means for grounding shall be an equipment grounding conductor run with the

power-supply conductors in the flexible cord that is properly terminated in a grounding-type attachment plug having a fixed grounding contact member. Cord-connected pool filter pumps shall be provided with a ground-fault circuit interrupter that is an integral part of the attachment plug or located in the power supply cord within 300 mm (12 in.) of the attachment plug.

**III. Storable Pools 680.32 Ground-Fault Circuit Interrupters Required.** All electrical equipment, including power-supply cords, used with storable pools shall be protected by ground-fault circuit interrupters. All 125-volt, 15- and 20-ampere receptacles located within 6.0 m (20 ft) of the inside walls of a storable pool shall be protected by a ground-fault circuit interrupter. In determining these dimensions, the distance to be measured shall be the shortest path the supply cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, doorway with hinged or sliding door, window opening, or other effective permanent barrier.

Informational Note: For flexible cord usage, see 400.4

**III. Storable Pools 680.33 Luminaires (A) Within the Low Voltage Contact Limit.** A luminaire shall be part of a cord-and-plug-connected lighting assembly. This assembly shall be listed as an assembly for the purpose and have the following construction features:

- (1) No exposed metal parts
- (2) A luminaire lamp that is suitable for use at the supplied voltage
- (3) An impact-resistant polymeric lens, luminaire body, and transformer enclosure
- (4) A transformer or power supply meeting the requirements of 680.23(A)(2) with a primary rating not over 150 volts

**III. Storable Pools 680.33 Luminaires (B) Over the Low Voltage Contact Limit But Not over 150 Volts.** According to this article, a lighting assembly without a transformer or power supply and with the luminaire lamp(s) operating at not over 150 volts shall be permitted to be cord-and-plug-connected where the assembly is listed as an assembly for the purpose. The installation shall comply with 680.23(A)(5), and the assembly shall have the following construction features:

- (1) No exposed metal parts
- (2) An impact-resistant polymeric lens and luminaire body
- (3) A ground-fault circuit interrupter with open neutral conductor protection as an integral part of the assembly
- (4) The luminaire lamp permanently connected to the groundfault circuit interrupter with open-neutral protection
- (5) Compliance with the requirements of 680.23(A)

**III. Storable Pools 680.34 Receptacle Locations.** Receptacles shall not be located less than 1.83 m (6 ft) from the inside walls of a pool. In determining these dimensions, the distance to be measured shall be the shortest path the supply cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, doorway with hinged or sliding door, window opening, or other effective permanent barrier.

**IV. Spas and Hot Tubs 680.41 Emergency Switch for Spas and Hot Tubs.** In this part of article 680, pay special attention to the requirements for emergency switches. A clearly labeled emergency shutoff or control switch for the purpose of stopping the motor(s) that provide power to the recirculation system and jet system shall be installed at a point readily accessible to the users and not less than 1.5 m (5 ft.) away, adjacent to, and within sight of the spa or hot tub. This requirement shall not apply to single-family dwellings.

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**87. For permanently wired radiant heaters what is the requirement for mounting the heaters?**

- A. suitable guarded, securely fastened
- B. suitable guarded
- C. securely fastened
- D. tether attached for fall protection

**88. What is the approved system that a cord-connected pool filter pump shall incorporate?**

- A. completely isolated
- B. both c and d
- C. double insulated
- D. GFCI protected

**89. The requirement for all storable pools is that they are protected by?**

- A. GFCI
- B. AFCI
- C. no special requirements
- D. A or B

**90. When installing low voltage luminaires for storable pools which of the following is a requirement for construction?**

- A. grounding of metal parts
- B. impact-resistant polymeric lens
- C. transformer must be rated over 150 volts
- D. none of these meets the requirements

**91. If installing luminaries for a storable pool. The available power is 208/480 volts. Is it allowable for the luminaries to be connected with a cord-and-plug-connection?**

- A. Not allowed
- B. Under special circumstances
- C. Is allowed
- D. sometimes

**92. When installing receptacles in locations around storable pools what is the shortest distance that it can be located from the inside wall of the pool?**

- A. 1.5 m (5 ft)
- B. 2.0 m (7 ft 6 in)
- C. 3.0 m (10 ft)
- D. 1.83 m (6 ft)

**93. When installing an emergency switch for spas and hot tubs it shall be readily accessible and \_\_\_\_\_?**

- A. less than 1.5 m (5 ft.) away
  - B. within sight
  - C. red in color
  - D. no higher than 1.5 m (5 ft.) above finished grade
- 

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

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

**(2) Cord-and-Plug Connections.** Cord-and-plug connections with a cord not longer than 4.6 m (15 ft) shall be permitted where protected by a ground-fault circuit interrupter.

