

E3401.1 Applicability. The provisions of 2015 International Residential Code Chapters 34 through 43 with the amendments below shall replace the adopted International Residential Code Chapters 34 through 43 and hereby establish the general scope of the electrical system and equipment requirements of this code. Chapters 34 through 43 cover those wiring methods and materials most commonly encountered in the construction of one- and two-family dwellings and structures regulated by this code. Other wiring methods, materials and subject matter covered in NFPA 70 are also allowed by this code.

E3401.2 Scope. Chapters 34 through 43 shall cover the installation of electrical systems, equipment and components indoors and outdoors that are within the scope of this code, including services, power distribution systems, fixtures, appliances, devices and appurtenances. Services within the scope of this code shall be limited to 120/240-volt, 0- to 400-ampere, single-phase systems. These chapters specifically cover the equipment, fixtures, appliances, wiring methods and materials that are most commonly used in the construction or alteration of one- and two-family dwellings and accessory structures regulated by this code. The omission from these chapters of any material or method of construction provided for in the referenced standard NFPA 70 shall not be construed as prohibiting the use of such material or method of construction.

E3401.2.1 Electrical systems, equipment or components not specifically covered in these chapters shall comply with the applicable provisions of NFPA 70. (Including but not limited to: alternative power generating equipment, photovoltaic, wind turbines and generators, etc.)

E3401.4 Additions and alterations. Any addition or alteration to an existing electrical system shall be made in conformity to the provisions of Chapters 34 through 43 additionally refer to Appendix J for additional requirements based upon the scope and area of work. Where additions subject portions of existing systems to loads exceeding those permitted herein, such portions shall be made to comply with Chapters 34 through 43.

E3601.6.2 Service disconnect location. The service disconnecting means shall be installed at a readily accessible location at the meter. Service disconnecting means shall not be installed in bathrooms. Each occupant shall have access to the disconnect serving the dwelling unit in which they reside.

E3602.2.1 Services under 100 amperes.

Services that are not required to be 100 amperes shall be sized in accordance with Chapter 37.

E3603.1 Grounded and ungrounded service conductor size.

Service and feeder conductors supplied by a single-phase, 120/240-volt system shall be sized in accordance with Table 3705.1.

Sections E3603.1. through E3603.2 shall be deleted.

E3603.4 Grounding electrode conductor size. The grounding electrode conductors shall be sized based on the size of the service entrance conductors as required in Table 3705.1.

Table E3603.4 shall be deleted.

E3605.5 Protection of all other service cables. Above-ground service-entrance cables, where subject to physical damage, shall be protected by one or more of the following: rigid metal conduit, intermediate metal conduit, or other approved means.

E3605.5.1 Conduit Support. Shall be added as follows: All service entrance conduit for overhead service drops shall be supported by galvanized 2 piece back-straps or an approved equal. Corrosion resistant materials shall be required per NEC 300.6

E3605.9 Overhead service locations. Connections at service heads shall be in accordance with Sections E3605.9.1 through E3605.9.7.

E3605.9.3 Service-head location. Service heads shall be located above the point of attachment of the service-drop or overhead service conductors to the building or other structure. Exception: Where it is impracticable to locate the service head above the point of attachment, the service head or gooseneck location shall be not more than 24 inches (610 mm) from the point of attachment.

E3605.9.5 Drip loops. Drip loops shall be formed on individual conductors. To prevent the entrance of moisture, service-entrance conductors shall be connected to the service-drop or overhead conductors below the level of the service head.

E3606.4 Marking. Service equipment shall be marked to identify it as being suitable for use as service equipment. Service equipment shall be listed. Individual meter socket enclosures shall be considered as service equipment.

E3608.1 Grounding electrode system.

E3608.1.2 Concrete-encased electrode.

Unless otherwise accepted by the building official, a concrete encased electrode shall be installed in new structures with an electrical service.

A concrete-encased electrode consisting of at least 20 feet (6096 mm) of either of the following shall be considered as a grounding electrode:

1. One or more bare or zinc galvanized or other electrically conductive coated steel reinforcing bars or rods not less than 1/2 inch (13 mm) in diameter, installed in one continuous 20-foot (6096 mm) length, or if in multiple pieces connected together by the usual steel tie wires, exothermic welding, welding, or other effective means to create a 20-foot (6096 mm) or greater length.

