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Swimming Pool Safety

Spring is here and everyone will start thinking about swimming pools. There are several concerns dealing with the installation of swimming pools, spas, or hot tubs, all of which require a permit for their installation if over 24" deep. Please contact the City of Rolla **Community Development Department** at (573) 364-5333 prior to installation of a pool, spa or hot tub. We have a handout available that will cover most every aspect of your pool, spa, or hot tub installation.

Clearances

Pay strict attention to any surrounding electrical equipment, overhead wires, receptacles, lighting, or windows when selecting a location for your new pool, spa, or hot tub. There are minimum clearances pertaining to all of these. Too many times we have been out for inspections only to find the hot tub next to the meter base, under a low light fixture, or even a swimming pool directly beneath overhead electrical conductors. The 1999 NEC governs the electrical installation and clearances associated with these.

Barrier Requirements

Outdoor swimming pools, either above-ground or in-ground, hot tubs, or spas require a barrier to protect against unauthorized entry. A swimming pool or similar facility creates an attractive temptation to children, including very young children and infants who do not know how to swim. Providing an effective barrier can help reduce the number of accidental deaths or injuries incurred every year as a result of open access to a pool, spa, or hot tub.

The top of the barrier shall be at least 48" above grade, with a 2" maximum clearance between the fence bottom and the ground. When the side of the pool, such as an aboveground pool, serves as the barrier, it too must also be 48" above grade. Additional railing or guards may be placed on top of the pool walls to achieve this height provided there is a 4" maximum clearance beneath the bottom of the guard and the top of the pool.

Barriers must be constructed with openings that will not allow passage of a 4" sphere and do not have openings or projections that would create a ladder for small children. When using chain link fencing, 1.25" is the largest mesh size allowed and 1.75" for lattice fence or decorative cutouts within vertical members of a fence. All fences shall contain a gate that is self-closing and self-latching. Where the release mechanism is less than 54" above the bottom of the gate, it shall be located on the pool side of the gate at least 3" below the top and the gate can have no opening greater than ½" within 18" of the release or latch.

Whenever a wall of a dwelling unit or building serves as part of the barrier, the pool, hot tub, or spa must be equipped with a power safety cover; the doors equipped with audible alarms; or other means such as self-closing and self-latching doors.

Where an aboveground pool structure is used as a barrier, the ladder or steps shall be capable of being secured, locked, removed, or shall have a barrier around the steps.

Electrical

Receptacles that provide power for filter motors or other related loads must be GFCI protected and may be located between 5 feet and 10 feet from the inside wall of the pool, hot tub, or spa. Other receptacles on the property shall be located not less than 10 feet from the inside wall of the pool. All outlets located within 20 feet of the pool, spa, or hot tub must be GFCI protected. All switches must be located at least 5 feet horizontally from the pool, spa, or hot tub.

Outdoor lighting must be a minimum of 12 feet above the water unless located outside of a zone that extends 5 feet horizontally beyond the pool, spa, or hot tub edge. Indoor lighting clearance may be reduced to a height of 7' 6" above the water when the fixture is a totally enclosed type and GFCI protected.

It is important to make sure all metal parts such as; piping, ladders, rails, reinforcing steel, lighting, motor or heater housing, or other parts that might become energized, are bonded with an approved bonding clamp or terminal. Small conductive parts such as towel bars, mirrors or jets not connected to metal piping are not likely to become energized and do not require bonding. A no. 8 solid copper shall be the minimum size bonding conductor.

General

Prior to filling the newly installed pool, hot tub, or spa, make sure the hose bib is equipped with a vacuum breaker or other means of backflow protection to prevent contamination of the water supply. All pools, spas, and hot tubs must be maintained in a sanitary condition throughout the season. Owners should be properly instructed in proper pool maintenance and care. Chemicals should be stored in a safe area with proper ventilation and out of the reach of small children. In addition to these requirements, any additional caution or care exhibited might save the life of a child!

APPENDIX G

SWIMMING POOLS, SPAS AND HOT TUBS

SECTION AG101 GENERAL

AG101.1 General. The provisions of this appendix shall control the design and construction of swimming pools, spas and hot tubs installed in or on the lot of a one- and two-family dwelling.

SECTION AG102 DEFINITIONS

AG102.1 General. For the purposes of these requirements, the terms used shall be defined as follows and as set forth in Chapter 2.

ABOVE-GROUND/ON-GROUND POOL. See "Swimming pool."

BARRIER. A fence, wall, building wall or combination thereof which completely surrounds the swimming pool and obstructs access to the swimming pool.

HOT TUB. See "Swimming pool."

IN-GROUND POOL. See "Swimming pool."

RESIDENTIAL. That which is situated on the premises of a detached one- or two-family dwelling or a one-family townhouse not more than three stories in height.

SPA, NONPORTABLE. See "Swimming pool."

SPA, PORTABLE. A nonpermanent structure intended for recreational bathing, in which all controls, water-heating and water-circulating equipment are an integral part of the product.

SWIMMING POOL. Any structure intended for swimming or recreational bathing that contains water over 24 inches (610 mm) deep. This includes in-ground, aboveground and on-ground swimming pools, hot tubs and spas.

SWIMMING POOL, INDOOR. A swimming pool which is totally contained within a structure and surrounded on all four sides by walls of said structure.

SWIMMING POOL, OUTDOOR. Any swimming pool which is not an indoor pool.

SECTION AG103 SWIMMING POOLS

AG103.1 In-ground pools. In-ground pools shall be designed and constructed in conformance with ANSI/NSPI-5 as listed in Section AG107.

AG103.2 Above-ground and on-ground pools. Above-ground and on-ground pools shall be designed and constructed in conformance with ANSI/NSPI-4 as listed in Section AG107.