**IV. Spas and Hot Tubs 680.42 Outdoor Installations (C) Interior Wiring to Outdoor Installations.** According to the code in this chapter, the interior of a one-family dwelling or in the interior of another building or structure associated with a one-family dwelling, any of the wiring methods recognized in Chapter 3 of this *Code* that contain a copper equipment grounding conductor that is insulated or enclosed within the outer sheath of the wiring method and not smaller than 12 AWG shall be permitted to be used 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 luminaire shall comply with 680.23 or 680.33.

**IV. Spas and Hot Tubs 680.43 Indoor Installations.** When installing a spa or hot tub indoors it shall comply with the provisions of Parts I and II of this article except as modified by this section and shall be connected by the wiring methods of Chapter 3.

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

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

**IV. Spas and Hot Tubs 680.43 Indoor Installations (A) Receptacles.** In this part of 680.43, one should pay special attention to #4 measurements. At least one 125-volt, 15- or 20-ampere receptacle on a general-purpose branch circuit shall be located not less than 1.83 m (6 ft) from, and not exceeding 3.0 m (10 ft) from, the inside wall of the spa or hot tub.

**(1) Location.** Receptacles shall be located at least 1.83 m (6 ft) measured horizontally from the inside walls of the spa or hot tub.

**(2) Protection, General.** Receptacles rated 125 volts and 30 amperes or less and located within 3.0 m (10 ft) of the inside walls of a spa or hot tub shall be protected by a ground fault circuit interrupter.

**(3) Protection, Spa or Hot Tub Supply Receptacle.** Receptacles that provide power for a spa or hot tub shall be ground-fault circuit-interrupter protected.

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

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**94. When installing a listed packaged spa or hot tub assemblies, it is permitted to use what type of connection?**

- A. electrical metallic conduit
- B. both c and d
- C. liquidtight flexible nonmetallic conduit
- D. liquidtight flexible metal conduit

**95. Cord-and-plug connections shall be permitted in outdoor spa and hot tub installation as long as it less than?**

- A. 3.0 m (10 ft)
- B. 6.0 m (20 ft)
- C. 4.6 m (15 ft)
- D. 3.7 m (12 ft)

**96. When installing wiring from the inside of a one-family dwelling to an outdoor spa or hot tub the wiring methods recognized in \_\_\_\_\_ of the code book?**

- A. chapter 2
- B. chapter 3
- C. chapter 6
- D. chapter 1

**97. When installing a spa or hot tub indoors is it permissible to use a cord-and-plug connection if the unit is rated 30 amps or less?**

- A. true
- B. false

**98. A customer has an indoor hot tub that is 9 ft. away from the nearest 15 amp outlet. What is the requirement for this outlet?**

- A. GFCI protected
- B. no special requirement
- C. must be 20 amp rated
- D. must be 20 amp rated and GFCI protected

**99. When determining the receptacle layout for an indoor spa or hot tub they shall always be located so that the supply cord?**

- A. it kept from physical damage
- B. ran so there is no tripping hazard
- C. runs the shortest path
- D. no special requirements

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**IV. Spas and Hot Tubs 680.43 Indoor Installations (B) Installation of Luminaires, Lighting Outlets, and Ceiling-Suspended (Paddle) Fans. (1) Elevation.** This part of article 680 describes indoor luminaries in spa and hot tub areas, luminaries except as covered in 680.43(B)(2), lighting outlets, and ceiling-suspended (paddle) fans located over the spa or hot tub or within 1.5 m (5 ft) from the inside walls of the spa or hot tub shall comply with the clearances specified in (B)(1)(a), (B)(1)(b), and (B)(1)(c) above the maximum water level.

(a) *Without GFCI.* Where no GFCI protection is provided, the mounting height shall be not less than 3.7 m (12 ft).

(b) *With GFCI.* Where GFCI protection is provided, the mounting height shall be permitted to be not less than 2.3 m (7 ft 6 in.).

