

Electric Inspection

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Wiring Guide For Exterior Pools, Spas and Hot Tubs Based On The 2008 National Electrical Code

This wiring guide for exterior pools, spas and hot tubs is based on the 2008 National Electrical Code, Section 680 requirements. This guide is written to provide a general guide line in the wiring of the above noted equipment in single family dwellings and is not intended to address every situation or to replace or limit the other requirements contained in the National Electrical Code. If you have specific questions with a particular installation, a qualified electrical contractor or an electrical inspector should be contacted.

A. Definitions

Bonding:	The permanent joining of metallic parts to ensure continuity.
Cord and Plug-Connected Lighting Assembly:	A lighting assembly consisting of a lighting fixture intended for installation in the wall of a spa, hot tub or storable pool, and a cord and plug-connected transformer.
Dry-Niche Lighting Fixture:	A lighting fixture intended for installation in the wall of a pool or fountain in a niche that is sealed against the entry of pool water.
Forming Shell:	A structure designed to support a wet-niche lighting fixture and intended for mounting in a pool or fountain structure.
Ground-Fault Circuit Interrupter:	A device intended for the protection of personnel that functions to de-energize a circuit or portion thereof within an established period of time when a current to ground exceeds some pre-determined value that is less than that required to operate the over-current protective device of the supply circuit.
Maximum Water Level:	The highest level water can reach before it spills out.
No-Niche Lighting Fixture:	A lighting fixture intended for installation above or below the water without a niche.
Packaged Spa or Hot Tub Equipment Assembly:	A factory-fabricated unit consisting of water-circulating, heating, and control equipment mounted on a common base, intended to operate a spa or hot tub, Equipment can include pumps, air blowers, heaters, lights, controls, sanitizer generators, and so forth.
Permanently Installed Swimming, Wading, all and Therapeutic Pools: greater, and all	Those that are constructed in the ground or partially in the ground, and others capable of holding water to a depth of 42 inches or pools inside a building, regardless of water depth, whether or not served by electrical circuits of any nature.
Spa or Hot Tub:	A hydromassage pool or tub for recreational or therapeutic use, designed for immersion of users and usually having a filter, heater and motor driven blower. Generally, a spa or hot tub is not designed or intended to have its contents drained after each use.
Storable Swimming or Wading Pool:	Those that are constructed on or above the ground and are capable of holding water to a <u>maximum depth of 42 inches</u> , or a pool with nonmetallic, molded polymeric walls or inflatable fabric walls regardless of dimension.

Through-Wall Lighting Assembly:	A lighting assembly intended for installation above grade, on or through the wall of the pool, consisting of two interconnected groups of components separated by the pool wall.
Wet-Niche Lighting Fixture:	A lighting fixture intended for installation in a forming shell mounted in a pool or fountain structure where the fixture will be completely surrounded by water.

