

Method of Wiring	Uses Permitted	Uses Not Permitted	Bending Radius	Securing and Supporting	Construction.
<p>ARTICLE 3.20</p> <p>ARMORED CABLE: TYPE AC</p> <p>Armored Cable, Type AC. A fabricated assembly of insulated conductors in a flexible metallic enclosure.</p>	<p>(1) In both exposed and concealed work</p> <p>(2) In cable trays</p> <p>(3) In dry locations</p> <p>(4) Embedded in plaster finish on brick or other masonry, except in damp or wet locations</p> <p>(5) To be run or fished in the air voids of masonry block or tile walls where such walls are not exposed or subject to excessive moisture or dampness</p>	<p>(1) Where subject to physical damage</p> <p>(2) In damp or wet locations</p> <p>(3) In air voids of masonry block or tile walls where such walls are exposed or subject to excessive moisture or dampness</p> <p>(4) Where exposed to corrosive fumes or vapors</p> <p>(5) Embedded in plaster finish on brick or other masonry in damp or wet locations</p>	<p>The radius of the curve of the inner edge of any bend shall not be less than five times the diameter of the cable.</p>	<p>- secured within 300 mm of every outlet box, junction box, cabinet, or fitting and at intervals not exceeding 1 400 mm where installed on or across framing members.</p> <p>Type AC cable shall be supported at intervals not exceeding 1 400 mm.</p> <p>- shall be permitted to be unsupported where the cable complies with any of the following:</p> <p>(1) Is fished between access points through concealed spaces in finished buildings or structures and supporting is impracticable</p> <p>(2) Is not more than 600 mm in length at terminals where flexibility is necessary</p> <p>(3) Is not more than 1 800 mm in length from the last point of cable support to the point of connection to a luminaire(s) [lighting fixture(s)] or other electrical equipment and the cable and point of connection are within an accessible ceiling.</p>	<p>Armor of flexible metal tape and shall have an internal bonding strip of copper or aluminum in intimate contact with the armor for its entire length.</p>

Method of Wiring	Uses Permitted	Uses Not Permitted	Installation	Clearance	Securing and Supporting	Construction.
<p>ARTICLE 3.66</p> <p>AUXILIARY GUTTERS</p> <p>Metallic Auxiliary Gutters. Sheet metal enclosures with hinged or removable covers for housing and protecting electric wires, cable, and busbars in which conductors are laid in place after the wireway has been installed as a complete system.</p> <p>Nonmetallic Auxiliary Gutters. Flame retardant, nonmetallic enclosures with removable covers for housing and protecting electric wires, cable, and busbars in which conductors are laid in place after the wireway has been installed as a complete system</p>	<p>Auxiliary gutters shall be permitted to supplement wiring spaces at meter centers, distribution center, switchboards, and may enclose conductors or busbars.</p> <p>(a) Sheet Metal Auxiliary Gutters. (1) Indoor and Outdoor Use. Sheet metal auxiliary gutters shall be permitted for indoor and outdoor use. (2) Wet Locations. Gutters installed in wet locations shall be suitable for such location</p> <p>(b) Nonmetallic Auxiliary Gutters. Nonmetallic auxiliary gutters shall be listed for the maximum ambient temperature of the installation and marked for the installed conductor insulation temperature rating. (1) Outdoors. Nonmetallic auxiliary gutters shall be permitted to be installed outdoors where listed and marked as suitable for the purpose. (2) Indoors. Nonmetallic auxiliary gutters shall be permitted to be installed</p>	<p>Auxiliary gutters shall not be used under the following conditions:</p> <p>(1) To enclose switches, overcurrent devices, appliances, or other similar equipment.</p> <p>(2) To extend a greater distance than 9 000 mm beyond the equipment that it supplements.</p>	<p>Number of Conductors.</p> <p>(a) Sheet Metal Auxiliary Gutters. The sum of the cross-sectional areas of all contained conductors at any cross section of a sheet metal auxiliary gutter shall not exceed 20 percent of the interior cross sectional area of the sheet metal auxiliary gutter.</p> <p>(b) Nonmetallic Auxiliary Gutters. The sum of cross-sectional areas of all contained conductors at any cross section of the nonmetallic auxiliary gutter shall not exceed 20 percent of the interior cross-sectional area of the nonmetallic auxiliary gutter.</p>	<p>Clearance of Bare Live Parts. Bare conductors shall be securely and rigidly supported so that the minimum clearance between bare current-carrying metal parts of different potential mounted on the same surface will not be less than 50 mm, nor less than 25 mm for parts that are held free in the air. A clearance not less than 25 mm shall be secured between bare current-carrying metal parts and any metal surface. Adequate provisions shall be made for the expansion and contraction of busbars.</p>	<p>(a) Sheet Metal Auxiliary Gutters. Sheet metal auxiliary gutters shall be supported throughout their entire length at intervals not exceeding 1 500 mm.</p> <p>(b) Nonmetallic Auxiliary Gutters. Nonmetallic auxiliary gutters shall be supported at intervals not to exceed 900 mm and at each end or joint, unless listed for other support intervals. In no case shall the distance between supports exceed 3 000 mm.</p>	<p>Splices and Taps. Splices and taps shall comply with the following</p> <p>(a) Within Gutters. Splices or taps shall be permitted within gutters where they are accessible by means of removable covers or doors. The conductors, including splices and taps, shall not fill the gutter to more than 75 percent of its area.</p> <p>(b) Bare Conductors. Taps from bare conductors shall leave the gutter opposite their terminal connections, and conductors shall not be brought in contact with uninsulated current-carrying parts of different potential.</p> <p>(c) Suitably Identified. All taps shall be suitably identified at the gutter as to the circuit or equipment that they supply.</p> <p>(a) Electrical and Mechanical Continuity. Gutters shall be constructed and installed so that adequate electrical and mechanical continuity of the complete system is secured.</p> <p>(b) Substantial Construction. Gutters shall be of substantial construction and shall provide a complete enclosure for the contained conductors. All surfaces, both interior and exterior, shall be suitably</p>

indoors.

protected from corrosion. Corner joints shall be made tight, and where the assembly is held together by rivets, bolts, or screws, such fasteners shall be spaced not more than 300 mm apart.

(c) Smooth Rounded Edges. Suitable bushings, shields, or fittings having smooth, rounded edges shall be provided where conductors pass between gutters, through partitions, around bends, between gutters and cabinets or junction boxes, and at other locations where necessary to prevent abrasion of the insulation of the conductors.

(d) Covers. Covers shall be securely fastened to the gutter.

Method of Wiring	Uses Permitted	Uses Not Permitted	Marking and Supporting	Construction.
<p>ARTICLE 3.68</p> <p>BUSWAYS</p> <p>A grounded metal enclosure containing factory-mounted, bare or insulated conductors, which are usually copper or aluminum bars, rods, or tubes.</p>	<p>(a) Exposed. Busways shall be permitted to be located in the open where visible.</p> <p>(b) Concealed. Busways shall be permitted to be installed behind access panels, provided the busways are totally enclosed, of nonventilating-type construction, and installed so that the joints between sections and at fittings are accessible for maintenance purposes. Means of access shall be provided, and either of the following conditions shall be met:</p> <p>(1) The space behind the access panels shall not be used for airhandling purposes.</p> <p>(2) Where the space behind the access panels is used for environmental air, other than ducts and plenums, there shall be no provisions for plug-in connections, and the conductors shall be insulated.</p> <p>(c) Through Walls and Floors. Busways shall be permitted to be installed through walls or floors in accordance below:</p> <p>(1) Walls. Unbroken lengths of busway shall be permitted to be extended through dry walls.</p> <p>(2) Floors. Floor penetrations shall comply below:</p> <p>a. Shall be permitted to be extended vertically through dry floors if totally enclosed (unventilated) where passing through and for a minimum distance of 1 800 mm above the floor to provide adequate protection from physical damage.</p> <p>b. In other than industrial establishments, where a vertical riser penetrates two or more dry floors, a minimum 100 mm high curb shall be installed around all floor openings for riser busways to prevent liquids from entering the opening. The curb shall be installed within 300 mm of the floor opening. Electrical equipment shall be located so that it will not be damaged by liquids that are retained by the curb.</p>	<p>(a) Physical Damage. Busways shall not be installed where subject to severe physical damage or corrosive vapors.</p> <p>(b) Hoistways. Busways shall not be installed in hoistways.</p> <p>(c) Hazardous Locations. Busways shall not be installed in any hazardous (classified) location.</p> <p>(d) Wet Locations. Busways shall not be installed outdoors or in wet or damp locations .</p> <p>(e) Working Platform. Lighting busway and trolley busway shall not be installed less than 2 400 mm above the floor or working platform unless provided with a cover identified for the purpose.</p>	<p>Support -Busways shall be securely supported at intervals not exceeding 1 500 mm unless otherwise designed and marked.</p> <p>Marking. Busways shall be marked with the voltage and current rating for which they are designed, and with the manufacturer's name or trademark in such a manner as to be visible after installation.</p> <p>Dead Ends. A dead end of a busway shall be closed.</p> <p>Grounding. Busway shall be grounded</p>	<p>Feeder or Branch Circuits. Where a busway is used as a feeder, devices or plug-in connections for tapping off feeder or branch circuits from the busway shall contain the overcurrent devices required for the protection of the feeder or branch circuits. The plug-in device shall consist of an externally operable circuit breaker or an externally operable fusible switch.</p> <p>Branches from Busways. Branches from busways shall be permitted to use any of the following wiring methods:</p> <ol style="list-style-type: none"> (1) Type AC armored cable (2) Type MC metal-clad cable (3) Type MI mineral-insulated, metal-sheathed cable (4) Type IMC intermediate metal conduit (5) Type RMC rigid metal conduit (6) Type FMC flexible metal conduit (7) Type LFMC liquidtight flexible metal conduit (8) Type RNC rigid nonmetallic conduit (9) Type LFNC liquidtight flexible nonmetal conduit (10) Type EMT electrical metallic tubing (11) Type ENT electrical nonmetallic tubing (12) Busways (13) Strut-type channel raceway (14) Surface metal raceways (15) Surface nonmetallic raceways