SECTION AG104 SPAS AND HOT TUBS

AG104.1 Permanently installed spas and hot tubs. Permanently installed spas and hot tubs shall be designed and constructed in conformance with ANSI/NSPI-3 as listed in Section AG107.

AG104.2 Portable spas and hot tubs. Portable spas and hot tubs shall be designed and constructed in conformance with ANSI/NSPI-6 as listed in Section AG107.

SECTION AG105 BARRIER REQUIREMENTS

AG105.1 Application. The provisions of this chapter shall control the design of barriers for residential swimming pools, spas and hot tubs. These design controls are intended to provide protection against potential drownings and near-drownings by restricting access to swimming pools, spas and hot tubs.

AG105.2 Outdoor swimming pool. An outdoor swimming pool, including an in-ground, aboveground or on-ground pool, hot tub or spa shall be provided with a barrier which shall comply with the following:

1. The top of the barrier shall be at least 48 inches (1219 mm) above grade measured on the side of the barrier which faces away from the swimming pool. The maximum vertical clearance between grade and the bottom of the barrier shall be 2 inches (51 mm) measured on the side of the barrier which faces away from the swimming pool. Where the top of the pool structure is above grade, such as an aboveground pool, the barrier may be at ground level, such as the pool structure, or mounted on top of the pool structure. Where the barrier is mounted on top of the pool structure, the maximum vertical clearance between the top of the pool structure and the bottom of the barrier shall be 4 inches (102 mm).
2. Openings in the barrier shall not allow passage of a 4-inch-diameter (102 mm) sphere.
3. Solid barriers which do not have openings, such as a masonry or stone wall, shall not contain indentations or protrusions except for normal construction tolerances and tooled masonry joints.
4. Where the barrier is composed of horizontal and vertical members and the distance between the tops of the horizontal members is less than 45 inches (1143 mm), the horizontal members shall be located on the swimming pool side of the fence. Spacing between vertical members shall not exceed 1.75 inches (44 mm) in width. Where there are decorative cutouts within vertical members, spacing within the cutouts shall not exceed 1.75 inches (44 mm) in width.
5. Where the barrier is composed of horizontal and vertical members and the distance between the tops of the horizontal members is 45 inches (1143 mm) or more, spacing

between vertical members shall not exceed 4 inches (102 mm). Where there are decorative cutouts within vertical members, spacing within the cutouts shall not exceed 1.75 inches (44 mm) in width.

6. Maximum mesh size for chain link fences shall be a 1.25-inch (32 mm) square unless the fence is provided with slats fastened at the top or the bottom which reduce the openings to not more than 1.75 inches (44 mm).
7. Where the barrier is composed of diagonal members, such as a lattice fence, the maximum opening formed by the diagonal members shall not be more than 1.75 inches (44 mm).
8. Access gates shall comply with the requirements of Section AG105.2, Items 1 through 7, and shall be equipped to accommodate a locking device. Pedestrian access gates shall open outward away from the pool and shall be self-closing and have a self-latching device. Gates other than pedestrian access gates shall have a self-latching device. Where the release mechanism of the self-latching device is located less than 54 inches (1372 mm) from the bottom of the gate, the release mechanism and openings shall comply with the following:
 - 8.1. The release mechanism shall be located on the pool side of the gate at least 3 inches (76 mm) below the top of the gate, and
 - 8.2. The gate and barrier shall have no opening greater than 0.5 inch (12.7 mm) within 18 inches (457 mm) of the release mechanism.
9. Where a wall of a dwelling serves as part of the barrier one of the following conditions shall be met:
 - 9.1. The pool shall be equipped with a powered safety cover in compliance with ASTM F1346; or
 - 9.2. All doors with direct access to the pool through that wall shall be equipped with an alarm which produces an audible warning when the door and its screen, if present, are opened. The alarm shall sound continuously for a minimum of 30 seconds immediately after the door is opened and be capable of being heard throughout the house during normal household activities. The alarm shall automatically reset under all conditions. The alarm system shall be equipped with a manual means, such as touchpad or switch, to temporarily deactivate the alarm for a single opening. Such deactivation shall last for not more than 15 seconds. The deactivation switch(es) shall be located at least 54 inches (1372 mm) above the threshold of the door; or
 - 9.3. Other means of protection, such as self-closing doors with self-latching devices, which are approved by the governing body, shall be acceptable so long as the degree of protection afforded is not less than the protection afforded by Item 9.1 or 9.2 described above.
10. Where an aboveground pool structure is used as a barrier or where the barrier is mounted on top of the pool structure, and the means of access is a ladder or steps, then:
 - 10.1. The ladder or steps shall be capable of being secured, locked or removed to prevent access, or

- 10.2. The ladder or steps shall be surrounded by a barrier which meets the requirements of Section AG105.2, Items 1 through 9. When the ladder or steps are secured, locked or removed, any opening created shall not allow the passage of a 4-inch-diameter (102 mm) sphere.

AG105.3 Indoor swimming pool. All walls surrounding an indoor swimming pool shall comply with Section AG105.2, Item 9.

AG105.4 Prohibited locations. Barriers shall be located so as to prohibit permanent structures, equipment or similar objects from being used to climb the barriers.

AG105.5 Barrier exceptions. Spas or hot tubs with a safety cover which complies with ASTM F 1346, as listed in Section AG107, shall be exempt from the provisions of this appendix.

SECTION AG106 ABBREVIATIONS

AG106.1 General.

ANSI—American National Standards Institute
11 West 42nd Street, New York, NY 10036

ASTM—American Society for Testing and Materials
1916 Race Street, Philadelphia, PA 19103

NSPI—National Spa and Pool Institute
2111 Eisenhower Avenue, Alexandria, VA 22314

SECTION AG107 STANDARDS

AG107.1 General.