2. A bare copper conductor not smaller than 4 AWG.

Metallic components shall be encased by at least 2 inches (51 mm) of concrete and shall be located horizontally within that portion of a concrete foundation or footing that is in direct contact with the earth or within vertical foundations or structural components or members that are in direct contact with the earth. Where multiple concrete-encased electrodes are

present at a building or structure, only one shall be required to be bonded into the grounding electrode system.

E3701.3 Selection of ampacity. Where more than one calculated or tabulated ampacity could apply for a given circuit length, the lowest value shall be used.

E3702.1.1 Existing 12 AWG branch circuits: Existing branch circuits with 12 AWG conductors that cannot be completely traced throughout the circuit shall be served by no more than 15 ampere breakers.

TABLE E3705.1 ALLOWABLE AMPACITIES

CONDUCTOR SIZE	CONDUCTOR TEMPERATURE RATING						CONDUCTOR SIZE
	60°C	75°C	90°C	60°C	75°C	90°C	
AWG kcmil	Types TW, UF	Types RHW, THHW, THW, THWN, USE, XHHW	Types RHW-2, THHN, THHW, THW-2, THWN-2, XHHW, XHHW-2, USE-2	Types TW, UF	Types RHW, THHW, THW, THWN, USE, XHHW	Types RHW-2, THHN, THHW, THW-2, THWN-2, XHHW, XHHW-2, USE-2	AWG kcmil
	Copper			Aluminum or copper-clad aluminum			
14 ^a	15	20	25				
12 ^a	20	25	30				
10 ^a	30	35	40				
8	40	50	55				
6	55	65	75				
4	70	85	95				
3	85	100	115				

2	95	115	130				
1	110	130	145				
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0

~~E3705.4.4 Conductors of Type NM cable. Delete section in its entirety~~

TABLE E3801.2 ALLOWABLE WIRING METHODS

ALLOWABLE WIRING METHOD		NEW STRUCTURES	EXISTING STRUCTURES for limitations of use refer to IRC Appendix J
Armored cable (BX)	AC	Deleted	Deleted - See FMC and MC for other options
Electrical metallic tubing (Conduit)	EMT	Permitted without indenter type couplings	Permitted without indenter type couplings
Electrical nonmetallic tubing	ENT	Deleted	Deleted
Flexible metal conduit (Greenfield)	FMC	Deleted	Limited in existing unexposed assemblies. (See IRC Appendix J). Then where partially exposed to transition to EMT/RMC shall only be permitted in lengths not to exceed (6) six feet.
Intermediate metal conduit	IMC	Permitted	Permitted

Liquidtight flexible metallic conduit	LFMC	Permitted in lengths not to exceed 6 feet	Permitted in lengths not to exceed 6 feet
Liquidtight flexible non-metallic conduit	LFNC	Permitted in lengths not to exceed 6 feet	Permitted in lengths not to exceed 6 feet
Metal-clad cable	MC	Deleted Except where included as a factory assembled sub component of a manufactured system.	Limited in existing unexposed assemblies. (See IRC Appendix J) Then where partially exposed to transition to EMT/RMC shall only be permitted in lengths not to exceed (6) six feet.
Nonmetallic sheathed cable (Romex)	NM	Deleted	Deleted
Rigid polyvinyl chloride conduit - (PVC)	RNC/PVC	Underground use only.	Underground use only.
Rigid metallic conduit	RMC	Permitted	Permitted
Service entrance cable	SE	Deleted	Deleted
Surface Metal raceways	SMR	Permitted when containing an equipment grounding conductor	Permitted when containing an equipment grounding conductor
Surface Non-Metallic raceways	SNR	Deleted	Deleted

Underground feeder cable	UF	Deleted	Limited see (IRC Appendix J) Only in exterior applications, and in conformance with the cable listing
Underground service cable	USE	Deleted	Deleted
USE-2	USE-2	Above ground when part of a manufacturers systems/requirements	Above ground when part of a manufacturers systems/requirements

TABLE E3801.4 ALLOWABLE APPLICATIONS FOR WIRING METHODS ^{a, b, c, d, e, f, g, h, i, j, k}