Method of Wiring	Uses Permitted	Size and Marking	Securing and Supporting	Construction.
<p>ARTICLE 3.70</p> <p>CABLEBUS</p> <p>An assembly of insulated conductors with fittings and conductor terminations in a completely enclosed, ventilated protective metal housing.</p> <p>Cablebus is ordinarily assembled at the point of installation from the components furnished or specified by the manufacturer in accordance with instructions for the specific job. This assembly is designed to carry fault current and to withstand the magnetic forces of such current.</p>	<p>Approved cablebus shall be permitted at any voltage or current for which spaced conductors are rated and shall be installed only for exposed work.</p> <p>Cablebus installed outdoors or in corrosive, wet, or damp locations shall be identified for such use.</p> <p>Cablebus shall not be installed in hoistways or hazardous (classified) locations.</p> <p>Cablebus shall be permitted to be used for branch circuits, feeders, and services.</p> <p>Cablebus framework, where bonded, shall be permitted to be used as the equipment grounding conductor for branch circuits and feeders.</p>	<p>Size and Number of Conductors. The size and number of conductors shall be that for which the cablebus is designed, and in no case smaller than 50 mm²</p> <p>Marking. Each section of cablebus shall be marked with the manufacturer's name or trade designation and the maximum diameter, number, voltage rating, and ampacity of the conductors to be installed.</p> <p>Markings shall be located so as to be visible after installation.</p>	<p>The insulated conductors shall be supported on blocks or other mounting means designed for the purpose.</p> <p>The individual conductors in a cablebus shall be supported at intervals not greater than 900 mm for horizontal runs and 450 mm for vertical runs.</p> <p>Vertical and horizontal spacing between supported conductors shall not be less than one conductor diameter at the points of support.</p> <p>Fittings. A cablebus system shall include approved fittings for the following:</p> <ol style="list-style-type: none"> (1) Changes in horizontal or vertical direction of the run (2) Dead ends (3) Terminations in or on connected apparatus or equipment or the enclosures for such equipment (4) Additional physical protection where required, such as guards where subject to severe physical damage 	<p>Types of Conductors. The current-carrying conductors in cablebus shall have an insulation rating of 75°C or higher and be an approved type suitable for the application.</p> <p>Transversely Routed. Cablebus shall be permitted to extend transversely through partitions or walls, other than fire walls, provided the section within the wall is continuous, protected against physical damage, and unventilated.</p> <p>Through Dry Floors and Platforms. Except where firestops are required, cablebus shall be permitted to extend vertically through dry floors and platforms, provided the cablebus is totally enclosed at the point where it passes through the floor or platform and for a distance of 1 800 mm above the floor or platform.</p> <p>Through Floors and Platforms in Wet Locations. Except where firestops are required, cablebus shall be permitted to extend vertically through floors and platforms in wet locations where:</p> <ol style="list-style-type: none"> (1) there are curbs or other suitable means to prevent water flow through the floor or platform opening, and (2) where the cablebus is totally enclosed at the point where it passes through the floor or platform and for a distance of 1 800 mm above the floor or platform. <p>Grounding. A cablebus installation shall be grounded and bonded.</p>

Method of Wiring	Uses Not Permitted	Size and Marking	Construction.
<p>ARTICLE 3.72</p> <p>CELLULAR CONCRETE FLOOR RACEWAYS</p> <p>Cell. A single, enclosed tubular space in a floor made of precast cellular concrete slabs, the direction of the cell being parallel to the direction of the floor member.</p> <p>Header. Transverse metal raceways for electric conductors, providing access to predetermined cells of a precast cellular concrete floor, thereby permitting the installation of electric conductors from a distribution center to the floor cells.</p>	<p>Conductors shall not be installed in precast cellular concrete floor raceways as follows:</p> <p>(1) Where subject to corrosive vapor</p> <p>(2) In any hazardous (classified) locations</p> <p>(3) In commercial garages, other than for supplying ceiling outlets or extensions to the area below the floor but not above</p>	<p>Size of Conductors. No conductor larger than 50 mm² shall be installed, except by special permission.</p> <p>Maximum Number of Conductors. The combined cross sectional area of all conductors or cables shall not exceed 40 percent of the cross-sectional area of the cell or header.</p> <p>Ampacity of Conductors. The ampacity adjustment factors, provided in 3.10.1.15(b)(2), shall apply to conductors installed in cellular concrete floor raceways.</p>	<p>Header. The header shall be installed in a straight line at right angles to the cells. The header shall be mechanically secured to the top of the precast cellular concrete floor. The end joints shall be closed by a metal closure fitting and sealed against the entrance of concrete. The header shall be electrically continuous throughout its entire length and shall be electrically bonded to the enclosure of the distribution center.</p> <p>Connection to Cabinets and Other Enclosures. Connections from headers to cabinets and other enclosures shall be made by means of listed metal raceways and listed fittings.</p> <p>Junction Boxes. Junction boxes shall be leveled to the floor grade and sealed against the free entrance of water or concrete. Junction boxes shall be of metal and shall be mechanically and electrically continuous with the header.</p> <p>Markers. A suitable number of markers shall be installed for the future location of cells.</p> <p>Inserts. Inserts shall be leveled and sealed against the entrance of concrete. Inserts shall be of metal and shall be fitted with grounded-type receptacles. A grounding conductor shall connect the insert receptacles to a positive ground connection provided on the header. Where cutting through the cell wall for setting inserts or other purposes (such as providing access openings between header and cells), chips and other dirt shall not be allowed to remain in the raceway, and the tool used shall be designed so as to prevent the tool from entering the cell and damaging the conductors.</p> <p>Splices and Taps. Splices and taps shall be made only in header access units or junction boxes. For the purposes of this section, so-called loop wiring (continuous unbroken conductor connecting the individual outlets) shall not be considered to be a splice or tap.</p> <p>Discontinued Outlets. When an outlet is abandoned, discontinued, or removed, the sections of circuit conductors supplying the outlet shall be removed from the raceway. No splices or reinsulated conductors, such as would be the case of abandoned outlets on loop wiring, shall be allowed in raceways.</p>

Method of Wiring	Uses Not Permitted	Size and Marking	Construction/ Installation
<p>ARTICLE 3.74</p> <p>CELLULAR METAL FLOOR RACEWAYS</p> <p>Cellular Metal Floor Raceway. The hollow spaces of cellular metal floors, together with suitable fittings, that may be approved as enclosures for electric conductors.</p> <p>Cell. A single enclosed tubular space in a cellular metal floor member, the axis of the cell being parallel to the axis of the metal floor member.</p> <p>Header. A transverse raceway (talabok) for electric conductors, providing access to predetermined cells of a cellular metal floor, thereby permitting the installation of electric conductors from a distribution center to the cells.</p>	<p>(1) Where subject to corrosive vapor</p> <p>(2) In any hazardous (classified) location.</p> <p>(3) In commercial garages, other than for supplying ceiling outlets or extensions to the area below the floor but not above</p>	<p>Size of Conductors. No conductor larger than 50 mm² shall be installed, except by special permission.</p> <p>Maximum Number of Conductors in Raceway. The combined cross-sectional area of all conductors or cables shall not exceed 40 percent of the interior cross-sectional area of the cell or header.</p> <p>Splices and Taps. Splices and taps shall be made only in header access units or junction boxes.</p> <p>For the purposes of this section, loop wiring (continuous unbroken conductor connecting the individual outlets) shall not be considered to be a splice or tap.</p> <p>Ampacity of Conductors. The ampacity adjustment factors in 3.10.1.15(b)(2) shall apply to conductors installed in cellular metal floor raceways.</p>	<p>Discontinued Outlets. When an outlet is abandoned, discontinued, or removed, the sections of circuit conductors supplying the outlet shall be removed from the raceway. No splices or reinsulated conductors, such as would be the case with abandoned outlets on loop wiring, shall be allowed in raceways.</p> <p>Markers. A suitable number of markers shall be installed for locating cells in the future.</p> <p>Junction Boxes. Junction boxes shall be leveled to the floor grade and sealed against the free entrance of water or concrete. Junction boxes used with these raceways shall be of metal and shall be electrically continuous with the raceway.</p> <p>Inserts. Inserts shall be leveled to the floor grade and sealed against the entrance of concrete. Inserts shall be of metal and shall be electrically continuous with the raceway. In cutting through the cell wall and setting inserts, chips and other dirt shall not be allowed to remain in the raceway, and tools shall be used that are designed to prevent the tool from entering the cell and damaging the conductors.</p> <p>Connection to Cabinets and Extensions from Cells. Connections between raceways and distribution centers and wall outlets shall be made by means of liquidtight flexible metal conduit, flexible metal conduit where not installed in concrete, rigid metal conduit, intermediate metal conduit, electrical metallic tubing, or approved fittings. Where there are provisions for the termination of an equipment grounding conductor, nonmetallic conduit, electrical nonmetallic tubing, or liquidtight flexible nonmetallic conduit shall be permitted. Where installed in concrete, liquidtight flexible nonmetallic conduit shall be listed and marked for direct burial.</p> <p>Cellular metal floor raceways shall be constructed so that adequate electrical and mechanical continuity of the complete system will be secured. They shall provide a complete enclosure for the conductors. The interior surfaces shall be free from burrs and sharp edges, and surfaces over which conductors are drawn shall be smooth. Suitable bushings or fittings having smooth rounded edges shall be provided where conductors pass.</p>

Method of Wiring	Uses Permitted	Uses Not Permitted	Clearances	Securing and Supporting
<p>ARTICLE 3.94</p> <p>CONCEALED KNOB-AND-TUBE WIRING</p> <p>A wiring method using knobs, tubes, and flexible nonmetallic tubing for the protection and support of single insulated conductors</p>	<p>Concealed knob-and-tube wiring shall be permitted to be installed in the hollow spaces of walls and ceilings or in unfinished attics and roof spaces follows:</p> <p>(1) For extensions of existing installations</p> <p>(2) Elsewhere by special permission</p>	<p>(1) Commercial garages</p> <p>(2) Theaters and similar locations</p> <p>(3) Motion picture studios</p> <p>(4) Hazardous (classified) locations</p> <p>(5) Hollow spaces of walls, ceilings, and attics where such spaces are insulated by loose, rolled, or foamed-in-place insulating material that envelops the conductors</p>	<p>Through or Parallel to Framing Members. Where passing through wood cross members in plastered partitions, conductors shall be protected by noncombustible, nonabsorbent, insulating tubes extending not less than 75 mm beyond the wood member.</p> <p>(a) General. A clearance of not less than 75 mm shall be maintained between conductors and a clearance of not less than 25 mm between the conductor and the surface over which it passes.</p> <p>(b) Limited Conductor Space. Where space is too limited to provide these minimum clearances, such as at meters, panelboards, outlets, and switch points, the individual conductors shall be enclosed in flexible nonmetallic tubing, which shall be continuous in length between the last support and the enclosure or terminal point.</p> <p>Accessible by Stairway or Permanent Ladder. Conductors shall be installed along the side of or through bored holes in floor joists, studs, or rafters. Where run through bored holes, conductors in the joists and in studs or rafters to a height of not less than 2 100 mm above the floor or floor joists shall be protected by substantial running boards extending not less than 25 mm on each side of the conductors. Running boards shall be securely fastened in place. Running boards and guard strips shall not be required where conductors are installed along the sides of joists, studs, or rafters.</p> <p>Not Accessible by Stairway or Permanent Ladder. Conductors shall be installed along the sides of or through bored holes in floor joists, studs, or rafters.</p>	<p>Supporting. Conductors shall be rigidly supported on noncombustible, nonabsorbent insulating materials and shall not contact any other objects. Supports shall be installed as follows:</p> <p>(1) Within 150 mm of each side of each tap or splice, and</p> <p>(2) At intervals not exceeding 1 400 mm.</p> <p>Securing. Where solid knobs are used, conductors shall be securely tied thereto by tie wires having insulation equivalent to that of the conductor.</p>