ANSI/NSPI

ANSI/NSPI-3 Standard for Permanently Installed Residential Spas AG104.1

ANSI/NSPI-4 Standard for Above-ground/On-ground Residential Swimming Pools AG103.2

ANSI/NSPI-5 Standard for Residential In-ground Swimming Pools AG103.1

ANSI/NSPI-6 Standard for Residential Portable Spas AG104.2

ASTM

ASTM F 1346-91 Standard Performance Specifications for Safety Covers and Labeling Requirements for All Covers for Swimming Pools, Spas and Hot Tub AG105.2, AG105.5

Chapter 41 SWIMMING POOLS

SECTION E4101 GENERAL

E4101.1 Scope. The provisions of this chapter shall apply to the construction and installation of electric wiring and equipment associated with all swimming pools, wading pools, hot tubs and spas, and hydromassage bathtubs, whether permanently installed or storable, and shall apply to metallic auxiliary equipment, such as pumps, filters and similar equipment. Sections E4102 through E4106 provide general rules for permanent pools, spas and hot tubs. Section E4107 provides specific rules for storable pools. Section E4108 provides specific rules for spas and hot tubs. Section E4109 provides specific rules for hydromassage bathtubs.

E4101.2 Definitions.

CORD- AND PLUG-CONNECTED LIGHTING ASSEMBLY. A lighting assembly consisting of a cord and plug-connected transformer and a lighting fixture intended for installation in the wall of a spa, hot tub, or storable pool.

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 assembly and intended for mounting in a pool or fountain structure.

HYDROMASSAGE 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.

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 may include pumps, air blowers, heaters, lights, controls and sanitizer generators.

PERMANENTLY INSTALLED SWIMMING AND WADING POOLS. Those that are constructed in the ground or partially in the ground, and all others capable of holding water with a depth greater than 42 inches (1067 mm), and all pools installed inside of a building, regardless of water depth, whether or not served by electrical circuits of any nature.

POOLCOVER, ELECTRICALLY OPERATED. Motor-driven equipment designed to cover and uncover the water surface of a pool by means of a flexible sheet or rigid frame.

SELF-CONTAINED SPA OR HOT TUB. A factory-fabricated unit consisting of a spa or hot tub vessel with all

water-circulating, heating and control equipment integral to the unit. Equipment may include pumps, air blowers, heaters, lights, controls and sanitizer generators.

SPA OR HOT TUB. A hydromassage 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. They are 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 OR WADING POOL. Those that are constructed on or above the ground and are capable of holding water with a maximum depth of 42 inches (1067 mm), or a pool with nonmetallic, molded polymeric walls or inflatable fabric walls regardless of dimension.

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.

SECTION E4102 WIRING METHODS FOR POOLS, SPAS, HOT TUBS AND HYDROMASSAGE BATHTUBS

E4102.1 General. Wiring methods used in conjunction with permanently installed swimming pools, spas, hot tubs or hydromassage bathtubs shall be installed in accordance with Table E4102.1 and Chapter 37 except as otherwise stated in this section. Storable swimming pools shall comply with Section E4107.

E4102.2 Flexible cords. Flexible cords used in conjunction with a pool, spa, hot tub or hydromassage bathtub shall be installed in accordance with the following:

1. For other than underwater lighting fixtures, fixed or stationary equipment, rated at 20 amperes or less shall be permitted to be connected with a flexible cord to facilitate the removal or disconnection for maintenance or repair. For other than storable pools, the flexible cord shall not exceed 3 feet (914 mm) in length. Cords that supply swimming pool equipment, shall have a copper equipment grounding conductor not smaller than No. 12 and shall be provided with a grounding-type attachment plug.
2. Flexible cord that is supplied as part of a listed underwater swimming pool lighting fixture shall be permitted to be installed in any of the permitted wiring methods from the fixture to a deck box or other enclosure. Splices shall not be made within a raceway. The equipment grounding conductor shall be an insulated copper conductor that is not smaller than the supply conductors and not smaller than No.16 AWG.

3. A listed packaged spa or hot tub installed outdoors that is GFCI protected, shall be permitted to be cord and plug connected provided that such cord does not exceed 15 feet (4572 mm) in length.
4. A listed packaged spa or hot tub rated at 20 amperes or less and installed indoors shall be permitted to be cord and plug connected to facilitate maintenance and repair.
5. For other than underwater and storable pool lighting fixtures, the requirements of Item 1 shall apply to any cord equipped lighting fixture that is located within 16 feet (4877 mm) radially from any point on the water surface.

SECTION E4103 EQUIPMENT LOCATION AND CLEARANCES

E4103.1 Receptacle outlets. Receptacle outlets shall be installed and located in accordance with Sections E4103.1.1 through E4103.1.5. Distances shall be measured as the shortest path that an appliance supply cord connected to the receptacle would follow without penetrating a floor, wall, ceiling, doorway with hinged or sliding door, window opening, or other effective permanent barrier.

E4103.1.1 Location. Receptacles that provide power for water-pump motors or other loads directly related to the circulation and sanitation system shall be permitted to be located between 5 feet and 10 feet (1524 mm and 3048 mm) from the inside walls of pools and outdoor spas and hot tubs, and, where so located, shall be single and of the locking and grounding type and shall be protected by ground-fault circuit interrupters.

Other receptacles on the property shall be located not less than 10 feet (3048 mm) from the inside walls of pools and outdoor spas and hot tubs.

E4103.1.2 Where required. At least one 125-volt 15- or 20-ampere receptacle supplied by a general-purpose branch circuit shall be located a minimum of 10 feet (3048 mm) from and not more than 20 feet (6096 mm) from the inside wall of pools and outdoor spas and hot tubs. This receptacle shall be located not more than 6 feet, 6 inches (1981 mm) above the floor, platform or grade level serving the pool, spa or hot tub.