(c) *Below 2.3 m (7 ft 6 in.).* Luminaires meeting the requirements of item (1) or (2) and protected by a ground fault circuit interrupter shall be permitted to be installed less than 2.3 m (7 ft 6 in.) over a spa or hot tub:

(1) Recessed luminaires with a glass or plastic lens, nonmetallic or electrically isolated metal trim, and suitable for use in damp locations

(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.

**IV. Spas and Hot Tubs 680.43 Indoor Installations (D) Bonding.** The following parts shall be bonded together:

(1) All metal fittings within or attached to the spa or hot tub structure

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

(3) Metal raceway and metal piping that are within 1.5 m (5 ft) of the inside walls of the spa or hot tub and that are not separated from the spa or hot tub by a permanent barrier

(4) All metal surfaces that are within 1.5 m (5 ft) of the inside walls of the spa or hot tub and that are not separated from the spa or hot tub area by a permanent barrier

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

(5) Electrical devices and controls that are not associated with the spas or hot tubs and that are located less than 1.5 m (5 ft) from such units; otherwise, they shall be bonded to the spa or hot tub system.

**IV. Spas and Hot Tubs 680.43 Indoor Installations (E) Methods of Bonding.** All metal parts associated with the spa or hot tub shall be bonded by any of the following methods:

(1) The interconnection of threaded metal piping and fittings

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

(3) The provisions of a solid copper bonding jumper, insulated, covered, or bare, not smaller than 8 AWG

**IV. Spas and Hot Tubs 680.43 Indoor Installations (G) Underwater Audio Equipment.**

Underwater audio equipment shall comply with the provisions of Part II of this article.

**IV. Spas and Hot Tubs 680.44 Protection.** According to article 680.44, everything except as otherwise provided in this section, 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 shall be protected by a ground-fault circuit interrupter.

**(A) Listed Units.** If so marked, a listed self-contained unit or listed packaged equipment assembly that includes integral ground-fault circuit-interrupter protection for all electrical parts within the unit or assembly (pumps, air blowers, heaters, lights, controls, sanitizer generators, wiring, and so forth) shall be permitted without additional GFCI protection.

**(B) Other Units.** A field-assembled spa or hot tub rated 3 phase or rated over 250 volts or with a heater load of more than 50 amperes shall not require the supply to be protected by a ground-fault circuit interrupter.

**V. Fountains 680.50 General.** The provisions of Part I and Part V of this article shall apply to all permanently installed fountains as defined in 680.2. Fountains that have water common to a pool shall additionally comply with the requirements in Part II of this article. Part V does not cover self-contained, portable fountains. Portable fountains shall comply with Parts II and III of Article 422.

**V. Fountains 680.51 Luminaires, Submersible Pumps, and Other Submersible Equipment.**

**(F) Servicing.** All equipment shall be removable from the water for relamping or normal maintenance. Luminaires shall not be permanently embedded into the fountain structure such that the water level must be reduced or the fountain drained for relamping, maintenance, or inspection.

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**100. A customer wants a fan above their indoor spa there is no GFCI protection, what is the minimum height that the fixture can be mounted?**

- A. 2.3 m (7 ft 6 in)
- B. 3.0 m (10 ft)
- C. must have GFCI protection
- D. 3.7 m (12 ft)

**101. Which of the following is an acceptable means for mounting luminaries lower than required by 680.43 (b)(1)?**

- A. GFCI protected and suitable for use in damp locations
- B. GFCI protected and mounted no less than 1.5 m (5 ft)
- C. GFCI protected and signed off by the authority having jurisdiction
- D. none of the above

**102. When bonding metal piping for indoor spas and hot tubs, the metal bonding has to be made within \_\_\_\_\_ unless it is separated by a permanent barrier?**

- A. 3.0 m (10 ft)
- B. 1.5 m (5 ft)
- C. 1.83 m (6 ft)
- D. 1.0 m (3 ft)

**103. Small metal conductive surfaces not likely to become energized are allowed to not be bonded?**

- A. true
- B. false

**104. Which of the following is not an acceptable means of bonding indoor spa and hot tubs?**

- A. metal to metal on a common frame
- B. solid copper bonding jumper, insulated, covered, or bare, not smaller than #10 awg
- C. interconnection of threaded metal piping
- D. none of the above