Method of Wiring	Uses Permitted	Uses Not Permitted	Bends	Size and Marking	Securing and Supporting	Construction.
<p>ARTICLE 3.58</p> <p>ELECTRICAL METALLIC TUBING: TYPE EMT An unthreaded thin wall raceway of circular cross section designed for the physical protection and routing of conductors and cables and for use as an equipment grounding conductor when installed utilizing appropriate fittings.</p> <p>EMT is generally made of steel (ferrous) with protective coatings or aluminum (nonferrous).</p>	<p>(a) Exposed and Concealed. The use of EMT shall be permitted for both exposed and concealed work.</p> <p>(b) Corrosion Protection. Ferrous or nonferrous EMT, elbows, couplings, and fittings shall be permitted to be installed in concrete, in direct contact with the earth, or in areas subject to severe corrosive influences where protected by corrosion protection and judged suitable for the condition.</p> <p>(c) Wet Locations. All supports, bolts, straps, screws, and so forth shall be of corrosion-resistant materials.</p>	<p>(1) Where, during installation or afterward, it will be subject to severe physical damage</p> <p>(2) Where protected from corrosion solely by enamel</p> <p>(3) In cinder concrete or cinder fill where subject to permanent moisture unless protected on all sides by a layer of noncinder concrete at least 50 mm thick or unless the tubing is at least 450 mm under the fill</p> <p>(4) In any hazardous (classified) location</p> <p>(5) For the support of luminaires (fixtures) or other equipment except conduit bodies no larger than the largest trade size of the tubing Where practicable, dissimilar metals in contact anywhere in the system shall be avoided to eliminate the possibility of action</p>	<p>How Made. Bends shall be made so that the tubing is not damaged and the internal diameter of the tubing is not Effectively reduced.</p> <p>Number in One Run. There shall not be more than the equivalent of four quarter bends (360 degrees total) between pull points, for example, conduit bodies and boxes.</p>	<p>(a) Minimum. EMT smaller than metric 15 mm shall not be used.</p> <p>(b) Maximum. The maximum size of EMT shall be 100 mm.</p> <p>Marking. EMT shall be clearly and durably marked at least every 3 000 mm</p>	<p>(a) Securely Fastened. EMT shall be securely fastened in place at least every 3 000 mm. In addition, each EMT run between termination points shall be securely fastened within 900 mm of each outlet box, junction box, device box, cabinet, conduit body, or other tubing termination.</p> <p>(b) Supports. Horizontal runs of EMT supported by openings through framing members at intervals not greater than 3 000 mm and securely fastened within 900 mm of termination points shall be permitted.</p>	<p>Reaming and Threading. (a) Reaming. All cut ends of EMT shall be reamed or otherwise finished to remove rough edges. (b) Threading. EMT shall not be threaded.</p> <p>Grounding. EMT shall be permitted as an equipment Grounding conductor.</p>

Method of Wiring	Uses Permitted	Uses Not Permitted		Securing and Supporting	Construction.
<p>ARTICLE 3.62</p> <p>ELECTRICAL NONMETALLIC TUBING: TYPE ENT</p> <p>A nonmetallic pliable corrugated raceway of circular cross section with integral or associated couplings, connectors, and fittings for the installation of electric conductors.</p> <p>ENT is composed of a material that is resistant to moisture and chemical atmospheres and is flame retardant. A pliable raceway is a raceway that can be bent by hand with a reasonable force but without other assistance.</p>	<p>(1) In any building not exceeding three floors above grade as follows:</p> <p>a. For exposed work,</p> <p>b. Concealed within walls, floors, and ceilings</p> <p>(2) In any building exceeding three floors above grade, ENT shall be concealed within walls, floors, and ceilings where the walls, floors, and ceilings provide a thermal barrier of material that has at least a 15- minute finish rating</p> <p>(3) In locations subject to severe corrosive influences</p> <p>(4) In concealed, dry, and damp locations</p> <p>(5) Above suspended ceilings where the suspended ceilings provide a thermal barrier of material that has at least a 15-minute finish rating</p>	<p>(1) In hazardous (classified) locations</p> <p>(2) For the support of luminaires (fixtures) and other equipment</p> <p>(3) Where subject to ambient temperatures in excess of 50°C unless listed otherwise</p> <p>(4) For conductors or cables operating at a temperature higher than the ENT listed temperature rating</p> <p>5) For direct earth burial</p> <p>(6) Where the voltage is over 600 volts</p> <p>(7) In exposed locations</p> <p>(8) In theaters and similar locations.</p> <p>(9) Where exposed to the direct rays of the sun.</p> <p>(10) Where subject to physical damage</p>	<p style="text-align: center;"><u>Bends</u></p> <p>Number in One Run. There shall not be more than the equivalent of four quarter bends (360 degrees total) between pull points, for example, conduit bodies and boxes.</p> <p style="text-align: center;"><u>Size and Marking</u></p> <p>Minimum. ENT smaller than 15 mm shall not be used.</p> <p>Maximum. ENT larger than 50 mm shall not be used.</p> <p>Marking. ENT shall be clearly and durably marked at least every 3 000 mm</p>	<p>ENT shall be installed as a complete system</p> <p>Securely Fastened. ENT shall be securely fastened at intervals not exceeding 900 mm. In addition, ENT shall be securely fastened in place within 900 mm of each outlet box, device box, junction box, cabinet, or fitting where it terminates.</p> <p>Supports. Horizontal runs of ENT supported by openings in framing members at intervals not exceeding 900 mm and securely fastened within 900 mm of termination points shall be permitted.</p> <p>Bushings. Where a tubing enters a box, fitting, or other enclosure, a bushing or adapter shall be provided to protect the wire from abrasion unless the box, fitting, or enclosure design provides equivalent protection</p>	<p>Grounding. Where equipment grounding is required, a separate equipment grounding conductor shall be installed in the raceway.</p> <p>ENT shall be made of material that does not exceed the ignitibility, flammability, smoke generation, and toxicity characteristics of rigid polyvinyl chloride.</p> <p>ENT, as a pre-wired manufactured assembly, shall be provided in continuous lengths capable of being shipped in a coil, reel, or carton without damage.</p>

	<p>6) Encased in poured concrete, or embedded in a concrete slab on grade where ENT is placed on sand or approved screenings, provided fittings identified for this purpose are used for connections.</p> <p>(7) For wet locations indoors as permitted in this section or in a concrete slab on or below grade, with fittings listed for the purpose.</p> <p>(8) Raceway size 15 mm through 25 mm as listed manufactured pre-wired assembly.</p>				
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Method of Wiring	Uses Permitted	Uses Not Permitted	Securing and Supporting	Construction.	Marking.
<p>ARTICLE 3.22 -</p> <p>FLAT CABLE ASSEMBLIES: TYPE FC</p> <p>An assembly of parallel conductors formed integrally with an insulating material web specifically designed for field installation in surface metal raceway</p>	<p>(1) As branch circuits to supply suitable tap devices for lighting, small appliances, or small power loads. The rating of the branch circuit shall not exceed 30 amperes.</p> <p>(2) Where installed for exposed work.</p> <p>(3) In locations where they will not be subjected to physical damage. Where a flat cable assembly is installed less than 2 400 mm above the floor or fixed working platform, it shall be protected by a cover identified for the use.</p> <p>(4) In surface metal raceways identified for the use. The channel portion of the surface metal raceway systems shall be installed as complete systems before the flat cable assemblies are pulled into the raceways.</p>	<p>(1) Where subject to corrosive vapors unless suitable for the application</p> <p>(2) In hoistways or on elevators or escalators</p> <p>(3) In any hazardous (classified) location</p> <p>(4) Outdoors or in wet or damp locations unless identified for the use</p>	<p>The flat cable assemblies shall be supported by means of their special design features, within the surface metal raceways. The surface metal raceways shall be supported as required for the specific raceway to be installed.</p>	<p>- Splices shall be made in listed junction boxes.</p> <p>-Flat cable assemblies shall consist of two, three, four, or five conductors</p> <p>- Flat cable assemblies shall have conductors of 5.5 mm² (2.6 mm dia.) special stranded copper wires.</p> <p>-Each flat cable assembly dead end shall be terminated in an end-cap device identified for the use.</p>	<p>- shall have the temperature rating durably marked on the surface at intervals not exceeding 600 mm.</p> <p>The grounded conductor shall be identified throughout its length by means of a distinctive and durable white or gray marking.</p>

Method of Wiring	Uses Permitted	Uses Not Permitted	Marking.	Construction.
<p>ARTICLE 3.24</p> <p>FLAT CONDUCTOR CABLE: TYPE FCC</p> <p>A complete wiring system for branch circuits that is designed for installation under carpet squares.</p> <p>The FCC system includes Type FCC cable and associated shielding, connectors, terminators, adapters, boxes, and receptacles.</p> <p>Three or more flat copper conductors placed edge-to-edge and separated and enclosed within an insulating assembly.</p>	<p>- Branch Circuits. Use of FCC systems shall be permitted both for general-purpose and appliance branch circuits and for individual branch circuits.</p> <p>- Branch-Circuit Ratings.</p> <p>(1) Voltage. Voltage between ungrounded conductors shall not exceed 300 volts. Voltage between ungrounded conductors and the grounded conductor shall not exceed 150 volts.</p> <p>System Height. Any portion of an FCC system with a height above floor level exceeding 2.30 mm shall be tapered or feathered at the edges to floor level.</p> <p>Floor-mounted Type FCC cable, cable connectors, and insulating ends shall be covered with carpet squares not larger than 900 mm²</p>	<p>(1) Outdoors or in wet locations</p> <p>(2) Where subject to corrosive vapors</p> <p>(3) In any hazardous (classified) location</p> <p>(4) In residential, school, and hospital buildings</p>	<p>Type FCC cable shall be clearly and durably marked on both sides at intervals of not more than 600 mm with the information required by 3.10.1.11(a) and with the following additional information:</p> <p>(1) Material of conductors (2) Maximum temperature rating (3) Ampacity</p>	<p>Type FCC cable shall be listed for use with the FCC system and shall consist of three, four, or five flat copper conductors, one of which shall be an equipment grounding conductor.</p>

Method of Wiring	Uses Permitted	Uses Not Permitted	Bends and Markings	Size and Marking	Securing and Supporting
<p>ARTICLE 3.48</p> <p>FLEXIBLE METAL CONDUIT: TYPE FMC</p> <p>A raceway of circular cross section made of helically wound, formed, interlocked metal strip.</p>	<p>FMC shall be permitted to be used in exposed and concealed locations.</p>	<p>(1) In wet locations unless the conductors are approved for the specific conditions and the installation is such that liquid is not likely to enter raceways or enclosures to which the conduit is connected</p> <p>(2) In hoistways</p> <p>(3) In storage battery rooms</p> <p>(4) In any hazardous (classified) location</p> <p>(5) Where exposed to materials having a deteriorating effect on the installed conductors, such as oil or gasoline</p> <p>(6) Underground or embedded in poured concrete or aggregate</p> <p>(7) Where subject to physical damage</p>	<p>There shall not be more than the equivalent of four quarter bends (360 degrees total) between pull points, for example, conduit bodies and boxes.</p>	<p>Minimum. FMC less than 15 mm shall not be used.</p> <p>(a) Minimum. FMC larger than raceway size 100 mm shall not be used.</p>	<p>Securely Fastened. FMC shall be securely fastened in place by an approved means within 300 mm of each box, cabinet, conduit body, or other conduit termination and shall be supported and secured at intervals not to exceed 1 400 mm.</p> <p>Supports. Horizontal runs of FMC supported by openings through framing members at intervals not greater than 1 400 mm and securely fastened within 300 mm of termination points shall be permitted</p>