E4103.1.3 GFCI protection. All 125-volt receptacles located within 20 feet (6096 mm) of the inside walls of pools and outdoor spas and hot tubs shall be protected by a ground-fault circuit-interrupter.

E4103.1.4 Indoor locations. Receptacles shall be located not less than 5 feet (1524 mm) from the inside walls of indoor spas and hot tubs. A minimum of one 125-volt receptacle shall be located between 5 feet (1524 mm) and 10 feet (3048 mm) from the inside walls of indoor spas or hot tubs.

E4103.1.5 Indoor GFCI protection. One hundred twenty-five-volt receptacles located within 10 feet (3048 mm) of the inside walls of spas and hot tubs installed indoors shall be protected by ground-fault circuit-interrupters. One hundred twenty-five-volt receptacles located within 5 feet (1524 mm) of the inside walls of hydromassage bathtubs shall be protected by a ground-fault circuit-interrupter.

E4103.2 Switching devices. Switching devices shall be located not less than 5 feet (1524 mm) horizontally from the inside walls of pools, spas and hot tubs except where separated from the pool, spa or hot tub by a solid fence, wall, or other permanent barrier. Switching devices located in a room or area containing a hydromassage bathtub shall be located in accordance with the general requirements of this code.

E4103.3 Disconnecting means. An accessible disconnecting means shall be provided and located within sight from all pools, spas, and hot tub equipment, and shall be located not less than 5 feet (1524 mm) from the inside walls of the pool, spa or hot tub.

E4103.4 Lighting fixtures and ceiling fans. Lighting outlets, fixtures, and ceiling-suspended paddle fans shall be installed and located in accordance with Sections E4103.4.1 through E4103.4.5.

E4103.4.1 Outdoor location. In outdoor pool, outdoor spa and outdoor hot tubs areas, lighting fixtures, lighting outlets, and ceiling-suspended paddle fans shall not be installed over the pool or over the area extending 5 feet (1524 mm) horizontally from the inside walls of a pool except where no part of the lighting fixture or ceiling-suspended paddle fan is less than 12 feet (3658 mm) above the maximum water level.

E4103.4.2 Indoor locations. In indoor pool areas, the limitations of Section E4103.4.1 shall apply except where the fixtures, lighting outlets and ceiling-suspended paddle fans comply with all of the following conditions:

1. The fixtures are of a totally enclosed type, and
2. A ground-fault circuit interrupter is installed in the branch circuit supplying the fixture(s) or ceiling-suspended (paddle) fans, and
3. The distance from the bottom of the fixture or ceiling-suspended (paddle) fan to the maximum water level is not less than 7 feet, 6 inches (2286 mm).

E4103.4.3 Existing lighting outlets and fixtures. Existing lighting outlets and fixtures that are located within 5 feet (1524 mm) horizontally from the inside walls of pools and outdoor spas and hot tubs shall be permitted to be located not less than 5 feet (1524 mm) vertically above the maximum water level, provided that such fixtures and outlets are rigidly attached to the existing structure and ground-fault circuit-interrupter protection is provided for the branch circuit that supplies such lighting fixtures and outlets.

TABLE E4102.1
ALLOWABLE APPLICATIONS FOR WIRING METHODS^{a,b,c,d,e,f,g}

WIRING LOCATION OR PURPOSE	AC, FMC, NM, SR, SE ^b	EMT ^c	ENT ^b	IMC, RMC, RNC	LFMC	LFNMC	UF	MC	Flex Cord ^g
Panelboard(s) that supply pool equipment: from service equipment to panelboard	A ^c	A	—	A	—	A	A ^e	A ^e	—
Wet niche and no niche fixtures: from branch circuit OCPD to deck or junction box	—	A	A	A	—	A	—	—	—
Wet niche and no niche fixtures: from deck or junction box to forming shell	—	—	—	A ^d	—	A	—	—	A
Dry niche: from branch circuit OCPD to fixture	—	A	A	A	—	A	—	—	—
Pool-associated motors: from branch circuit OCPD to motor	A	A	A	A	A ^f	A ^f	A ^b	A	A
Packaged or self-contained outdoor spas and hot tubs with underwater lighting fixture: from branch circuit OCPD to spa or hot tub	—	A	A	A	—	A ^f	—	—	A
Packaged or self-contained outdoor spas and hot tubs without underwater lighting fixture: from branch circuit OCPD to spa or hot tub	A	A	A	A	A ^f	A ^f	A ^b	A	A
Indoor spa and hot tubs, hydromassage bathtubs, and other pool, spa or hot tub associated equipment: from branch circuit OCPD to equipment	A	A	A	A	A	A	A	A	A

For SI: 1 foot = 304.8 mm.

- a. For all wiring methods, see Section E4105.2 for equipment grounding conductor requirements.
- b. Limited to use within buildings.
- c. Limited to use on or within buildings.
- d. Metal conduit shall be constructed of brass or other approved corrosion resistant metal
- e. Permitted only for existing feeder panelboards where the equipment grounding conductor is insulated or covered.
- f. Limited to use in lengths not to exceed 3 feet at pool, spa or hot tub equipment where flexibility is necessary.
- g. Flexible cord shall be installed in accordance with Section E4102.2.

E4103.4.4 Indoor spas and hot tubs.

1. Lighting fixtures, lighting outlets, and ceiling-suspended paddle fans located over the spa or hot tub or within 5 feet (1524 mm) from the inside walls of the spa or hot tub shall be a minimum of 7 feet, 6 inches (2286 mm) above the maximum water level and shall be protected by a ground-fault circuit interrupter.

Lighting fixtures, lighting outlets, and ceiling-suspended paddle fans that are located 12 feet (3658 mm) or more above the maximum water level shall not require ground-fault circuit interrupter protection.