Note that uses of wiring methods are further restricted by Table 3801.2

ALLOWABLE APPLICATIONS (application allowed where marked with an "A")	EMT	FM C	IMC RMC RNC PVC	LFMC, LFNC ^{a, g}	MC	SMR
Services			A			--
Feeders	A	A	A	A		--
Branch circuits	A	A	A	A	A	A
Inside a building	A	A	A	A	A	A
Wet locations exposed to sunlight	A	--	A	A	A	--
Damp locations	A	A ^d	A	A	A	--
Embedded in noncinder concrete in dry location	A	--	A	A ^j	--	--
In noncinder concrete in contact with grade		--	A ^f		--	--
Embedded in plaster not exposed to dampness	A	A	A	A	A	--
Embedded in masonry	A	--	A ^f	A	A	--

In masonry voids and cells exposed to dampness or below grade line			A ^f	A	A	--
Fished in masonry voids	--	A	--	A	A	--
In masonry voids and cells not exposed to dampness	A	A	A	A	A	--
Run exposed	A	A	A	A	A	A
Run exposed and subject to physical damage	--	--	A ^g	--	--	--
For direct burial		--	A ^f	A		--

For SI: 1 foot = 304.8 mm.

- a. Liquid-tight flexible nonmetallic conduit without integral reinforcement within the conduit wall shall not exceed 6 feet in length.
- b. Type USE cable shall not be used inside buildings.
- c. The grounded conductor shall be insulated.
- d. Conductors shall be a type approved for wet locations and the installation shall prevent water from entering other raceways.
- e. Shall be listed as "Sunlight Resistant."
- f. Metal raceways shall be protected from corrosion and approved for the application. Aluminum RMC requires approved supplementary corrosion protection.
- g. RNC shall be Schedule 80.
- h. Shall be listed as "Sunlight Resistant" where exposed to the direct rays of the sun.
- i. Conduit shall not exceed 6 feet in length.
- j. Liquid-tight flexible nonmetallic conduit is permitted to be encased in concrete where listed for direct burial and only straight connectors listed for use with LFNC are used.
- k. In wet locations under any of the following conditions:
 1. The metallic covering is impervious to moisture.
 2. A lead sheath or moisture-impervious jacket is provided under the metal covering.
 3. The insulated conductors under the metallic covering are listed for use in wet locations and a corrosion-resistant jacket is provided over the metallic sheath.

TABLE E3802.1 GENERAL INSTALLATION AND SUPPORT REQUIREMENTS FOR WIRING METHODS a, b, c, d, e, f, g, h, i, j, k

Note that uses of wiring methods are further restricted by Table 3801.2

INSTALLATION REQUIREMENTS (Requirement applicable only to wiring methods marked "A")	MC	EMT IMC RMC	FMC, LFMC, LFNC	UF	RNC / PVC	SMR ^a
Where run parallel with the framing member or furring strip, the wiring shall be not less than 1 1/4 inches from the edge of a furring strip or a framing member such as a joist, rafter or stud or shall be physically protected.	A	--	A	A	--	--
Bored holes in framing members for wiring shall be located not less than 1 1/4 inches from the edge of the framing member or shall be protected with a minimum 0.0625-inch steel plate or sleeve, a listed steel plate or other physical protection.	A ^k	--	A ^k	A ^k	--	--
Where installed in grooves, to be covered by wallboard, siding, paneling, carpeting, or similar finish, wiring methods shall be protected by 0.0625-inch-thick steel plate, sleeve, or equivalent, a listed steel plate or by not less than 1 1/4-inch free space for the full length of the groove in which the cable or raceway is installed.	A	--	A	A	--	A
Securely fastened bushings or grommets shall be provided to protect wiring run through openings in metal framing members.	--	--	--	A ^j	--	--
The maximum number of 90-degree bends shall not exceed four between junction boxes.	--	A	A	--	A	--
Bushings shall be provided where entering a box, fitting or enclosure unless the box or fitting is designed to afford equivalent protection.	A	A	A	--	A	A
Ends of raceways shall be reamed to remove rough edges.	--	A	A	--	A	A

Maximum allowable on center support spacing for the wiring method in feet.	4.5 _{b, c}	10 ^l	4.5 ^b	4.5 _i	3 ^{d, l}	--
Maximum support distance in inches from box or other terminations.	12 _{b, f}	36	12 ^{b, g}	12 _{h, i}	36	--

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 degree = 0.0175 rad.