Method of Wiring	Uses Permitted	Uses Not Permitted	Bends		Size and Marking	Construction.																								
<p>ARTICLE 3.60</p> <p>FLEXIBLE METALLIC TUBING: TYPE FMT</p> <p>A raceway that is circular in cross section, flexible, metallic, and liquidtight without a nonmetallic jacket.</p>	<p>(1) In dry locations</p> <p>(2) Where concealed</p> <p>(3) In accessible locations</p> <p>(4) For system voltages of 1 000 volts maximum</p>	<p>(1) In hoistways</p> <p>(2) In storage battery rooms</p> <p>(3) In hazardous (classified) locations unless otherwise permitted under other articles in this Code</p> <p>(4) Under ground for direct earth burial, or embedded in poured concrete or aggregate</p> <p>(5) Where subject to physical damage</p> <p>(6) In lengths over 1 800 mm</p>	<p style="text-align: center;">Table 3.60.2.15(a) Minimum Radius for Flexing Use</p> <table border="1" data-bbox="904 293 1422 501"> <thead> <tr> <th>Raceway Size (mm)</th> <th>Minimum Radius (mm)</th> </tr> </thead> <tbody> <tr> <td>10</td> <td>250</td> </tr> <tr> <td>15</td> <td>310</td> </tr> <tr> <td>20</td> <td>440</td> </tr> </tbody> </table> <p style="text-align: center;">Table 3.60.2.15 (b) Minimum Radius for Fixed Bend</p> <table border="1" data-bbox="904 655 1422 831"> <thead> <tr> <th>Raceway Size (mm)</th> <th>Minimum Radius (mm)</th> </tr> </thead> <tbody> <tr> <td>10</td> <td>90</td> </tr> <tr> <td>15</td> <td>100</td> </tr> <tr> <td>20</td> <td>125</td> </tr> </tbody> </table> <p style="text-align: center;">Table 9.1.1.1 Percent of Cross Section of Conduit and Tubing for Conductors</p> <table border="1" data-bbox="904 1082 1422 1337"> <thead> <tr> <th>Number of Conductors</th> <th>All Conductor Types</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>53</td> </tr> <tr> <td>2</td> <td>31</td> </tr> <tr> <td>Over 2</td> <td>40</td> </tr> </tbody> </table>		Raceway Size (mm)	Minimum Radius (mm)	10	250	15	310	20	440	Raceway Size (mm)	Minimum Radius (mm)	10	90	15	100	20	125	Number of Conductors	All Conductor Types	1	53	2	31	Over 2	40	<p>(a) Minimum. FMT smaller than raceway size 15 mm shall not be used.</p> <p>(b) Maximum. The maximum size of FMT shall be raceway size 20 mm</p>	<p>Number of Conductors.</p> <p>(a) Raceway size 15 mm and 20 mm. The number of conductors in raceway size 15 mm and 20 mm shall not exceed that permitted by the percentage fill specified in Table 9.1.1.1</p> <p>(b) Metric Designator 12 (Trade Size). The number of conductors in raceway size 10 mm shall not exceed that permitted in Table 3.48.2.13</p> <p>Grounding. FMT shall be permitted as an equipment grounding conductor where installed in accordance with 2.50.6.9(7).</p>
Raceway Size (mm)	Minimum Radius (mm)																													
10	250																													
15	310																													
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Method of Wiring	Uses Permitted	Uses Not Permitted	Bends	Size and Marking	Securing and Supporting	Construction.
<p>ARTICLE 3.53</p> <p>HIGH DENSITY POLYETHYLENE CONDUIT: TYPE HDPE CONDUIT</p> <p>A nonmetallic raceway of circular cross section, with associated couplings, connectors, and fittings for the installation of electrical conductors.</p>	<p>(1) In discrete lengths or in continuous lengths from a reel</p> <p>(2) In locations subject to severe corrosive influences and where subject to chemicals for which the conduit is listed</p> <p>(3) In cinder fill</p> <p>(4) In direct burial installations in earth or concrete</p>	<p>(1) Where exposed</p> <p>(2) Within a building</p> <p>(3) In hazardous (classified) locations</p> <p>(4) Where subject to ambient temperatures in excess of 50°C unless listed otherwise</p> <p>(5) For conductors or cables operating at a temperature higher than the HDPE conduit listed operating temperature rating</p>	<p>How Made. Bends shall be so made that the conduit will not be damaged and the internal diameter of the conduit will not be effectively reduced. Bends shall be permitted to be made manually without auxiliary equipment, and the radius of the curve to the centerline of such bends shall not be less than shown in Table 3.54.2.15.</p> <p>Number in One Run. There shall not be more than the equivalent of four quarter bends (360 degrees total) between pull points, for example, conduit bodies and boxes.</p>	<p>(a) Minimum. HDPE conduit smaller than raceway size 15 mm shall not be used.</p> <p>(b) Maximum. HDPE conduit larger than raceway size 100 mm shall not be used.</p> <p>Each length of HDPE shall be clearly and durably marked at least every 3 000 mm. The type of material shall also be included in the marking.</p>		<p>Number of Conductors. The number of conductors shall not exceed that permitted by the percentage fill specified in Table 1, Chapter 9.</p> <p>Bushings. Where a conduit enters a box, fitting, or other enclosure, a bushing or adapter shall be provided to protect the wire from abrasion unless the box, fitting, or enclosure design provides equivalent protection.</p> <p>Grounding. Where equipment grounding is required, a separate equipment grounding conductor shall be installed in the conduit.</p>

Method of Wiring	Uses Permitted	Uses Not Permitted	Bending Radius	Construction
<p>ARTICLE 3.26 —</p> <p>INTEGRATED GAS SPACER CABLE: TYPE IGS</p> <p>A factory assembly of one or more conductors, each individually insulated and enclosed in a loose fit, nonmetallic flexible conduit as an integrated gas spacer cable rated 0 through 600 volts.</p>	<p>Type IGS cable shall be permitted for use under ground, including direct burial in the earth, as the following:</p> <p>(1) Service-entrance conductors</p> <p>(2) Feeder or branch-circuit conductors</p>	<p>Type IGS cable shall not be used as interior wiring or be exposed in contact with buildings.</p>	<p>Where the coilable nonmetallic conduit and cable is bent for installation purposes or is flexed or bent during shipment or installation, the radii of bends measured to the inside of the bend shall not be less than specified in Table 3.26.2.15.</p> <p>A run of Type IGS cable between pull boxes or terminations shall not contain more than the equivalent of four quarter bends (360 degrees total), including those bends located immediately at the pull box or terminations.</p>	<p>Terminations and splices for Type IGS cable shall be identified as a type that is suitable for maintaining the gas pressure within the conduit. A valve and cap shall be provided for each length of the cable and conduit to check the gas pressure or to inject gas into the conduit.</p> <p>The conductors shall be solid aluminum rods, laid parallel, consisting of one to nineteen 13 mm diameter rods. The minimum conductor size shall be 125 mm², and the maximum size shall be 2375 mm².</p> <p>Fittings. Terminations and splices for Type IGS cable shall be identified as a type that is suitable for maintaining the gas pressure within the conduit. A valve and cap shall be provided for each length of the cable and conduit to check the gas pressure or to inject gas into the conduit.</p> <p>Insulation. The insulation shall be dry kraft paper tapes and a pressurized sulfur hexafluoride gas (SF6), both approved for electrical use. The nominal gas pressure shall be 138 kPa gauge.</p> <p>Conduit. The conduit shall be a medium density polyethylene identified as suitable for use with natural gas rated pipe.</p>

Table 3.26.2.15 Minimum Radii of Bends (IGS)

Raceway Size	Minimum Radii mm
50	600
80	900
100	1150

Method of Wiring	Uses Permitted		Securing and Supporting	Construction.
<p>ARTICLE 3.42</p> <p>INTERMEDIATE METAL CONDUIT TYPE IMC</p> <p>A steel threadable raceway of circular cross section designed for the physical protection and routing of conductors and cables and for use as an equipment grounding conductor when installed with its integral or associated coupling and appropriate fittings.</p>	<p>(a) All Atmospheric Conditions and Occupancies. Use of IMC shall be permitted under all atmospheric conditions and occupancies.</p> <p>(b) Corrosion Environments. IMC, elbows, couplings, and fittings shall be permitted to be installed in concrete, in direct contact with the earth, or in areas subject to severe corrosive influences where protected by corrosion protection and judged suitable for the condition.</p> <p>(c) Cinder Fill. IMC shall be permitted to be installed in or under cinder fill where subject to permanent moisture where protected on all sides by a layer of noncinder concrete not less than 50 mm thick; where the conduit is not less than 450 mm under the fill; or where protected by corrosion protection and judged suitable for the condition.</p> <p>(d) Wet Locations. All supports, bolts, straps, screws, and so forth, shall be of corrosion-resistant materials or protected against corrosion by corrosion-resistant materials.</p>	<p style="text-align: center;">Size</p> <p>(a) Minimum. IMC smaller than raceway size 15 mm shall not be used.</p> <p>(b) Maximum. IMC larger than 100 mm shall not be used.</p> <p>Standard Lengths. The standard length of IMC shall be 3 000 mm, including an attached coupling, and each end shall be threaded</p> <p style="text-align: center;">Marking</p> <p>Each length shall be clearly and durably marked at least every 1 500 mm with the letters IMC. Each length shall be marked</p> <p style="text-align: center;">Bends</p> <p>Number in One Run. There shall not be more than the equivalent of four quarter bends (360 degrees total) between pull points, for example, conduit bodies and boxes</p>	<p>(a) Securely Fastened. Each IMC shall be securely fastened within 900 mm of each outlet box, junction box, device box, cabinet, conduit body, or other conduit termination. Fastening shall be permitted to be increased to a distance of 1 500 mm where structural members do not readily permit fastening within 900 mm. Where approved, conduit shall not be required to be securely fastened within 900 mm of the service head for above-the-roof termination of a mast.</p> <p>(b) Supports. IMC shall be supported in accordance with one of the following:</p> <p>(1) Conduit shall be supported at intervals not exceeding 3 000 mm.</p> <p>(2) Exposed vertical risers from industrial machinery or fixed equipment shall be permitted to be supported at intervals not exceeding 6 000 mm if the conduit is made up with threaded couplings, the conduit is supported and securely fastened at the top and bottom of the riser, and no other means of intermediate support is readily available.</p> <p>(3) Horizontal runs of IMC supported by openings through framing members at intervals not exceeding 3 000 mm and securely fastened within 900 mm of termination points shall be permitted.</p>	<p>Dissimilar Metals. Where practicable, dissimilar metals in contact anywhere in the system shall be avoided to eliminate the possibility of galvanic action. Aluminum fittings and enclosures shall be permitted to be used with IMC.</p> <p>Reaming and Threading. All cut ends shall be reamed or otherwise finished to remove rough edges. Where conduit is threaded in the field, a standard cutting die with a taper of 1 in 16 shall be used.</p> <p>Bushings. Where a conduit enters a box, fitting, or other enclosure, a bushing shall be provided to protect the wire from abrasion unless the design of the box, fitting, or enclosure is such as to afford equivalent protection.</p>