B. Wiring of Pools, Spas or Hot Tubs General Requirements

1. No receptacles shall be located within six feet from the inside walls of the pool, spa or hot tub. All 125-volt receptacles located within twenty feet of the inside walls of the pool, spa or hot tub shall be protected by a ground-fault circuit interrupter. A receptacle that supplies power for the circulation or sanitation system pump motors only may be located from six to ten feet of the inside wall of the pool if it complies with all of the following conditions, (1) is a single, twist lock receptacle, (2) is of the grounding type and (3) is ground-fault circuit interrupter protected. All of the above distances to be measured is the shortest path the supply cord would follow to the receptacle without piercing a floor, wall, ceiling or doorway. An in-use weatherproof cover is required.
2. Lighting fixtures, outlets or ceiling fans shall not be installed over the pool, spa or hot tub or over the area extending five feet horizontally from the inside wall unless no part of the fixture is less than twelve feet above the maximum water level. Lighting fixtures, outlets and ceiling fans within five to ten feet horizontally from the inside walls shall be protected by a ground-fault circuit-interrupter unless installed five feet above the maximum water level and rigidly attached to the structure. **Existing** lighting fixtures installed less than five feet horizontally from the inside wall shall be not less than five feet 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.
3. Switching devices shall be located at least five feet horizontally from the pool, spa or hot tub unless separated by a permanent barrier.
4. No part of the pool, spa or hot tub shall be placed under overhead lines or an area extending ten feet horizontally from the pool, spa or hot tub, unless a minimum of twenty-two and a half feet of clearance above the maximum water level is maintained. Where a condition exists as described above, the electrical inspector and utility company should be consulted before placement of the pool.
5. All electrical equipment and components shall be listed for their intended use by an approved agency and be installed according to their listing and installation instructions. Each pump motor shall be identified with a label identifying it as suitable for use with a storable pool, permanently installed pool, spa or hot tub, etc.
6. All electrical equipment installed in wet locations shall be installed in weatherproof enclosures. Receptacles in wet locations shall have a weatherproof cover that is weatherproof when the plug is inserted in the receptacle if not attended.
7. On spas, hot tubs and permanently installed pools, all metal parts over four inches square shall be bonded together with a #8 solid copper conductor, insulated or bare, using listed and approved connectors. Parts to be bonded include, but are not limited to the following; (1) all metallic parts of the pool structure, including reinforcing metal, (2) all forming shells, (3) all metal fittings within or attached to the pool structure, (4) metal parts of electrical equipment associated with the pool, (5) all metal piping, raceways, fencing etc., within five feet horizontally of the inside of the walls of the pool and within twelve feet above the maximum water level. (6) The pool water. Where a double-insulated pump motor is provided, a #8 solid copper bonding conductor shall be extended from the bonding grid to the motor location for replacement motor bonding.
8. On a permanently installed pool, at least one 125 volt ground-fault circuit-interrupter protected receptacle shall be installed a minimum of six feet and a maximum of twenty feet from the pool. An existing GFCI protected receptacle meeting the above criteria may serve as the required receptacle. General use receptacles shall be weather-resistant rated. In addition, receptacles at dwelling units shall also be tamper-resistant rated and provided with an in-use weatherproof cover.
9. For the purposes of this article, where an insulated equipment grounding conductor is referred to, non-metallic sheathed cable (romex) and underground feeder cable (UF), the equipment grounding conductor is considered covered but not insulated and does not meet the requirements.
10. A maintenance disconnect shall be provided for all equipment, other than lighting, that serves pool, hot tub and spa's. The disconnect shall be accessible and within sight of the equipment.

C. Storable Pool

The pump motor shall be identified for use with a storable pool and shall be double insulated. The pump motor comes complete with an attached cord and plug of up to twenty-five feet and is intended to be plugged into a receptacle located a minimum of six feet from the pool. The receptacle shall be ground-fault circuit-interrupter protected and weatherproof when the plug is installed. (ie: in-use cover) This receptacle may also supply a cord and plug-connected lighting assembly listed and marked as suitable for use with a storable pool. Depending on the size of the pump motor, it may be able to be connected to an existing branch circuit. The maximum ampacity of the pump on an existing 15 amp circuit is 7.5 amps and 10 amps for a 20 amp circuit. A dedicated circuit for the pump motor and light, if used, is recommended.

D. Permanently Installed Pool

1. PUMP MOTORS: A permanent pool pump or motor may come with a temporary cord or a permanent cord and is provided with an external lug to facilitate the bonding of the pump motor. The motor may be permanently connected or cord and plug connected. If cord and plug connected, the temporary cord is required to be replaced with, (a) a cord rated for outdoor use (marked outdoor use of W-A), (b) of a minimum of #12 copper, (c) a maximum length of 3' (three feet), (d) provided with a cord gripped bushing at the motor. If the receptacle is located within six to ten feet of the pool, it shall be (a) ground-fault circuit-interrupter protected, (b) a single receptacle of the twist lock and grounding type with matching plug. If located between ten feet to twenty feet of the pool the receptacle shall be single, weather-resistant rated, and ground-fault circuit-interrupter protected and of the proper rating for other than 125 volt rating. The receptacle shall be provided with a weatherproof cover that is weatherproof while the cord cap is inserted.