2. Lighting fixtures protected by a ground-fault circuit interrupter and complying with Item 2.1. or 2.2. shall be permitted to be installed less than 7 feet, 6 inches (2286 mm) over a spa or hot tub.

2.1. Recessed fixtures shall have a glass or plastic lens and nonmetallic or electrically isolated metal trim, and shall be suitable for use in damp locations.

2.2. Surface-mounted fixtures shall have a glass or plastic globe and a nonmetallic body or a metallic body isolated from contact. Such fixtures shall be suitable for use in damp locations.

E4103.4.5 GFCI protection. Lighting fixtures and outlets that are installed in the area extending between 5 feet (1524 mm) and 10 feet (3048 mm) from the inside walls of pools and outdoor spas and hot tubs shall be protected by ground-fault circuit-interrupters except where such fixtures and outlets are installed not less than 5 feet (1524 mm) above the maximum water level and are rigidly attached to the structure.

E4103.5 Overhead conductor clearances. Except where installed with the clearances specified in Table E4103.5, the following parts of pools and outdoor spas and hot tubs shall not be placed under existing service-drop conductors or any other open overhead wiring; nor shall such wiring be installed above the following:

1. Pools and the areas extending 10 feet (3048 mm) horizontally from the inside of the walls of the pool;
2. Diving structures; or
3. Observation stands, towers, and platforms.

Utility-owned, -operated and -maintained communications conductors, community antenna system coaxial cables and the supporting messengers shall be permitted at a height of not less than 10 feet (3048 mm) above swimming and wading pools, diving structures, and observation stands, towers, and platforms.

E4103.6 Underground wiring. Underground wiring shall not be installed under or within the area extending 5 feet (1524 mm) horizontally from the inside walls of pools and outdoor hot tubs and spas except where the wiring is installed to supply pool, spa or hot tub equipment or where space limitations prevent wiring from being routed 5 feet (1524 mm) or more horizontally from the inside walls. Where installed within 5 feet (1524 mm) of the inside walls, the wiring method shall be rigid metal conduit, intermediate metal conduit or a nonmetallic raceway system. Metal conduit shall be corrosion resistant and suitable for the location. The minimum raceway burial depth shall not be in accordance with in Table E4103.6.

SECTION E4104 BONDING

E4104.1 Bonded parts. The following parts shall be bonded together:

1. All metallic parts of pool, spa and hot tub structures, including the reinforcing metal of pool, spa and hot tub shells, coping stones, and decks. The usual steel tie wires shall be considered suitable for bonding the reinforcing steel together, and welding or special clamping shall not be required. Such tie wires shall be made tight. Where reinforcing steel is effectively insulated by a listed encapsulating nonconductive compound, at the time of manufacture and installation, it shall not be required to be bonded.
2. All forming shells and mounting brackets of no-niche fixtures except where a listed low-voltage lighting system is used that does not require bonding.
3. All metal fittings within or attached to pool, spa and hot tub structures. Isolated parts that are not over 4 inches (102 mm) in any dimension and do not penetrate into the pool structure more than 1 inch (25.4 mm) shall not require bonding. The metal bands or hoops used to secure wooden staves for a hot tub or spa shall not be required to be bonded.

4. Metal parts of electrical equipment associated with pool, spa and hot tub water circulating systems, including pump motors and metal parts of equipment associated with pool covers, including electric motors. Metal parts of listed equipment incorporating an approved system of double insulation and providing a means for grounding internal nonaccessible, noncurrent-carrying metal parts shall not be bonded.
5. Metal-sheathed cables and raceways, metal piping and all fixed metal parts that are within 5 feet (1524 mm) horizontally of the inside walls of the pool, spa or hot tub and that are within 12 feet (3658 mm) above the maximum water level of the pool or any observation stands, towers or platforms, or from any diving structures, and that are not separated from the pool by a permanent barrier.

For pool water heaters rated at more than 50 amperes and having specific instructions regarding bonding and grounding, only those parts designated to be bonded shall be bonded and only those parts designated to be grounded shall be grounded.

E4104.2 Parts not required to be bonded. Small conductive surfaces not likely to become energized, such as towel bars, mirror frames, and air and water jets and drain fittings that are not connected to metallic piping, and similar equipment installed on or within indoor spas and hot tubs shall not be required to be bonded.

E4104.3 Methods of bonding. It shall not be the intent to require that the No. 8 or larger solid copper bonding conductor be extended or attached to any remote panelboard, service equipment, or any electrode, but only that it shall be employed to eliminate voltage gradients in the pool area as prescribed. Bonding shall be accomplished by one or more of the following methods:

1. Common Bonding Grid. The parts specified in Section E4104.1 above shall be connected to a common bonding grid with a solid copper conductor, insulated, covered, or bare, not smaller than No. 8. Connection shall be made by exothermic welding or by pressure connectors or clamps that are labeled as being suitable for the purpose and that are made of stainless steel, brass, copper or copper alloy.

The common bonding grid shall be permitted to be any of the following:

- 1.1. The structural reinforcing steel of a concrete pool where the reinforcing rods are bonded together by the usual steel tie wires made up tight or the equivalent; or
- 1.2. The wall of a bolted or welded metal pool; or
- 1.3. A solid copper conductor, insulated, covered, or bare, not smaller than No. 8.
2. For hot tubs and spas, metal to metal mounting on a common frame or base
3. The interconnection of threaded metal piping and fittings.