Method of Wiring	Uses Permitted	Uses Not Permitted	Bends and Markings	Size and Marking	Securing and Supporting	Construction.
<p>ARTICLE 3.50</p> <p>LIQUIDTIGHT FLEXIBLE METAL CONDUIT: TYPE LFMC</p> <p>A raceway of circular cross section having an outer liquidtight, nonmetallic, sunlight-resistant jacket over an inner flexible metal core with associated couplings, connectors, and fittings for the installation of electric conductors</p>	<p>(1) Where conditions of installation, operation, or maintenance require flexibility or protection from liquids, vapors, or solids</p> <p>(2) in other hazardous (classified) locations where specifically approved.</p> <p>(3) For direct burial where listed and marked for the purpose</p>	<p>(1) Where subject to physical damage</p> <p>(2) Where any combination of ambient and conductor temperature produces an operating temperature in excess of that for which the material is approved</p>	<p>Bends — Number in One Run. There shall not be more than the equivalent of four quarter bends (360 degrees total) between pull points, for example, conduit bodies and boxes.</p> <p>Marking. LFMC shall be marked according to 1.10.1.21. The trade size and other information required by the listing shall also be marked on the conduit. Conduit suitable for direct burial shall be so marked.</p>	<p>(a) Minimum. LFMC smaller than 15 mm electrical trade size shall not be used.</p> <p>(b) Maximum. The maximum size of LFMC shall be 100 mm electrical trade size.</p>	<p>Securely Fastened. LFMC shall be securely fastened in place by an approved means within 300 mm of each box, cabinet, conduit body, or other conduit termination and shall be supported and secured at intervals not to exceed 1 400 mm.</p> <p>Supports. Horizontal runs of LFMC supported by openings through framing members at intervals not greater than 1 400 mm and securely fastened within 300 mm of termination points shall be permitted.</p>	<p>Couplings and Connectors. Angle connectors shall not be used for concealed raceway installations.</p> <p>Grounding and Bonding. Where used to connect equipment where flexibility is required, an equipment grounding conductor shall be installed. Where flexibility is not required, LFMC shall be permitted to be used as an equipment grounding conductor.</p>

Method of Wiring	Uses Permitted	Uses Not Permitted	Bends	Size and Marking	Securing and Supporting	Construction.
<p>ARTICLE 3.56</p> <p>LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT: TYPE LFNC</p> <p>(1) A smooth seamless inner core and cover bonded together and having one or more reinforcement layers between the core and covers, designated as Type LFNC-A</p> <p>(2) A smooth inner surface with integral reinforcement within the conduit wall, designated as Type LFNC-B</p> <p>(3) A corrugated internal and external surface without integral reinforcement within the conduit wall, designated as LFNC-C</p> <p>LFNC is flame resistant and with fittings and is approved for the installation of electrical conductors.</p>	<p>(1) Where flexibility is required for installation, operation, or maintenance</p> <p>(2) Where protection of the contained conductors is required from vapors, liquids, or solids</p> <p>(3) For outdoor locations</p> <p>(4) For direct burial where listed and marked for the purpose</p> <p>5) Type LFNC-B shall be permitted to be installed in lengths longer than 1 800 mm where secured in accordance with 3.56.2.21</p>	<p>(1) Where subject to physical damage</p> <p>(2) Where any combination of ambient and conductor temperatures is in excess of that for which the LFNC is approved</p> <p>(3) In lengths longer than 1 800 mm, except as permitted by 3.56.2.1(5) or where a longer length is approved as essential for a required degree of flexibility</p> <p>(4) Where the operating voltage of the contained conductors is in excess of 600 volts, nominal,</p> <p>(5) In any hazardous (classified)</p>	<p>How Made. Bends shall be manually made so that the conduit will not be damaged and the internal diameter of the conduit will not be effectively reduced.</p> <p>Bends — Number in One Run. There shall not be more than the equivalent of four quarter bends (360 degrees total) between termination points.</p>	<p>a) Minimum. LFNC smaller than raceway size 15 mm shall not be used.</p> <p>(b) Maximum. LFNC larger than raceway size 100 mm shall not be used</p> <p>LFNC shall be marked at least every 600 mm</p> <p>The marking shall include a type designation and the trade size. Conduit that is intended for outdoor use or direct burial shall be marked. The type, size, and quantity of conductors used in prewired manufactured assemblies shall be identified by means of a printed tag or label attached to each end of the manufactured assembly and either the carton, coil, or reel. The enclosed conductors shall be marked.</p>	<p>(1) Where installed in lengths exceeding 1 800 mm, the conduit shall be securely fastened at intervals not exceeding 900 mm and within 300 mm on each side of every outlet box, junction box, cabinet, or fitting.</p> <p>(2) Securing or supporting of the conduit shall not be required where it is fished, installed in lengths not exceeding 900 mm at terminals where flexibility is required, or installed in lengths not exceeding 1 800 mm from a luminaire (fixture) terminal connection for tap conductors to luminaires</p> <p>(3) Horizontal runs of LFNC supported by openings through framing members at intervals not exceeding 900 mm and securely fastened within 300 mm of termination points shall be permitted.</p> <p>(4) Securing or supporting of LFNC-B shall not be required where installed in lengths not exceeding 1 800 mm from the last point where the raceway is securely fastened for connections within an accessible ceiling to luminaire(s) [lighting fixture(s)] or other equipment.</p>	<p>Number of Conductors. The number of conductors or cables shall not exceed that permitted by the percentage fill in Table 1, Chapter 9.</p> <p>Grounding. Where equipment grounding is required, an assembly containing a separate equipment grounding conductor shall be used.</p> <p>LFNC-B as a prewired manufactured assembly shall be provided in continuous lengths capable of being shipped in a coil, reel, or carton without damage.</p>

Method of Wiring	Uses Permitted	Uses Not Permitted	Size and Marking	Construction.
<p>ARTICLE 3.60</p> <p>FLEXIBLE METALLIC TUBING: TYPE FMT</p> <p>A raceway that is circular in cross section, flexible, metallic, and liquidtight without a nonmetallic jacket.</p>	<p>(1) In dry locations</p> <p>(2) Where concealed</p> <p>(3) In accessible locations</p> <p>(4) For system voltages of 1 000 volts maximum</p>	<p>(1) In hoistways</p> <p>(2) In storage battery rooms</p> <p>(3) In hazardous (classified) locations</p> <p>(4) Under ground for direct earth burial, or embedded in poured concrete or aggregate</p> <p>(5) Where subject to physical damage</p> <p>(6) In lengths over 1 800 mm</p>	<p>(a) Minimum. FMT smaller than raceway size 15 mm shall not be used.</p> <p>Maximum. The maximum size of FMT shall be raceway size 20 mm.</p>	<p>Grounding. FMT shall be permitted as an equipment grounding conductor</p>

Table 3.60.2.15(a) Minimum Radii for Flexing Use

Raceway Size	Minimum Radii for Flexing Use (mm)
10 mm	250
15 mm	310
20 mm	440

Table 3.60.2.15(a) Minimum Radii for Fixed Bends

Raceway Size	Minimum Radii for Flexing Use (mm)
10 mm	90
15 mm	100
20 mm	125

Method of Wiring	Uses Permitted	Uses Not Permitted	Bending Radius	Securing and Supporting	Construction.	Marking.
<p>ARTICLE 3.28 —</p> <p>MEDIUM VOLTAGE CABLE: TYPE MV</p> <p>A single or multiconductor solid dielectric insulated cable rated 2 001 volts or higher.</p>	<p>Type MV cable shall be permitted for use on power systems rated up to 35 000 volts nominal as follows:</p> <p>(1) In wet or dry locations</p> <p>(2) In raceways</p> <p>(3) In cable trays as specified in 3.92.1.3(b)(2)</p> <p>(4) Direct buried in accordance with 3.0.2.20</p> <p>(5) In messenger-supported wiring</p>	<p>Unless identified for the use, Type MV cable shall not be used as follows:</p> <p>(1) Where exposed to direct sunlight</p> <p>(2) In cable trays, unless specified in 3.92.1.3(b)(2)</p> <p>(3) Direct buried, unless in accordance with 3.0.2.20</p>			<p>Type MV cables shall have copper, aluminum, or copper-clad aluminum conductors and shall comply with Table 3.10.1.61 and Table 3.10.1.63 or Table 3.10.1.64.</p>	<p>Medium voltage cable shall be marked as required by 3.10.1.11.</p>

Method of Wiring	Uses Permitted	Uses Not Permitted	Securing and Supporting	Construction.
<p>ARTICLE 3.96</p> <p>MESSENGER SUPPORTED WIRING</p> <p>An exposed wiring support system using a messenger wire to support insulated conductors by any one of the following:</p> <p>(1) A messenger with rings and saddles for conductor support</p> <p>(2) A messenger with a field-installed lashing material for conductor support</p> <p>(3) Factory-assembled aerial cable</p> <p>(4) Multiplex cables utilizing a bare conductor, factory assembled and twisted with one or more insulated conductors, such as duplex, triplex, or quadruplex type of construction</p>	<p>(a) Cable Types. The cable types in Table 3.96.2.1(a) shall be permitted to be installed in messenger supported wiring under the conditions described in the article or section referenced for each.</p> <p>(b) In Industrial Establishments. In industrial establishments only, where conditions of maintenance and supervision ensure that only licensed electrical practitioner or non licensed electrical practitioner under the supervision of a licensed electrical practitioner service the installed messenger supported wiring, the following shall be permitted:</p> <p>(c) Hazardous (Classified) Locations. Messenger supported wiring shall be permitted to be used in hazardous (classified) locations</p>	<p>Messenger supported wiring shall not be used in hoistways or where subject to physical damage.</p>	<p>Messenger Support. The messenger shall be supported at dead ends and at intermediate locations so as to eliminate tension on the conductors. The conductors shall not be permitted to come into contact with the messenger supports or any structural members, walls, or pipes.</p>	<p>Grounding. The messenger shall be grounded as required by 2.50.4.1 and 2.50.4.7 for enclosure grounding.</p>

Method of Wiring	Uses Permitted	Uses Not Permitted	Bending Radius	Securing and Supporting	Construction.
<p>ARTICLE 3.30</p> <p>METAL-CLAD CABLE: TYPE MC</p> <p>A factory assembly of one or more insulated circuit conductors with or without optical fiber members enclosed in an armor of interlocking metal tape, or a smooth or corrugated metallic sheath.</p>	<p>(1) For services, feeders, and branch circuits</p> <p>(2) For power, lighting, control, and signal circuits</p> <p>(3) Indoors or outdoors</p> <p>(4) Exposed or concealed</p> <p>(5) To be direct buried where identified for such use</p> <p>(6) In cable tray where identified for such use</p> <p>(7) In any raceway</p> <p>(8) As aerial cable on a messenger</p> <p>(9) In hazardous (classified) locations as permitted</p> <p>(10) In dry locations and embedded in plaster finish on brick or other masonry except in damp or wet locations</p> <p>(11) In wet locations where any of the following conditions are met:</p> <p>a. The metallic covering is impervious to moisture.</p> <p>b. A lead sheath or moisture-impervious jacket is provided under the metal covering.</p> <p>c. The insulated conductors under the metallic covering are listed for use in wet locations</p> <p>(12) Where single-conductor cables are used, all phase conductors and, where used, the neutral conduct.</p>	<p>(1) Where subject to physical damage</p> <p>(2) Direct burial in the earth</p> <p>(3) In concrete</p> <p>(4) Where subject to cinder fills, strong chlorides, caustic alkalis, or vapors of chlorine or of hydrochloric acids</p>	<p>(a) Smooth Sheath.</p> <p>(1) Ten times the external diameter of the metallic sheath for cable not more than 19 mm in external diameter</p> <p>(2) Twelve times the external diameter of the metallic sheath for cable more than 19 mm but not more than 40 mm in external diameter</p> <p>(3) Fifteen times the external diameter of the metallic sheath for cable more than 40 mm in external diameter</p> <p>(b) Interlocked-Type Armor or Corrugated Sheath. Seven times the external diameter of the metallic sheath.</p> <p>(c) Shielded Conductors. Twelve times the overall diameter of one of the individual conductors or seven times the overall diameter of the multiconductor cable, whichever is greater.</p>	<p>Securing. cables shall be secured at intervals not exceeding 1 800 mm. Cables containing four or fewer conductors sized no larger than 5.5 mm² (2.6 mm dia.) shall be secured within 300 mm of every box, cabinet, fitting, or other cable terminations.</p> <p>Supporting. cables shall be supported at intervals not exceeding 1 800 mm. Horizontal runs of Type MC cable installed in wooden or metal framing members or similar supporting means shall be considered supported and secured where such support does not exceed 1 800 mm intervals</p> <p>Unsupported Cables. shall be permitted to be unsupported where the cable:</p> <p>(1) Is fished between access points through concealed spaces in finished buildings or structures and supporting is impractical; or</p> <p>(2) Is not more than 1 800 mm in length from the last point of cable support to the point of connection to a luminaire (lighting fixture) or other piece of electrical equipment and the cable and point of connection are within an accessible ceiling.</p>	<p>Sheath. Metallic covering shall be one of the following types: smooth metallic sheath, corrugated metallic sheath, interlocking metal tape armor.</p> <p>The metallic sheath shall be continuous and close fitting. A nonmagnetic sheath or armor shall be used on single conductor Type MC.</p> <p>Supplemental protection of an outer covering of corrosion resistant material shall be permitted and shall be required where such protection is needed. The sheath shall not be used as a current-carrying conductor.</p>