- a. Installed in accordance with listing requirements.
- b. Supports not required in accessible ceiling spaces between light fixtures where lengths do not exceed 6 feet.
- c. Six feet for MC cable.
- d. Five feet for trade sizes greater than 1 inch.
- e. Two and one-half feet where used for service or outdoor feeder and 4.5 feet where used for branch circuit or indoor feeder.
- f. Twenty-four inches for AC cable and thirty-six inches for interlocking Type MC cable where flexibility is necessary.
- g. Where flexibility after installation is necessary, lengths of flexible metal conduit and liquidtight flexible metal conduit measured from the last point where the raceway is securely fastened shall not exceed: 36 inches for trade sizes ½ through 1¼, 48 inches for trade sizes 1½ through 2 and 5 feet for trade sizes 2½ and larger.
- h. Within 8 inches of boxes without cable clamps.
- i. Flat cables shall not be stapled on edge.
- j. Bushings and grommets shall remain in place and shall be listed for the purpose of cable protection.
- k. See Sections R502.8 and R802.7 for additional limitations on the location of bored holes in horizontal framing members.

E3802.2 Cables in accessible attics. When permitted by table E3801.2. Cables in attics or roof spaces provided with access shall be installed as specified in Sections E3802.2.1 and E3802.2.2.

E3802.4 In unfinished basements and crawl spaces.

When existing and permitted to remain. Where type NM or SE cable is run at angles with joists in unfinished basements and crawl spaces, cable assemblies containing two or more conductors of sizes 6 AWG and larger and assemblies containing three or more conductors of sizes 8 AWG and larger shall not require additional protection where attached directly to the bottom of the joists. Smaller cables shall be run either through bored holes in joists or on running boards. Type NM or SE cable installed on the wall of an unfinished basement

shall be permitted to be installed in a listed conduit or tubing or shall be protected in accordance with Table E3802.1. Conduit or tubing shall be provided with a suitable insulating bushing or adapter at the point where the cable enters the raceway. The sheath of the Type NM or SE cable shall extend through the conduit or tubing and into the outlet or device box not less than 1/4 inch (6.4 mm). The cable shall be secured within 12 inches (305 mm) of the point where the cable enters the conduit or tubing. Metal conduit, tubing, and metal outlet boxes shall be connected to an equipment grounding conductor complying with Section E3908.13.

SECTION E3803 UNDERGROUND INSTALLATION REQUIREMENTS E3803.1 Minimum cover requirements.

Direct buried cable or raceways shall be installed in accordance with the minimum cover requirements of Table E3803.1.

TABLE E3803.1 MINIMUM COVER REQUIREMENTS, BURIAL IN INCHES a, b, c, d, e

LOCATION OF WIRING METHOD OR CIRCUIT	TYPE OF WIRING METHOD OR CIRCUIT				
	1 Direct burial cables or conductors	2 Rigid metal conduit or intermediate metal conduit	3 Nonmetallic raceways listed for direct burial without concrete encasement or other approved raceways	4 Residential branch circuits rated 120 volts or less with GFCI protection and maximum overcurrent protection of 20 amperes	5 Circuits for control of irrigation and landscape lighting limited to not more than 30 volts and installed with type UF or in other identified cable or raceway
All locations not specified below	24	6	18	12	6
In trench below 2-inch-thick concrete or equivalent	18	6	12	6	6

Under minimum of 4-inch-thick concrete exterior slab with no vehicular traffic and the slab extending not less than 6 inches beyond the underground installation	18	4	4	6 (Direct burial) 4 (In raceway)	6 (Direct burial) 4 (In raceway)
Under streets, highways, roads, alleys, driveways and parking lots	24	24	24	24	24
One- and two-family dwelling driveways and outdoor parking areas, and used only for dwelling-related purposes	18	18	18	12	18
In solid rock where covered by minimum of 2 inches concrete extending down to rock	2 (In raceway only)	2	2	2 (In raceway only)	2 (In raceway only)

For SI: 1 inch = 25.4 mm.

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

- b. Lesser depths shall be permitted where cables and conductors rise for terminations or splices or where access is otherwise required.
- c. Where one of the wiring method types listed in columns 1 to 3 is combined with one of the circuit types in columns 4 and 5, the shallower depth of burial shall be permitted.
- d. Where solid rock prevents compliance with the cover depths specified in this table, the wiring shall be installed in metal or nonmetallic raceway permitted for direct burial. The raceways shall be covered by a minimum of 2 inches of concrete extending down to the rock.
- e. Cover is defined as the shortest distance in inches (millimeters) measured between a point on the top surface of any direct-buried conductor, cable, conduit or other raceway and the top surface of finished grade, concrete, or similar cover.