**TABLE E4103.5
OVERHEAD CONDUCTOR CLEARANCES**

	INSULATED SUPPLY OR SERVICE DROP CABLES, 0-750 VOLTS TO GROUND, SUPPORTED ON AND CABLED TOGETHER WITH AN EFFECTIVELY GROUNDED BARE MESSENGER OR EFFECTIVELY GROUNDED NEUTRAL CONDUCTOR (feet)	ALL OTHER SUPPLY OR SERVICE DROP CONDUCTORS (feet)	
		Voltage to ground	
		0-15 kV	Greater than 15 to 50 kV
A. Clearance in any direction to the water level, edge of water surface, base of diving platform, or permanently-anchored raft	22	25	27
B. Clearance in any direction to the diving platform	14	17	18
C. Horizontal limit of clearance measured from inside wall of the pool	This limit shall extend to the outer edge of the structures listed in Rows (A) and (B) above but not less than 10 feet.		

For SI: 1 foot = 304.8 mm.

**TABLE E4103.6
MINIMUM BURIAL DEPTHS**

WIRING METHOD	MINIMUM BURIAL DEPTH (inches)
Rigid metal conduit	6
Intermediate metal conduit	6
Nonmetallic raceways listed for direct burial without concrete encasement	18
Other approved raceways ^a	18

For SI: 1 inch = 25.4 mm.

a. Raceways approved for burial only where concrete-encased shall require a concrete envelope not less than 2 inches in thickness.

**SECTION E4105
GROUNDING**

E4105.1 Equipment to be grounded. The following equipment shall be grounded:

1. Wet-niche, dry-niche and no-niche underwater lighting fixtures other than those low-voltage systems listed for the application without a grounding conductor.
2. All electrical equipment located within 5 feet (1524 mm) of the inside wall of the pool, spa or hot tub.
3. All electrical equipment associated with the recirculating system of the pool, spa or hot tub.
4. Junction boxes.
5. Transformer enclosures.
6. Ground-fault circuit-interrupters.
7. Panelboards that are not part of the service equipment and that supply any electrical equipment associated with the pool, spa or hot tub.

E4105.2 Light fixtures and related equipment. Wet-niche, dry-niche, or no-niche lighting fixtures shall be connected to an insulated copper equipment grounding conductor sized in accordance with Table E3808.12 but not smaller than No. 12. The 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 such circuit. The junction box, transformer enclosure, or other enclosure in the supply circuit to a wet-niche or no-niche lighting fixture and the field-wiring chamber of a dry-niche lighting fixture shall be grounded to the equipment grounding terminal of the panelboard. The equipment grounding terminal shall be directly connected to the panelboard enclosure. The equipment grounding conductor shall be installed without joint or splice.

Exceptions:

1. Where more than one underwater lighting fixture 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 fixtures, or between the field-wiring compartments of dry-niche fixtures, shall be permitted to be terminated on grounding terminals.
2. Where an underwater lighting fixture 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 lighting fixture, 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.

E4105.3 Nonmetallic conduit. Where a nonmetallic conduit is installed between a wet-niche fixture and a junction box, transformer enclosure, or other enclosure, a No. 8 insulated copper conductor shall be installed in this conduit with provisions for terminating in the forming shell, junction box or transformer enclosure, or ground-fault circuit-interrupter enclosure. The termination of the No. 8 conductor 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.

E4105.4 Flexible cords. Wet-niche or no-niche lighting fixtures that are supplied by a flexible cord or cable shall have all exposed noncurrent-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 No. 16.

E4105.5 Motors. Pool-associated motors shall be connected to a copper equipment grounding conductor sized in accordance with Table E3808.12, but not smaller than No. 12.

E4105.6 Panelboards. A panelboard that is not part of the service equipment, or source of a separately derived system shall have an equipment grounding conductor installed between its grounding terminal and the grounding terminal of the applicable service equipment or source of a separately derived system. This conductor shall be sized in accordance with Table E3808.12, but not smaller than No. 12.

E4105.7 Cord-connected equipment. Where fixed or stationary equipment is connected with a flexible cord to facilitate removal or disconnection for maintenance, repair, or storage, as provided in Section E4102.2, the equipment grounding conductors shall be connected to a fixed metal part of the assembly. The removable part shall be mounted on or bonded to the fixed metal part.

E4105.8 Other equipment. Other electrical equipment shall be grounded in accordance with Section E3808.

SECTION E4106 EQUIPMENT INSTALLATION

E4106.1 Transformers. Transformers used for the supply of underwater fixtures, together with the transformer enclosure, shall be identified for the purpose. Such transformers shall be of an isolated winding type having a grounded metal barrier between the primary and secondary windings.

E4106.2 Ground-fault circuit-interrupters. Ground-fault circuit-interrupters shall be self-contained units, circuit-breaker types, receptacle types or other approved types.

E4106.3 Wiring on load side of ground-fault circuit-interrupters and transformers. For other than grounding conductors, conductors installed on the load side of a ground-fault circuit-interrupter or transformer used to comply with the provisions of Section E4106.4, shall not occupy raceways, boxes, or enclosures containing other conductors except

where the other conductors are protected by ground-fault circuit interrupters or are grounding conductors. Supply conductors to a feed-through type ground-fault circuit interrupter shall be permitted in the same enclosure. Ground-fault circuit interrupters shall be permitted in a panelboard that contains circuits protected by other than ground-fault circuit interrupters.

E4106.4 Underwater lighting fixtures. The design of an underwater lighting fixture supplied from a branch circuit either directly or by way of a transformer meeting the requirements of Section E4106.1, shall be such that, where the fixture is properly installed without a ground-fault circuit-interrupter, there is no shock hazard with any likely combination of fault conditions during normal use (not relamping). In addition, a ground-fault circuit-interrupter shall be installed in the branch circuit supplying fixtures operating at more than 15 volts, so 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 fixture to ground. Compliance with this requirement shall be obtained by the use of a listed underwater lighting fixture and by installation of a listed ground-fault circuit-interrupter in the branch circuit. Fixtures that depend on submersion for safe operation shall be inherently protected against the hazards of overheating when not submerged.