Generally, pump motors are required to be connected to an individual circuit that contains a minimum insulated green #12 copper conductor for grounding the motor. The individual circuit for the motor may be non-metallic sheathed cable (romex), #12 copper conductor minimum, in the interior of the dwelling only. Electrical metallic tubing (EMT) may be used in or on the dwelling with insulated conductors (not romex) pulled in conduit. From the dwelling to the pump motor, three insulated conductors (not UF cable) installed in rigid metal conduit, intermediate metal conduit, or rigid non-metallic conduit are required. A disconnecting means is required at the pump motor. It shall be a properly rated switch or cord and plug. Ground-fault circuit-interrupter protection is required for all receptacles and all pool pump motors.

2. UNDERWATER LIGHT FIXTURES: A wet niche light fixture is the type of light normally installed in a permanent pool. A rigid non-metallic conduit is installed from the forming shell to an approved pool lighting junction box that contains multiple grounding terminals and is located a minimum of four feet from the pool. It is mounted a minimum of four inches above the ground or eight inches above the maximum water level, whichever provides the greatest elevation and is required to be supported independently of the rigid non-metallic conduit. An insulated #8 conductor stranded copper is installed between the forming shell and the junction box and each ground wire that enters the junction box is required to be terminated to an individual grounding terminal. The junction box shall also provide a strain relief device for the cord that goes to the light. The #8 termination in the forming shell is covered with a listed potting compound. An insulated ground wire, minimum #12 copper, is required to be installed without splices between the junction box and the panel. This ground wire and the circuit supplying the light (no romex or UF cable) is required to be installed in rigid metal conduit, liquid flexible non-metallic, intermediate metal conduit or rigid non-metallic conduit from the panel. Electrical metallic tubing may be used within or on a dwelling. This circuit shall have installed in it a ground-fault circuit-interrupter and no other circuits may be installed in this conduit on the load side of the ground-fault circuit-interrupter unless they are ground-fault circuit-interrupter protected also. In all wiring methods, an insulated, green, minimum #12 copper equipment grounding conductor is required.

3. REMOTE PANELS: A panel supplying pool equipment, fed from the main service equipment, shall have an insulated equipment grounding conductor installed between its grounding terminal and the terminal of the service equipment. It shall be installed with the feeder conductors in rigid metal conduit, intermediate metal conduit or rigid non-metallic conduit, liquidite flexible non-metallic conduit. Electrical metallic tubing (EMT), electrical non-metallic or type MC with an insulated equipment grounding conductor may be used where installed on or within the building. EXCEPTION: An existing remote panelboard that has an equipment grounding conductor installed in flexible metal conduit or an approved cable assembly with an insulated or covered equipment grounding conductor.

E. Spas and Hot Tubs

1. Spas and Hot Tubs installed outdoors shall comply with the same requirements as a permanently installed pool and in addition shall be ground-fault circuit-interrupter protected.

Please Note: The designation "National Electrical Code" where used, is a registered trademark of the National Fire Protection Association.

F. Bonding and Equipotential Bonding

1. Performance: The equipotential bonding requirements shall be installed to reduce voltage gradients in the pool and outdoor hot tub areas. These requirements are required for pools, spas, and above ground pools capable of holding water to a level of 42" or greater and outdoor hot tubs.
2. Bonding: All metal parts associated with the pool and the pool water circulating system, the pool water, the conductive pool shell, all metallic components and fittings of the pool and perimeter areas to within five feet of the pool and the perimeter surface within three feet horizontality of the structure shall be bonded together with a minimum #8 solid copper conductor using listed, labeled and approved fittings.
3. Perimeter Surface: The pool perimeter surface shall extend three feet from the pool structure and be bonded together from the reinforcing steel to the pool structure in four equally spaced locations to the pool structure. Where reinforcing steel is not used or no concrete pavement is provided, a #8 solid copper conductor shall be installed encircling the structure and bonded to the pool shell in four equally spaced locations. It shall be installed 18" to 24" from the pool structure, contained in the concrete or 4" to 6" below grade level where no concrete is installed.
For non-conductive pool shells, bonding at all four points is not required.