Method of Wiring	<u>Uses Permitted</u>	Size and Marking	Securing and Supporting	Construction/Installation
<p>ARTICLE 3.76</p> <p>METAL WIREWAYS</p> <p>Sheet metal troughs with hinged or removable covers for housing and protecting electric wires and cable and in which, conductors are laid in place after the wireway has been installed as a complete system.</p>	<p>(1) For exposed work</p> <p>(2) In concealed spaces as permitted.</p> <p>(3) In hazardous (classified) locations as permitted for Class I, Division 2 locations and for Class II, Division 2 Locations, and for intrinsically safe wiring. Where installed in wet locations, wireways shall be listed for the purpose.</p> <p>(4) As extensions to pass transversely through walls if the length passing through the wall is unbroken. Access to the conductors shall be maintained on both sides of the wall.</p> <p><u>Uses Not Permitted</u></p> <p>(1) Where subject to severe physical damage</p> <p>(2) Where subject to severe corrosive environments</p>	<p>Size of Conductors. No conductor larger than that for which the wireway is designed shall be installed in any wireway.</p> <p>Number of Conductors. The sum of the cross-sectional areas of all contained conductors at any cross section of a wireway shall not exceed 20 percent of the interior cross-sectional area of the wireway. The derating factors shall be applied only where the number of current-carrying conductors, including neutral conductors classified as current-carrying exceeds 30.</p> <p>Marking. Metal wireways shall be so marked that their manufacturer's name or trademark will be visible after installation.</p>	<p>Securing and Supporting. Metal wireways shall be supported in accordance with 3.76.2.21(a) and (b).</p> <p>(a) Horizontal Support. Wireways shall be supported where run horizontally at each end and at intervals not to exceed 1 500 mm or for individual lengths longer than 1 500 mm at each end or joint, unless listed for other support intervals. The distance between supports shall not exceed 3 000 mm.</p> <p>(b) Vertical Support. Vertical runs of wireways shall be securely supported at intervals not exceeding 4 500 mm and shall not have more than one joint between supports. Adjoining wireway sections shall be securely fastened together to provide a rigid joint.</p>	<p>Insulated Conductors. Insulated conductors installed in a metallic wireway shall comply with 3.76.2.14(a) and (b).</p> <p>(a) Deflected Insulated Conductors. Where insulated conductors are deflected within a metallic wireway, either at the ends or where conduits, fittings, or other raceways or cables enter or leave the metallic wireway, or where the direction of the metallic wireway is deflected greater than 30 degrees, dimensions corresponding to one wire per terminal in Table 3.12.1.6(a) shall apply.</p> <p>Splices and Taps. Splices and taps shall be permitted within a wireway, provided they are accessible. The conductors, including splices and taps, shall not fill the wireway to more than 75 percent of its area at that point.</p> <p>Power Distribution Blocks.</p> <p>(1) Installation. Power distribution blocks installed in metal wireways shall be listed.</p> <p>(2) Size of Enclosure. In addition to the wiring space requirement in 3.76.2.47(a), the power distribution block shall be installed in a wireway with dimensions not smaller than specified in the installation instructions of the power distribution block.</p> <p>(3) Wire Bending Space. Wire bending space at the terminals of power distribution blocks shall comply with 3.12.1.6(b).</p> <p>(4) Live Parts. Power distribution blocks shall not have exposed live parts in the wireway after installation.</p> <p>Dead Ends. Dead ends of metal wireways shall be closed.</p> <p>Extensions from Metal Wireways. Extensions from wireways shall be made with cord pendants or with any wiring method in Chapter 3 that includes a means for equipment grounding.</p>

Method of Wiring	Uses Permitted	Uses Not Permitted	Bending Radius	Securing and Supporting	Construction.
<p>ARTICLE 3.32</p> <p>MINERAL-INSULATED, METALSHEATHED CABLE: TYPE MI</p> <p>A factory assembly of one or more conductors insulated with a highly compressed refractory mineral insulation and enclosed in a liquidtight and gastight continuous copper or alloy steel sheath.</p>	<p>(1) For services, feeders, and branch circuits</p> <p>(2) For power, lighting, control, and signal circuits</p> <p>(3) In dry, wet, or continuously moist locations</p> <p>(4) Indoors or outdoors</p> <p>(5) Where exposed or concealed</p> <p>(6) Where embedded in plaster, concrete, fill, or other masonry, whether above or below grade</p> <p>(7) In any hazardous (classified) location</p> <p>(8) Where exposed to oil and gasoline</p> <p>(9) Where exposed to corrosive conditions not deteriorating to its sheath</p> <p>(10) In underground runs where suitably protected against physical damage and corrosive conditions</p> <p>(11) In or attached to cable tray</p>	<p>(1) In underground runs unless protected from physical damage, where necessary</p> <p>(2) Where exposed to conditions that are destructive and corrosive to the metallic sheath, unless additional protection is provided</p>	<p>(1) Five times the external diameter of the metallic sheath for cable not more than 19 mm in external diameter</p> <p>(2) Ten times the external diameter of the metallic sheath for cable greater than 19 mm but not more than 25 mm in external Diameter.</p>	<p>(a) Horizontal Runs Through Holes and Notches. In other than vertical runs, shall be considered supported and secured where such support does not exceed 1 800 mm intervals.</p> <p>(b) Unsupported Cable. Type MI cable shall be permitted to be unsupported where the cable is fished between access points through concealed spaces in finished buildings or structures and supporting is impracticable.</p>	<p>(a) Fittings. Fittings used for connecting Type MI cable to boxes, cabinets, or other equipment shall be identified for such use.</p> <p>(b) Terminal Seals. Where Type MI cable terminates, an end seal fitting shall be installed immediately after stripping to prevent the entrance of moisture into the insulation. The conductors extending beyond the sheath shall be individually provided with an insulating material.</p> <p>Type MI cable conductors shall be of solid copper, nickel, or nickel-coated copper with a resistance corresponding to standard mm² and mm dia. sizes.</p>

Method of Wiring	Uses Permitted	Uses Not Permitted	Bending Radius	Securing and Supporting	Construction.
<p>ARTICLE 3.34</p> <p>NONMETALLIC-SHEATHED CABLE:</p> <p>TYPES NM, NMC, AND NMS</p> <p>A factory assembly of two or more insulated conductors enclosed within an overall nonmetallic jacket.</p> <p>Type NM. Insulated conductors enclosed within an overall nonmetallic jacket.</p> <p>Type NMC. Insulated conductors enclosed within an overall, corrosion resistant, nonmetallic jacket.</p> <p>Type NMS. Insulated power or control conductors with signaling, data, and communications conductors within an overall nonmetallic jacket.</p>	<p>(a) Type NM. permitted as follows:</p> <p>(1) For both exposed and concealed work in normally dry locations To be installed or fished in air voids in masonry block or tile walls</p> <p>(b) Type NMC. permitted as follows:</p> <p>(1) For both exposed and concealed work in dry, moist, damp, or corrosive locations,</p> <p>(2) In outside and inside walls of masonry block or tile</p> <p>(3) In a shallow chase in masonry, concrete, or adobe protected against nails or screws by a steel plate at least 1.60 mm thick and covered with plaster, adobe, or similar finish</p> <p>(c) Type NMS permitted as follows:</p> <p>(1) For both exposed and concealed work in normally dry locations</p> <p>(2) To be installed or fished in air voids in masonry block or tile walls</p>	<p>(a) Types NM, NMC, and NMS. shall not be permitted as follows:</p> <p>(1) In any dwelling or structure.</p> <p>(2) Exposed in dropped or suspended ceilings in other than one and two-family and multifamily dwellings</p> <p>(3) As service-entrance cable</p> <p>(4) In commercial garages having hazardous (classified) locations</p> <p>(5) In theaters and similar locations</p> <p>(6) In motion picture studios</p> <p>(7) In storage battery rooms</p> <p>(8) In hoistways or on elevators or escalators</p> <p>(9) Embedded in poured cement, concrete, or aggregate</p> <p>(10) In hazardous (classified) locations</p>	<p>Bends in Types NM, NMC, and NMS cable shall be so made that the cable will not be damaged. The radius of the curve of the inner edge of any bend during or after installation shall not be less than five times the diameter of the cable.</p>	<p>Shall be supported and secured by staples, cable ties, straps, hangers, or similar fittings at intervals not exceeding 1 400 mm and within 300 mm of every outlet box, junction box, cabinet, or fitting.</p> <p>(a) Horizontal Runs Through Holes and Notches. In other than vertical runs, cables shall be considered to be supported and secured where such support does not exceed 1 400 mm intervals and the nonmetallic-sheathed cable is securely fastened in place by an approved means within 300 mm of each box, cabinet, conduit body, or other nonmetallic-sheathed cable termination.</p> <p>(b) Unsupported Cables. Nonmetallic-sheathed cable shall be permitted to be unsupported where the cable:</p> <p>(1) Is fished between access points through</p>	<p>Exposed Work. In exposed work,</p> <p>(a) To Follow Surface. Cable shall closely follow the surface of the building finish or of running boards.</p> <p>(b) Protection from Physical Damage. Cable shall be protected from physical damage where necessary by rigid metal conduit, intermediate metal conduit, electrical metallic tubing, Schedule 80 PVC rigid nonmetallic conduit, or other approved means. Where passing through a floor, the cable shall be enclosed in rigid metal conduit intermediate metal conduit, electrical metallic tubing, Schedule 80 PVC rigid nonmetallic conduit, or other approved means extending at least 150 mm above the floor. Where Type NMC cable is installed in shallow chases in masonry, concrete, or adobe, the cable shall be protected against nails or screws by a steel plate at least 1.60 mm thick and covered with plaster, adobe, or similar finish.</p> <p>(c) In Unfinished Basements. Where cable is run at angles with joists in unfinished basements, it shall be permissible to secure cables not smaller than two 14 mm² or three 8.0 mm⁸ (3.2 mm dia.) conductors directly to the lower edges of the joists. Smaller cables shall be run either through bored holes in joists or on running boards. NM cable used on a wall of an unfinished basement shall be permitted to be installed in conduit or tubing. Conduit or tubing shall utilize a nonmetallic bushing or adapter at the point the cable enters the raceway. Metal conduit and tubings and metal outlet boxes shall be grounded.</p> <p>3.34.2.31 Boxes and Fittings.</p> <p>(a) Boxes of Insulating Material. Nonmetallic outlet boxes shall be permitted.</p>