E4106.4.1 Maximum voltage. Lighting fixtures shall not be installed for operation on supply circuits over 150 volts between conductors.

E4106.4.2 Fixture location. Lighting fixtures mounted in walls shall be installed with the top of the fixture lens not less than 18 inches (457 mm) below the normal water level of the pool, except where the lighting fixture is listed and identified for use at a depth of not less than 4 inches (102 mm) below the normal water level of the pool. A lighting fixture facing upward shall have the lens adequately guarded to prevent contact by any person.

E4106.5 Wet-niche fixtures. Forming shells shall be installed for the mounting of all wet-niche underwater fixtures and shall be equipped with provisions for conduit entries. Conduit shall extend from the forming shell to a suitable junction box or other enclosure located as provided in Section E4106.8. Metal parts of the fixture and forming shell in contact with the pool water shall be of brass or other approved corrosion-resistant metal.

The end of flexible-cord jackets and flexible-cord conductor terminations within a fixture shall be covered with, or encapsulated in, a suitable potting compound to prevent the entry of water into the fixture through the cord or its conductors. In addition, the grounding connection within a fixture shall be similarly treated to protect such connection from the deteriorating effect of pool water in the event of water entry into the fixture.

Fixtures 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 fixture from the forming shell.

E4106.6 Dry-niche fixtures. Dry-niche lighting fixtures shall be provided with provisions for drainage of water and means for accommodating one equipment grounding conductor for each conduit entry. Junction boxes shall not be required but, if used, shall not be required to be elevated or located as specified in Section E4106.8 if the fixture is specifically identified for the purpose.

E4106.7 No-niche fixtures. No-niche fixtures shall be listed for the purpose and shall be installed in accordance with the requirements of Section E4106.5. Where connection to a forming shell is specified, the connection shall be to the mounting bracket.

E4106.8 Junction boxes and enclosures for transformers or ground-fault circuit interrupters. Junction boxes for underwater lighting fixtures and enclosures for transformers and ground-fault circuit-interrupters that supply underwater lighting fixtures shall comply with the following:

E4106.8.1 Junction boxes. A junction box connected to a conduit that extends directly to a forming shell or mounting bracket of a no-niche fixture shall be:

1. Listed and labeled for the purpose; and
2. Equipped with threaded entries or hubs or a nonmetallic hub listed for the purpose; and
3. Constructed of copper, brass, suitable plastic, or other approved corrosion-resistant material; and
4. 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; and
5. Located not less than 4 inches (102 mm), measured from the inside of the bottom of the box, above the ground level, or pool deck, or not less than 8 inches (203 mm) above the maximum pool water level, whichever provides the greatest elevation, and shall be located not less than 4 feet (1219 mm) from the inside wall of the pool, unless separated from the pool by a solid fence, wall or other permanent barrier. Where used on a lighting system operating at 15 volts or less, a flush deck box shall be permitted provided that an approved potting compound is used to fill the box to prevent the entrance of moisture; and the flush deck box is located not less than 4 feet (1219 mm) from the inside wall of the pool.

E4106.8.2 Other enclosures. An enclosure for a transformer, ground-fault circuit-interrupter or a similar device connected to a conduit that extends directly to a forming shell or mounting bracket of a no-niche fixture shall be:

1. Listed and labeled for the purpose; and
2. Equipped with threaded entries or hubs or a nonmetallic hub listed for the purpose; and
3. Provided with an approved seal, such as duct seal at the conduit connection, that prevents circulation of air between the conduit and the enclosures; and
4. 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 enclosures; and

5. Located not less than 4 inches (102 mm), measured from the inside bottom of the enclosure, above the ground level or pool deck, or not less than 8 inches (203 mm) above the maximum pool water level, whichever provides the greater elevation, and shall be located not less than 4 feet (1219 mm) from the inside wall of the pool, except where separated from the pool by a solid fence, wall or other permanent barrier.

E4106.8.3 Protection of junction boxes and enclosures. 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 or adjacent to fixed structures.

E4106.8.4 Grounding terminals. Junction boxes, transformer 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 fixture shall be provided with grounding terminals in a quantity not less than the number of conduit entries plus one.

E4106.8.5 Strain relief. The termination of a flexible cord of an underwater lighting fixture within a junction box, transformer enclosure, ground-fault circuit-interrupter, or other enclosure shall be provided with a strain relief.

E4106.9 Underwater audio equipment. Underwater audio equipment shall be identified for the purpose.

E4106.9.1 Speakers. Each speaker shall be mounted in an approved metal forming shell, the front of which is enclosed by a captive metal screen, or equivalent, that is bonded to and secured to the forming shell by a positive locking device that ensures a low-resistance contact and requires a tool to open for installation or servicing of the speaker. The forming shell shall be installed in a recess in the wall or floor of the pool.

E4106.9.2 Wiring methods. Rigid metal conduit or intermediate metal conduit of brass or other identified corrosion-resistant metal or rigid nonmetallic conduit shall extend from the forming shell to a suitable junction box or other enclosure as provided in Section E4106.8. Where rigid nonmetallic conduit is used, a No. 8 insulated copper conductor shall be installed in this conduit with provisions for terminating in the forming shell and the junction box. The termination of the No. 8 conductor in the forming shell shall be covered with, or encapsulated in, a suitable potting compound to protect such connection from the possible deteriorating effect of pool water.

E4106.9.3 Forming shell and metal screen. The forming shell and metal screen shall be of brass or other approved corrosion-resistant metal.

E4106.10 Electrically operated pool covers. The electric motors, controllers, and wiring for pool covers shall be located not less than 5 feet (1524 mm) from the inside wall of the pool except where 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 electric motor and controller shall be connected to a circuit protected by a ground-fault circuit-interrupter.