**105. When installing underwater audio equipment for indoor spas and hot tubs you shall follow the provisions of?**

- A. authority having jurisdiction
- B. part IV
- C. part II
- D. part III

**106. When installing a self-contained spa unit that has an integral ground-fault circuit-interrupter built in, what is allowed by this code?**

- A. no additional bonding
- B. no additional GFCI protection
- C. no equipment grounding conductor
- D. none of these

**107. When pools have common water with fountains what part are the additional requirements in?**

- A. part II
- B. part III
- C. part IV
- D. part V

**108. When servicing luminaires that are part of a fountain what is the requirement when relamping the luminaires?**

- A. all equipment shall be removable from the water
- B. must disconnect the power
- C. must drain the water before removing the luminaires
- D. no special requirement

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**V. Fountains 680.55 Methods of Grounding (B) Supplied by a Flexible Cord.** Electrical equipment that is supplied by a flexible cord shall have all exposed non-current-carrying metal parts grounded by an insulated copper equipment grounding conductor that is an integral part of this cord. The equipment grounding conductor shall be connected to an equipment grounding terminal in the supply junction box, transformer enclosure, power supply enclosure, or other enclosure.

**VI. Pools and Tubs for Therapeutic Use 680.62 Therapeutic Tubs (Hydrotherapeutic Tanks).**

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

**(A) Protection.** Except as otherwise provided in this section, the outlet(s) that supplies a self-contained therapeutic tub or hydrotherapeutic tank, a packaged therapeutic tub or hydrotherapeutic tank, or a field-assembled therapeutic tub or hydrotherapeutic tank shall be protected by a groundfault circuit interrupter.

**(1) Listed Units.** If so marked, a listed self-contained unit or listed packaged equipment assembly that includes integral ground-fault circuit-interrupter protection for all electrical parts within the unit or assembly (pumps, air blowers, heaters, lights, controls, sanitizer generators, wiring, and so forth) shall be permitted without additional GFCI protection.

**(2) Other Units.** A therapeutic tub or hydrotherapeutic tank rated 3 phase or rated over 250 volts or with a heater load of more than 50 amperes shall not require the supply to be protected by a ground-fault circuit interrupter.

**VI. Pools and Tubs for Therapeutic Use 680.62 Therapeutic Tubs (Hydrotherapeutic Tanks). (B) Bonding.** The following parts shall be bonded together:

(1) All metal fittings within or attached to the tub structure

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

(3) Metal-sheathed cables and raceways and metal piping that are within 1.5 m (5 ft) of the inside walls of the tub and not separated from the tub by a permanent barrier.

(4) All metal surfaces that are within 1.5 m (5 ft) of the inside walls of the tub and not separated from the tub area by a permanent barrier.

(5) Electrical devices and controls that are not associated with the therapeutic tubs and located within 1.5 m (5 ft.) from such units.

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

**VI. Pools and Tubs for Therapeutic Use 680.62 Therapeutic Tubs (Hydrotherapeutic Tanks) (D) Grounding.**

**(1) Fixed or Stationary Equipment.** The equipment specified in (a) and (b) shall be connected to the equipment grounding conductor.

(a) *Location.* All electrical equipment located within 1.5 m (5 ft) of the inside wall of the tub shall be connected to the equipment grounding conductor.

(b) *Circulation System.* All electrical equipment associated with the circulating system of the tub shall be connected to the equipment grounding conductor.

**VII. Hydromassage Bathtubs 680.74 Bonding.** In this section of article 680, one should pay special attention to what is required and what is allowable. All metal piping systems and all grounded metal parts in contact with the circulating water shall be bonded together using a solid copper bonding jumper, insulated, covered, or bare, not smaller than 8 AWG. The bonding jumper shall be connected to the terminal on the circulating pump motor that is intended for this purpose. The bonding jumper shall not be required to be connected to a double insulated circulating pump motor. The 8 AWG or larger solid copper bonding jumper shall be required for equipotential bonding in the area of the hydromassage bathtub and shall not be required to be extended or attached to any remote panelboard, service equipment, or any electrode. The 8 AWG

or larger solid copper bonding jumper shall be long enough to terminate on a replacement non-double-insulated pump motor and shall be terminated to the equipment grounding conductor of the branch circuit of the motor when a double-insulated circulating pump motor is used.