		<p>(b) Types NM and NMS. Types NM and NMS cables shall not be used under the following conditions or in the following locations:</p> <p>(1) Where exposed to corrosive fumes or vapors</p> <p>(2) Where embedded in masonry, concrete, adobe, fill, or plaster</p> <p>(3) In a shallow chase in masonry, concrete, or adobe and covered with plaster, adobe, or similar finish</p> <p>(4) Where exposed or subject to excessive moisture or dampness</p>		<p>concealed spaces in finished buildings or structures and supporting is impracticable.</p> <p>(2) Is not more than 1 400 mm from the last point of cable support to the point of connection to a luminaire (lighting fixture) or other piece of electrical equipment and the cable and point of connection are within an accessible ceiling.</p> <p>(c) Wiring Device Without a Separate Outlet Box. A wiring device identified for the use, without a separate outlet box, and incorporating an integral cable clamp shall be permitted where the cable is secured in place at intervals no exceeding 1 400 mm and within 300 mm from the wiring device wall opening, and there shall be at least a 300 mm loop of unbroken cable or 150 mm of a cable end available on the interior side of the finished wall to permit replacement.</p>	<p>(b) Devices of Insulating Material. Switch, outlet, and tap devices of insulating material shall be permitted to be used without boxes in exposed cable wiring and for rewiring in existing buildings where the cable is concealed and fished.</p> <p>3.34.3.1 Construction. The outer cable sheath of nonmetallic sheathed cable shall be a nonmetallic material.</p> <p>3.34.3.5 Conductors. The 600 volt insulated conductors shall be sizes 2.0 mm² (1.6 mm dia.) through 30 mm² copper conductors.</p> <p>3.34.3.9 Equipment Grounding. In addition to the insulated conductors, the cable shall have an insulated or bare conductor for equipment grounding purposes only.</p> <p>3.34.3.17 Sheath. The outer sheath of nonmetallic-sheathed cable shall comply the following</p> <p>(a) Type NM. The overall covering shall be flame retardant and moisture resistant.</p> <p>(b) Type NMC. The overall covering shall be flame retardant, moisture resistant, fungus resistant, and corrosion resistant.</p> <p>(c) Type NMS. The overall covering shall be flame retardant and moisture resistant. The sheath shall be applied so as to separate the power conductors from the communications and signaling conductors. The signaling conductors shall be permitted to be shielded. An optional outer jacket shall be permitted.</p>
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Method of Wiring	Uses Permitted	Uses Not Permitted	Bends	Size and Marking	Construction.								
<p>ARTICLE 3.54</p> <p>NONMETALLIC UNDERGROUND CONDUIT WITH CONDUCTORS: TYPE NUCC</p> <p>A factory assembly of conductors or cables inside a nonmetallic, smooth wall conduit with a circular cross section</p>	<p>(1) For direct burial underground installation (For minimum cover requirements, see Table 3.0.1.5 and Table 3.0.2.20 under Rigid Nonmetallic Conduit.)</p> <p>(2) Encased or embedded in concrete</p> <p>(3) In cinder fill</p> <p>(4) In underground locations subject to severe corrosive influences and where subject to chemicals for which the assembly is specifically approved</p>	<p>1) In exposed locations</p> <p>(2) Inside buildings</p> <p>(3) In hazardous (classified) locations.</p>	<p>How Made. The radius of the curve of the centerline of such bends shall not be less than shown in Table 3.54.2.15.</p> <p>Number in One Run. There shall not be more than the equivalent of four quarter bends (360 degrees total) between termination points</p>	<p>(a) Minimum. NUCC smaller than raceway size 15 mm shall not be used.</p> <p>(b) Maximum. NUCC larger than 100 mm shall not be used.</p> <p>NUCC shall be clearly and durably marked at least every 3 000 mm</p>	<p>Number of Conductors. The number of conductors or cables shall not exceed that permitted by the percentage fill in Chapter 9.1.1.1</p> <p>Trimming. For termination, the conduit shall be trimmed away from the conductors or cables using an approved method that will not damage the conductor or cable insulation or jacket. All conduit ends shall be trimmed inside and out to remove rough edges.</p> <p>Bushings. Where the NUCC enters a box, fitting, or other enclosure, a bushing or adapter shall be provided to protect the conductor or cable from abrasion unless the design of the box, fitting, or enclosure provides equivalent protection.</p> <p>Splices and Taps. Splices and taps shall be made in junction boxes or other enclosures</p> <p>Grounding. Where equipment grounding is required, an assembly containing a separate equipment grounding conductor shall be used.</p> <p>Conductor Fill. The maximum number of conductors or cables in NUCC shall not exceed that permitted by the percentage fill in Table 9.1.1.1.1</p>								
<p>Table 9.1.1.1 Percent of Cross Section of Conduit and Tubing for Conductors</p>													
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th data-bbox="629 903 1093 1034" style="width: 50%; text-align: center;">Number of Conductors</th> <th data-bbox="1093 903 1588 1034" style="width: 50%; text-align: center;">All Conductor Types</th> </tr> </thead> <tbody> <tr> <td data-bbox="629 1034 1093 1082" style="text-align: center;">1</td> <td data-bbox="1093 1034 1588 1082" style="text-align: center;">53</td> </tr> <tr> <td data-bbox="629 1082 1093 1129" style="text-align: center;">2</td> <td data-bbox="1093 1082 1588 1129" style="text-align: center;">31</td> </tr> <tr> <td data-bbox="629 1129 1093 1206" style="text-align: center;">Over 2</td> <td data-bbox="1093 1129 1588 1206" style="text-align: center;">40</td> </tr> </tbody> </table>						Number of Conductors	All Conductor Types	1	53	2	31	Over 2	40
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Over 2	40												

Method of Wiring		Clearances	Securing and Supporting
<p>ARTICLE 398</p> <p>OPEN WIRING ON INSULATORS</p> <p>An exposed wiring method using cleats, knobs, tubes, and flexible tubing for the protection and support of single insulated conductors run in or on buildings.</p>	<p>Uses Permitted</p> <p>Open wiring on insulators shall be permitted only for industrial or agricultural establishments on systems of 600 volts, nominal, or less, as follows:</p> <ol style="list-style-type: none"> (1) Indoors or outdoors (2) In wet or dry locations (3) Where subject to corrosive vapors (4) For services <p>Uses Not Permitted</p> <p>Open wiring on insulators shall not be installed where concealed by the building structure</p>	<p>Open conductors shall be separated at least 50 mm from metal raceways, piping, or other conducting material, and from any exposed lighting, power, or signaling conductor, or shall be separated therefrom by a continuous and firmly fixed nonconductor in addition to the insulation of the conductor. Where any insulating tube is used, it shall be secured at the ends. Where practicable, conductors shall pass over rather than under any piping subject to leakage or accumulations of moisture.</p> <p>In Accessible Attics. Conductors in unfinished attics and roof spaces shall comply with the following</p> <p>(a) Accessible by Stairway or Permanent Ladder. Conductors shall be installed along the side of or through bored holes in floor joists, studs, or rafters. Where run through bored holes, conductors in the joists and in studs or rafters to a height of not less than 2 100 mm above the floor or floor joists shall be protected by substantial running boards extending not less than 25 mm on each side of the conductors. Running boards shall be securely fastened in place. Running boards and guard strips shall not be required for conductors installed along the sides of joists, studs, or rafters.</p>	<p>(a) Dry Locations. In dry locations, where not exposed to physical damage, conductors shall be permitted to be separately enclosed in flexible nonmetallic tubing. The tubing shall be in continuous lengths not exceeding 4 500 mm and secured to the surface by straps at intervals not exceeding 1 400 mm.</p> <p>(b) Entering Spaces Subject to Dampness, Wetness, or Corrosive Vapors. Conductors entering or leaving locations subject to dampness, wetness, or corrosive vapors shall have drip loops formed on them and shall then pass upward and inward from the outside of the buildings, or from the damp, wet, or corrosive location, through noncombustible, nonabsorbent insulating tubes.</p> <p>(c) Exposed to Physical Damage. Conductors within 2 100 mm from the floor shall be considered exposed to physical damage. Where open conductors cross ceiling joists and wall studs and are exposed to physical damage, they shall be protected by one of the following methods:</p> <ol style="list-style-type: none"> 1) Guard strips not less than 25 mm nominal in thickness and at least as high as the insulating supports, placed on each side of and close to the wiring. 2) A substantial running board at least 13 mm thick in back of the conductors with side protections. Running boards shall extend at least 25 mm outside the conductors, but not more than 50 mm, and the protecting sides shall be at least 50 mm high and at least 25 mm nominal in thickness. 3) Boxing made in accordance with 3.98.2.6(c)(1) or (c)(2) and furnished with a cover kept at least 25 mm away from the conductors within. Where protecting vertical conductors on side walls, the boxing shall be closed at the top and the holes through which the conductors pass shall be bushed. 4) Rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing. When installed in metal piping, the conductors shall be encased in continuous lengths of approved flexible tubing. <p>(a) Conductor Sizes Smaller Than 8.0 mm²(3.2 mm dia.). Conductors smaller than 8.0 mm² (3.2 mm dia.) shall be rigidly supported on noncombustible, nonabsorbent insulating materials and shall not contact any other objects. Supports shall be installed as follows:</p> <ol style="list-style-type: none"> (1) Within 150 mm from a tap or splice

(b) Not Accessible by Stairway or Permanent Ladder.

Conductors shall be installed along the sides of or through bored holes in floor joists, studs, or rafters.

- (2) Within 300 mm of a dead-end connection to a lampholder or Receptacle
(3) At intervals not exceeding 1 400 mm and at closer intervals sufficient to provide adequate support where likely to be disturbed

(b) Conductor Sizes 8.0 mm²(3.2 mm dia.) and Larger. Supports for conductors 8.0 mm² (3.2 mm dia.) or larger installed across open spaces shall be permitted up to 4 500 mm apart if noncombustible, nonabsorbent insulating spacers are used at least every 1 400 mm to maintain at least 65 mm between conductors. Where not likely to be disturbed in buildings of mill construction, 8.0 mm²(3.2 mm dia.) and larger conductors shall be permitted to be run across open spaces if supported from each wood cross member on approved insulators maintaining 150 mm between conductors.

(c) Industrial Establishments. In industrial establishments only, where conditions of maintenance and supervision ensure that only licensed electrical practitioner or non licensed electrical practitioner under the supervision of a licensed electrical practitioner service the system, conductors of sizes 125 mm² and larger shall be permitted to be run across open spaces where supported at intervals up to 9 000 mm.

(d) Mounting of Conductor Supports. Where nails are used to mount knobs, they shall not be smaller than ten penny. Where screws are used to mount knobs, or where nails or screws are used to mount cleats, they shall be of a length sufficient to penetrate the wood to a depth equal to at least one-half the height of the knob and the full thickness of the cleat. Cushion washers shall be used with nails.