E4106.11 Electric pool water heaters. All electric pool water heaters shall have the heating elements subdivided into loads not exceeding 48 amperes and protected at not more than 60 amperes. The ampacity of the branch-circuit conductors and the rating or setting of overcurrent protective devices shall be not less than 125 percent of the total nameplate load rating.

E4106.12 Pool area heating. The provisions of Sections E4106.12.1 through E4106.12.3 shall apply to all pool deck areas, including a covered pool, where electrically operated comfort heating units are installed within 20 feet (6096 mm) of the inside wall of the pool.

E4106.12.1 Unit heaters. Unit heaters shall be rigidly mounted to the structure and shall be of the totally enclosed or guarded types. Unit heaters shall not be mounted over the pool or within the area extending 5 feet (1524 mm) horizontally from the inside walls of a pool.

E4106.12.2 Permanently wired radiant heaters. Electric radiant heaters shall be suitably guarded and securely fastened to their mounting devices. Heaters shall not be installed over a pool or within the area extending 5 feet (1524 mm) horizontally from the inside walls of the pool and shall be mounted not less than 12 feet (3658 mm) vertically above the pool deck.

E4106.12.3 Radiant heating cables prohibited. Radiant heating cables embedded in or below the deck shall be prohibited.

E4106.13 Double insulated pool pumps. A permanently installed pool shall be permitted to be provided with listed cord- and plug-connected pool pumps incorporating an approved system of double insulation that provides a means for grounding only the internal and nonaccessible, noncurrent-carrying metal parts of the pump.

SECTION E4107 STORABLE SWIMMING POOLS

E4107.1 Pumps. A cord-connected pool filter pump for use with storable pools shall incorporate an approved system of double insulation or its equivalent and shall be provided with means for grounding only the internal and nonaccessible noncurrent-carrying metal parts of the appliance.

The means for grounding shall be an equipment grounding conductor run with the power-supply conductors in a flexible cord that is properly terminated in a grounding-type attachment plug having a fixed grounding contact.

E4107.2 Ground-fault circuit-interrupters required. Electrical equipment, including power-supply cords, used with storable pools shall be protected by ground-fault circuit-interrupters.

E4107.3 Lighting fixtures. Lighting fixtures for storable pools shall not have exposed metal parts and shall be listed for the purpose as an assembly. In addition, lighting fixtures for storable pools shall comply with the requirements of Section E4107.3.1 or E4107.3.2.

E4107.3.1 Fifteen (15) volts or less. A lighting fixture installed in or on the wall of a storable pool shall be part of a cord- and plug-connected lighting assembly. The assembly shall:

1. Have a fixture lamp that operates at 15 volts or less; and
2. Have an impact-resistant polymeric lens, fixture body, and transformer enclosure; and
3. Have a transformer meeting the requirements of Section E4106.1 with a primary rating not over 150 volts.

E4107.3.2 Not over 150 volts. A lighting assembly without a transformer, and with the fixture lamp(s) operating at not over 150 volts, shall be permitted to be cord- and plug-connected where the assembly complies with all of the following:

1. It has an impact-resistant polymeric lens and fixture body.
2. A ground-fault circuit interrupter with open neutral protection is provided as an integral part of the assembly.
3. The fixture lamp is permanently connected to the ground-fault circuit interrupter with open-neutral protection.
4. It complies with the requirements of Section E4106.4.

SECTION E4108 SPAS AND HOT TUBS

E4108.1 Ground-fault circuit-interrupters. The outlet(s) that supplies a self-contained spa or hot tub, or a packaged spa or hot tub equipment assembly, or a field-assembled spa or hot tub with a heater load of 50 amperes or less, shall be protected by a ground-fault circuit-interrupter.

A listed self-contained unit or listed packaged equipment assembly marked to indicate that integral ground-fault circuit-interrupter protection is provided for all electrical parts within the unit or assembly, including pumps, air blowers, heaters, lights, controls, sanitizer generators and wiring, shall not require that the outlet supply be protected by a ground-fault circuit interrupter.

A field assembled spa or hot tub rated greater than 250 volts or rated 3 phase shall not require the supply to be protected by a ground-fault circuit interrupter.

A combination pool/hot tub or spa assembly commonly bonded need not be protected by a ground-fault circuit interrupter.

E4108.2 Electric water heaters. Electric spa and hot tub water heaters shall be listed and shall have the heating elements subdivided into loads not exceeding 48 amperes and protected at not more than 60 amperes. The ampacity of the

branch-circuit conductors, and the rating or setting of over-current protective devices, shall be not less than 125 percent of the total nameplate load rating.

E4108.3 Underwater audio equipment. Underwater audio equipment used with spas and hot tubs shall comply with the provisions of Section E4106.9.

SECTION E4109 HYDROMASSAGE BATHTUBS

E4109.1 Ground-fault circuit-interrupters. Hydromassage bathtubs and their associated electrical components shall be protected in accordance with Section E4109.

E4109.2 Other electric equipment. Lighting fixtures, switches, receptacles, and other electrical equipment located in the same room, and not directly associated with a hydromassage bathtub, shall be installed in accordance with the requirements of this code relative to the installation of electrical equipment in bathrooms.

E4109.3 Accessibility. Hydromassage bathtub electrical equipment shall be accessible without damaging the building structure or building finish.

E4109.4 Bonding. All metal piping systems, metal parts of electrical equipment, and pump motors associated with the hydromassage tub shall be bonded together using a copper bonding jumper, insulated, covered, or bare, not smaller than No. 8 solid.

Metal parts of listed equipment incorporating an approved system of double insulation and providing a means for grounding internal nonaccessible, noncurrent-carrying metal parts shall not be bonded.