E3803.11 Under buildings. Underground cable installed under a building shall be in a(n) RMC, IMC, RNC/PVC, raceway.

E3903.1 General. Lighting outlets shall be provided in accordance with Sections E3903.2 through E3903.4.

E3903.2 Habitable rooms. At least one wall switch-controlled lighting outlet shall be installed in every habitable room, closet with a depth greater than 4 feet, and bathroom.

E3904.6 Conduit and tubing fill. The maximum number of conductors installed in conduit or tubing shall not exceed 9 conductors.

E3904.7 Low Voltage Air handling-stud cavity and joist spaces. Where wiring methods having a nonmetallic covering pass through stud cavities and joist spaces used for air handling, such wiring shall pass through such spaces perpendicular to the long dimension of the spaces.

E3905.3 Nonmetallic boxes. Nonmetallic boxes shall not be installed, except in corrosive locations or in non-grounded circuits when they are permitted to remain. Further when permitted they shall be used only with cabled wiring methods with entirely nonmetallic sheaths, flexible cords and nonmetallic raceways.

E3905.6.2 Ceiling outlets. At every outlet not physically capable of hanging a ceiling fan, the box shall be designed or installed so that a luminaire or lampholder can be attached. Such boxes shall be capable of supporting a luminaire weighing up to 50 pounds (22.7 kg). A luminaire that weighs more than 50 pounds (22.7 kg) shall be supported independently of the outlet box, unless the outlet box is listed and marked for the maximum weight to be supported. Ceiling outlets physically capable (due to location and clearances) of hanging a future ceiling fan shall meet the requirements of E3905.8 Boxes at fan outlets.

E3908.9 Equipment fastened in place or connected by permanent wiring methods. Noncurrent-carrying metal parts of equipment, raceways and other enclosures, where required to be grounded, shall be grounded by one of the following methods:

1. By any of the equipment grounding conductors permitted by Sections E3908.8 through E3908.8.2.

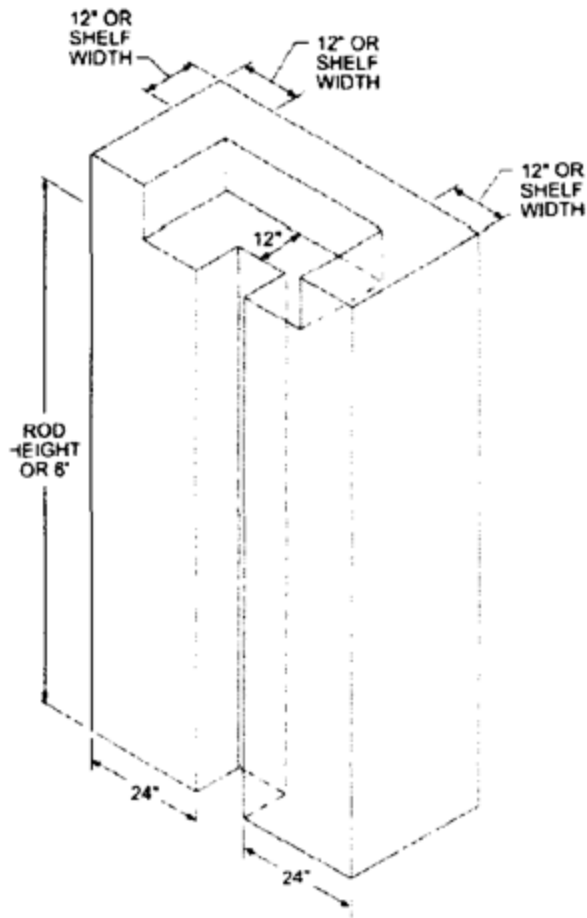
2. By an equipment grounding conductor contained within the same raceway, cable or cord, or otherwise run with the circuit conductors. Equipment grounding conductors shall be identified in accordance with Section E3407.2.