(e) Tie Wires. 8.0 mm² (3.2 mm dia.) or larger conductors supported on solid knobs shall be securely tied thereto by tie wires having an insulation equivalent to that of the conductor.

Method of Wiring	Uses Permitted	Bends and markings	Size and Marking	Securing and Supporting	Construction.
<p>ARTICLE 3.44</p> <p>RIGID METAL CONDUIT: TYPE RMC</p> <p>A threadable raceway of circular cross section designed for the physical protection and routing of conductors and cables and for use as an equipment grounding conductor when installed with its integral or associated coupling and appropriate fittings.</p> <p>RMC is generally made of steel (ferrous) with Protective coatings or aluminum (nonferrous). Special use types are silicon bronze and stainless steel</p>	<p>(a) All Atmospheric Conditions and Occupancies. Shall be permitted under all atmospheric conditions and occupancies. Ferrous raceways and fittings protected from corrosion solely by enamel shall be permitted only indoors and in occupancies not subject to severe corrosive influences.</p> <p>(b) Corrosion Environments. RMC, elbows, couplings, and fittings shall be permitted to be installed in concrete, in direct contact with the earth, or in areas subject to severe corrosive influences where protected by corrosion protection and judged suitable for the condition.</p> <p>(c) Cinder Fill. RMC shall be permitted to be installed in or under cinder fill where subject to permanent moisture where protected on all sides by a layer of non-cinder concrete not less than 50 mm thick; where the conduit is not less than 450 mm under the fill; or where protected by corrosion protection and judged suitable for the condition.</p> <p>(d) Wet Locations. All supports, bolts, straps, screws, and so forth, shall be of corrosion-resistant materials or protected against corrosion by corrosion-resistant materials</p>	<p>Bends — How Made. Bends of RMC shall be so made that the conduit will not be damaged and so that the internal diameter of the conduit will not be effectively reduced. The radius of the curve of any field bend to the centerline of the conduit shall not be less than indicated in Table 2, Chapter 9.</p> <p>Bends — Number in One Run. There shall not be more than the equivalent of four quarter bends (360 degrees total) between pull points, for example, conduit bodies and boxes.</p>	<p>(a) Minimum. RMC smaller than 15 mm shall not be used.</p> <p>(b) Maximum. RMC larger than 150 mm shall not be used.</p> <p>Marking. Each length shall be clearly and durably identified in every 3 000 mm.</p> <p>Standard Lengths. The standard length of RMC shall be 3 000 mm, including an attached coupling, and each end shall be threaded. Longer or shorter lengths with or without coupling and threaded or unthreaded shall be permitted.</p>	<p>Securing and Supporting. RMC shall be installed as a complete system and shall be securely fastened in place and supported in accordance below.</p> <p>(a) Securely Fastened. RMC shall be securely fastened within 900 mm of each outlet box, junction box, device box, cabinet, conduit body, or other conduit termination. Fastening shall be permitted to be increased to a distance of 1 500 mm where structural members do not readily permit fastening within 900 mm. Where approved, conduit shall not be required to be securely fastened within 900 mm of the service head for above-the-roof termination of a mast.</p> <p>(b) Supports. RMC shall be supported in accordance with one of the following:</p> <p>(1) Conduit shall be supported at intervals not exceeding 3 000 mm.</p> <p>(2) The distance between supports for straight runs of conduit shall be permitted in accordance with Table 3.44.2.21(b)(2), provided the conduit is made up with threaded couplings, and such supports prevent transmission of stresses to termination where conduit is deflected between supports.</p>	<p>Reaming and Threading. All cut ends shall be reamed or otherwise finished to remove rough edges. Where conduit is threaded in the field, a standard cutting die with a 1 in 16 taper shall be used.</p> <p>Bushings. Where a conduit enters a box, fitting, or other enclosure, a bushing shall be provided to protect the wire from abrasion unless the design of the box, fitting, or enclosure is such as to afford equivalent protection</p> <p>(Threadless. Threadless couplings and connectors used with conduit shall be made tight. Where buried in masonry or concrete, they shall be the concrete tight type. Where installed in wet locations, they shall comply with 3.14.2.1(a). Threadless couplings and connectors shall not be used on threaded conduit ends unless listed for the purpose.</p> <p>Running Threads. Running threads shall not be used on conduit for connection at couplings.</p> <p>Grounding. RMC shall be permitted as an equipment grounding conductor.</p>

				<p>(3) Exposed vertical risers from industrial machinery or fixed equipment shall be permitted to be supported at intervals not exceeding 6 000 mm if the conduit is made up with threaded couplings, the conduit is supported and securely fastened at the top and bottom of the riser, and no other means of intermediate support is readily available.</p> <p>(4) Horizontal runs of RMC supported by openings through framing members at intervals not exceeding 3 000 mm and securely fastened within 900 mm of termination points shall be permitted.</p>	
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Table 3.44.2.21(b)(2) Supports for Rigid Metal Conduit

Conduit Size (mm)	Maximum Distance Between Rigid Metal Conduit Supports (mm)
15-20	3000
25	3600
32-40	4200
50-65	4800
80 and larger	6000

Method of Wiring	Uses Permitted	Uses Not Permitted	Bends	Size and Marking	Securing and Supporting	Construction.
<p>ARTICLE 3.52</p> <p>RIGID NONMETALLIC CONDUIT: TYPE RNC</p> <p>A nonmetallic raceway of circular cross section, with integral or associated couplings, connectors, and fittings for the installation of electrical conductors and cables.</p>	<p>(a) Concealed. RNC shall be permitted in walls, floors, and ceilings.</p> <p>(b) Corrosive Influences. RNC shall be permitted in locations subject to severe corrosive influences and where subject to chemicals for which the materials are specifically approved.</p> <p>(c) Cinders. RNC shall be permitted in cinder fill.</p> <p>(d) Wet Locations. RNC shall be permitted in portions of dairies, laundries, canneries, or other wet locations and in locations where walls are frequently washed, the entire conduit system including boxes and fittings used therewith shall be installed and equipped so as to prevent water from entering the conduit. All supports, bolts, straps, screws, and so forth, shall be of corrosion-resistant materials or be</p>	<p>a) Hazardous Locations. (1) In hazardous locations.</p> <p>(b) Support of Luminaires (Fixtures). For the support of Luminaries (fixtures) or other equipment.</p> <p>(c) Physical Damage. Where subject to physical damage unless identified for such use.</p> <p>(d) Ambient Temperatures. Where subject to ambient temperatures in excess of 50°C.</p> <p>(e) Insulation Temperature Limitations. For conductors or cables operating at a temperature higher than the RNC listed operating temperature rating.</p> <p>(f) Theaters and Similar Locations. In theaters and similar</p>	<p>Bends — How Made. shown in Table 2, Chapter 9.</p> <p>Bends — Number in One Run. There shall not be more than the equivalent of four quarter bends (360 degrees total) between pull points, for example, conduit bodies and boxes.</p>	<p>(a) Minimum. RNC smaller than 15 mm.</p> <p>(b) Maximum. RNC larger than raceway size 150 mm shall not be used.</p> <p>Marking. Each length of RNC shall be clearly and durably marked at least every 3 000 mm. The type of material shall also be included in the marking unless it is visually identifiable. For conduit recognized for use above ground, these markings shall be permanent. For conduit limited to underground use only, these markings shall be sufficiently durable to remain legible until the material is installed. Conduit shall be permitted to be surface marked to indicate special characteristics of the material.</p>	<p>RNC shall be installed as a complete system.</p> <p>(a) Securely Fastened. RNC shall be securely fastened within 900 mm of each outlet box, junction box, device box, conduit body, or other conduit termination.</p> <p>(b) Supports. RNC shall be supported as required in Table 3.52.2.21(b). Horizontal runs of RNC supported by openings through framing members at intervals not exceeding those in Table 3.52.2.21(b) and securely fastened within 900 mm of termination points shall be permitted.</p>	<p>Number of Conductors. The number of conductors shall not exceed that permitted by the percentage fill specified in Table 1,</p> <p>Expansion Fittings. Expansion fittings for RNC shall be provided to compensate for thermal expansion and contraction where the length change is expected to be 6 mm or greater in a straight run between securely mounted items such as boxes, cabinets, elbows, or other conduit terminations.</p> <p>Bushings. Where a conduit enters a box, fitting, or other enclosure, a bushing or adapter shall be provided to protect the wire from abrasion unless the box, fitting, or enclosure design provides equivalent protection.</p> <p>Grounding. Where equipment grounding is required, a separate equipment grounding conductor shall be installed in the conduit.</p>

	<p>protected against corrosion by approved corrosion-resistant materials.</p> <p>(e) Dry and Damp Locations. RNC shall be permitted for use in dry and damp locations.</p> <p>(f) Exposed. RNC shall be permitted for exposed work where not subject to physical damage if identified for such use.</p> <p>(g) Underground Installations. For underground installations.</p>	locations.				
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Table 3.52.2.21(b) Support of Rigid Nonmetallic Conduit (RNC)

Conduit Raceway Size (mm)	Maximum Spacing Between Supports (mm)
15-25	900
32-50	1 500
65-80	1 800
90-125	2 100
150	2 400

Method of Wiring	Uses Permitted	Uses Not Permitted	Bends	Construction.
<p>ARTICLE 3.40 —</p> <p>UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE: TYPE UF</p> <p>A factory assembly of one or more insulated conductors with an integral or an overall covering of nonmetallic material suitable for direct burial in the earth.</p>	<p>(1) For use underground, including direct burial in the earth.</p> <p>(2) As single-conductor cables. Where installed as single conductor cables, all conductors of the feeder grounded conductor or branch circuit, including the grounded conductor and equipment grounding conductor, if any.</p> <p>(3) For wiring in wet, dry, or corrosive locations.</p> <p>(4) Installed as nonmetallic-sheathed cable. Where so installed, the installation and conductor shall be of the multiconductor type.</p> <p>(5) For solar photovoltaic systems in accordance with 6.90.4.1.</p> <p>(6) As single-conductor cables as the nonheating leads for heating cables.</p> <p>(7) Supported by cable trays. Type UF cable supported by cable trays shall be of the multiconductor type.</p>	<p>(1) As service-entrance cable</p> <p>(2) In commercial garages</p> <p>(3) In theaters and similar locations</p> <p>(4) In motion picture studios</p> <p>(5) In storage battery rooms</p> <p>(6) In hoistways or on elevators or escalators</p> <p>(7) In hazardous (classified) locations</p> <p>(8) Embedded in poured cement, concrete, or aggregate where embedded in plaster.</p> <p>(9) Where exposed to direct rays of the sun, unless identified as sunlight resistant</p> <p>(10) Where subject to physical damage</p> <p>(11) As overhead cable, except where installed as messenger supported wiring.</p>	<p>Type UF cable shall be so made that the cable is not damaged. The radius of the curve of the inner edge of any bend shall not be less than five times the diameter of the cable.</p>	<p>Conductors. The conductors shall be sizes 2.0 mm² (1.6 mm dia.) copper or 3.5 mm² (2.0 mm dia.) aluminum or copperclad aluminum through 100 mm².</p> <p>Equipment Grounding. In addition to the insulated conductors, the cable shall be permitted to have an insulated or bare conductor for equipment grounding purposes only.</p> <p>Sheath. The overall covering shall be flame retardant; moisture, fungus, and corrosion resistant; and suitable for direct burial in the earth.</p>