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**109. When a fountain is connected by a flexible cord, the equipment grounding conductor shall be connected to?**

- A. equipment bonding jumper
- B. main bonding jumper
- C. equipment grounding terminal
- D. none of the above

**110. Is it required to always have a pool or tub for therapeutic use GFCI protected?**

- A. yes
- B. no

**111. Which of the following does not require additional GFCI protection when used with self contained pools and tubs for therapeutic use?**

- A. blowers
- B. heaters
- C. wiring
- D. all listed answers

**112. When a raceway is within \_\_\_\_\_ of the inside wall of pools and tubs for therapeutic use it shall be bonded?**

- A. 2.3 m (7 ft 6in)
- B. 1.83 m (6 ft)
- C. 1.5 m (5 ft)
- D. 3.0 m (12 ft)

**113. When grounding a fixed pool for therapeutic use, the circulating system shall be connected to the?**

- A. equipment bonding jumper
- B. equipment grounding conductor
- C. equipment grounding terminal
- D. neutral conductor

**114. When installing a hydromassage bathtub with a double insulated circulating pump motor, which of the following shall not apply?**

- A. bonding jumper
- B. bonding of metal parts
- C. use of an equipment bonding conductor
- D. solid copper bonding jumper

## **ARTICLE 682 Natural and Artificially Made Bodies of Water**

### **682.2 Definitions.**

**Artificially Made Bodies of Water.** Bodies of water that have been constructed or modified to fit some decorative or commercial purpose such as, but not limited to, aeration ponds, fish farm ponds, storm retention basins, treatment ponds, and irrigation (channel) facilities. Water depths may vary seasonally or be controlled.

**Electrical Datum Plane.** The electrical datum plane as used in this article is defined as follows:

- (1) In land areas subject to tidal fluctuation, the electrical datum plane is a horizontal plane 600 mm (2 ft.) above the highest tide level for the area occurring under normal circumstances, that is, highest high tide.
- (2) In land areas not subject to tidal fluctuation, the electrical datum plane is a horizontal plane 600 mm (2 ft.) above the highest water level for the area occurring under normal circumstances.
- (3) In land areas subject to flooding, the electrical datum plane based on (1) or (2) above is a horizontal plane 600 mm (2 ft.) above the point identified as the prevailing high water mark or an equivalent benchmark based on seasonal or storm-driven flooding from the authority having jurisdiction.
- (4) The electrical datum plane for floating structures and landing stages that are (1) installed to permit rise and fall response to water level, without lateral movement, and (2) that are so equipped that they can rise to the datum plane established for (1) or (2) above, is a horizontal plane 750 mm (30 in.) above the water level at the floating structure or landing stage and a minimum of 300 mm (12 in.) above the level of the deck.

**Equipotential Plane.** An area where wire mesh or other conductive elements are on, embedded in, or placed under the walk surface within 75 mm (3 in.), bonded to all metal structures and fixed nonelectrical equipment that may become energized, and connected to the electrical grounding system to prevent a difference in voltage from developing within the plane.

**Shoreline.** The farthest extent of standing water under the applicable conditions that determine the electrical datum plane for the specified body of water.

**682.3 Other Articles.** If the water is subject to boat traffic, the wiring shall comply with 555.13(B).

**II. Installation 682.11 Location of Service Equipment.** On land, the service equipment for floating structures and submersible electrical equipment shall be located no closer than 1.5 m (5 ft) horizontally from the shoreline and live parts shall be elevated a minimum of 300 mm (12 in.) above the electrical datum plane. Service equipment shall disconnect when the water level reaches the height of the established electrical datum plane.

**II. Installation 682.13 Wiring Methods and Installation.** This part of article 682 describes wiring methods. Liquidtight flexible metal conduit or liquidtight flexible nonmetallic conduit with approved fittings shall be permitted for feeders and where flexible connections are required for services. Extra-hard usage portable power cable listed for both wet locations and sunlight resistance shall be permitted for a feeder or a branch circuit where flexibility is required. Other

wiring methods suitable for the location shall be permitted to be installed where flexibility is not required. Temporary wiring in accordance with 590.4 shall be permitted.