TABLE E3908.12 EQUIPMENT GROUNDING CONDUCTOR SIZING. Heading of aluminum column shall be modified as indicated

RATING OR SETTING OF AUTOMATIC OVERCURRENT DEVICE IN CIRCUIT AHEAD OF EQUIPMENT, CONDUIT, ETC., NOT EXCEEDING THE FOLLOWING RATINGS (amperes)	MINIMUM SIZE
Copper wire No. (AWG)	Aluminum or copper-clad aluminum wire No. (AWG) Minimum 1/0

E3908.16 Nonmetallic boxes. When allowed per 3905.3, one or more equipment grounding conductors brought into a nonmetallic outlet box shall be arranged to allow connection to fittings or devices installed in that box.

E3908.21 Underground/Under-slab/Concrete Encased Raceway: shall be added Equipment Grounding Conductor: A conductor to serve as a 100% redundant Equipment Grounding conductor shall be installed in all underground raceways and raceways in concrete.



SECTION E4003 FIXTURES

E4003.12 Luminaires in clothes closets. The types of luminaires installed in clothes closets shall be limited to surface-mounted LED luminaires with completely enclosed light sources, surface-mounted or recessed fluorescent luminaires, and surface-mounted fluorescent or LED luminaires identified as suitable for installation within the closet storage area. The minimum clearance between luminaires installed in clothes closets and the nearest point of a closet storage area shall be as follows:

1. Surface-mounted LED luminaires with a completely enclosed light source shall be installed on the wall above the door or on the ceiling, provided that there is a minimum clearance of 12 inches (305 mm) between the fixture and the nearest point of a storage space.
2. Surface-mounted fluorescent luminaires shall be installed on the wall above the door or on the ceiling, provided that there is a minimum clearance of 6 inches (152 mm).
3. Recessed LED luminaires with a completely enclosed light source shall be installed in the wall or the ceiling provided that there is a minimum clearance of 6 inches (152 mm).

TABLE E4202.1 ALLOWABLE APPLICATIONS FOR WIRING METHODS a, b, c, d, e, f, g, h, i

Note that uses of wiring methods are further restricted by Table 3801.2

WIRING LOCATION OR PURPOSE (Application allowed where marked with an "A")	FMC, SMR	EMT	ENT	IMC ^j , RMC ^j , RNC/PVC ⁱ	LF MC	LFN MC	MC ^k	FLEX CORD
Panelboard(s) that supply pool equipment: from service equipment to panelboard	A ^{b,e} SR not permitted	A ^c	A ^b	A	--	A	A ^e	--
Wet-niche and no-niche luminaires: from branch circuit OCPD to deck or junction box	AC ^b only	A ^c	A ^b	A	--	A	A ^b	--
Wet-niche and no-niche luminaires: from deck or junction box to forming shell	--	--	--	A ^d	--	A	--	A ^h
Dry niche: from branch circuit OCPD to luminaires	AC ^b only	A ^c	A ^b	A	--	A	A ^b	--
Pool-associated motors: from branch circuit OCPD to motor	A ^b	A ^c	A ^b	A	A ^f	A ^f	A ^b	A ^h
Packaged or self-contained outdoor spas and hot tubs with underwater luminaire: from branch circuit OCPD to spa or hot tub	AC ^b only	A ^c	A ^b	A	A ^g	A ^g	A ^b	A ^h
Packaged or self-contained outdoor spas and hot tubs without underwater luminaire: from branch	A ^b	A ^c	A ^b	A	A ^g	A ^g	A	A ^h

circuit OCPD to spa or hot tub								
Indoor spas and hot tubs, hydromassage bathtubs, and other pool, spa or hot tub associated equipment: from branch circuit OCPD to equipment	A ^b	A ^c	A ^b	A	A	A	A	A ^h
Connection at pool lighting transformers or power supplies	AC ^b only	A ^c	A ^b	A	A ^{m, g}	A ^g	A ^b	--

- a. For all wiring methods, see Section E4205 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 installations in accordance with the exception to Section E4205.6.
- f. Limited to where necessary to employ flexible connections at or adjacent to a pool motor.
- g. Sections installed external to spa or hot tub enclosure limited to individual lengths not to exceed 6 feet. Length not limited inside spa or hot tub enclosure.
- h. Flexible cord shall be installed in accordance with Section E4202.2.
- i. Nonmetallic conduit shall be rigid polyvinyl chloride conduit Type PVC or reinforced.