## **II. Installation 682.14 Submersible or Floating Equipment Power Connection(s).**

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

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

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

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

**II. Installation 682.15 Ground-Fault Circuit-Interrupter (GFCI) Protection.** Fifteen- and 20-ampere single-phase, 125-volt through 250-volt receptacles installed outdoors and in or on floating buildings or structures within the electrical datum plane area that are used for storage, maintenance, or repair where portable electric hand tools, electrical diagnostic equipment, or portable lighting equipment are to be used shall be provided with GFCI protection. The GFCI protection device shall be located not less than 300 mm (12 in.) above the established electrical datum plane.

## **III. Grounding and Bonding 682.31 Equipment Grounding Conductors.**

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

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

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

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

**III. Grounding and Bonding 682.33 Equipotential Planes and Bonding of Equipotential Planes.** According to article 682, an equipotential plane shall be installed where required in this section to mitigate step and touch voltages at electrical equipment.

**(A) Areas Requiring Equipotential Planes.** Equipotential planes shall be installed adjacent to all outdoor service equipment or disconnecting means that control equipment in or on water, that have a metallic enclosure and controls accessible to personnel, and that are likely to become energized. The equipotential plane shall encompass the area around the equipment and shall extend from the area directly below the equipment out not less than 900 mm (36 in.) in all directions from which a person would be able to stand and come in contact with the equipment.

**(B) Areas Not Requiring Equipotential Planes.** Equipotential planes shall not be required for the controlled equipment supplied by the service equipment or disconnecting means. All circuits rated not more than 60 amperes at 120 through 250 volts, single phase, shall have GFCI protection.

**(C) Bonding.** Equipotential planes shall be bonded to the electrical grounding system. The bonding conductor shall be of solid copper, insulated, covered or bare, and not smaller than 8 AWG. Connections shall be made by exothermic welding or by listed pressure connectors or clamps that are labeled as being suitable for the purpose and are of stainless steel, brass, copper, or copper alloy.

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**115. What is the definition of an electrical datum plane that is subject to flooding?**

- A. 2 ft above the highest water level for the area occurring under normal circumstances
- B. 2 ft above the highest tide level for the area occurring under normal circumstances, that is, highest high tide.
- C. 2 ft above the point identified as the prevailing high water mark or an equivalent benchmark based on seasonal or storm-driven flooding from the authority having jurisdiction
- D. 30 inches above the water level at the floating structure or landing stage and a minimum of 300 mm (12 in.) above the level of the deck

**116. Connected to the electrical grounding system to prevent a difference in voltage from developing within the plane is an example of what?**

- A. equipotential plane
- B. electrical datum plane
- C. bonding
- D. grounding

**117. Considered to be the farthest extent of standing water under the applicable conditions that determine the electrical plane for the specified body of water is the definition of a \_\_\_\_\_.**

- A. outcropping
- B. shoreline
- C. jetty
- D. cove

**118. When the water is allowed to have boat traffic, the code states that the wiring shall comply with the following article?**

- A. 300.32
- B. 682.11
- C. 310.5(A)(1)
- D. 555.13(B)

**119. For floating structures, the service equipment shall be located not closer than \_\_\_\_\_ horizontally from shoreline?**

- A. 1.0 m (1 ft)
- B. 300 mm (12 in)
- C. 1.5 m (5 ft)
- D. 450 mm (18 in)

**120. Is it ever permissible to allow feeders to be installed in liquidtight flexible nonmetallic conduit?**

- A. yes, with approved fittings
- B. only when the AHJ allows it
- C. never
- D. yes, with no special conditions

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

- A. 682.14
- B. 682.14(B)
- C. 680.27(A)
- D. 682.13

**122. When receptacles are installed on a floating structure within the \_\_\_\_\_ and where portable lighting equipment are used it shall be GFCI protected.**

- A. sight of shoreline
- B. equipotential planes
- C. electrical datum plane
- D. none of the above

**123. When installing feeders in the area of a bodies of water that supply a remote panelboard, the equipment grounding conductor shall extend from \_\_\_\_\_ in the service to the remote panelboard.**

- A. grounding terminal
- B. main equipment bond
- C. main equipment ground
- D. the neutral conductor

**124. In areas that require equipotential planes, they shall extend from the area directly below equipment and out not less than \_\_\_\_\_?**

- A. 48 in
- B. 36 in
- C. 24 in
- D. 60 in

**125. Is it allowable in equipotential planes to use a mechanical connection for bonding the electrical grounding system?**

A. acceptable

B. violation