The size of the conduit permitted for each conductor size shall be calculated for a percent fill not to exceed those found in Table 1, Chapter 9.

TABLE 326.116 Conduit Dimensions

Conduit Size		Actual Outside Diameter		Actual Inside Diameter	
Metric Designator	Trade Size	mm	in.	mm	in.
53	2	60	2.375	49.46	1.947
78	3	89	3.500	73.30	2.886
103	4	114	4.500	94.23	3.710

326.120 Marking. The cable shall be marked in accordance with 310.8(A), (B)(1), and (D).

ARTICLE 330

Metal-Clad Cable: Type MC

Part I. General

330.1 Scope. This article covers the use, installation, and construction specifications of metal-clad cable, Type MC.

Type MC cable is rated up to 2000 volts in sizes 18 AWG and larger for copper or nickel-coated copper and 12 AWG and larger for aluminum or copper-clad aluminum. Type MC cable rated 2400 to 35,000 volts is classified as medium-voltage cable, is marked "Type MV or MC," and is covered by Article 315. Type MC-HL cable rated up to 35,000 volts is suitable for hazardous locations and is provided with a gas/vapor tight continuous sheath. Composite electrical MC and optical fiber cables are classified as Type MC cable and are marked "Type MC-OF."

Type MC cable is available in three designs: interlocked metal tape, corrugated metal tube, and smooth metal tube. A nonmetallic jacket may be provided over the metal sheath. Cable construction must comply with 250.118(10) for the cable to be used as an equipment grounding conductor (EGC). It must be marked with the maximum rated voltage, the proper insulation-type letter or letters, and the AWG size or circular mil area.

Exhibit 330.1 shows some examples of Type MC cable. The basic standard to investigate cable in this category is UL 1569, *Standard for Metal-Clad Cables*. Summary information regarding listed metal-clad cable may be found in the UL *Guide Information for Electrical Equipment*, under category PJAZ.

330.6 Listing Requirements. Type MC cable shall be listed. Fittings used for connecting Type MC cable to boxes, cabinets, or other equipment shall be listed and identified for such use.

The sheath of Type MC cable is constructed of aluminum, copper, or steel and can also have a supplemental protective polyvinyl chloride (PVC) jacket. Connectors should be selected in accordance with the size and type of cable for which they are designated. Bronze connectors are intended for use only with cable employing corrugated copper armor. Fittings with direct-bearing screws are suitable for steel armor only. Type AC cable connectors are also acceptable and listed for use with MC cable if specifically indicated on the fitting or the shipping carton.

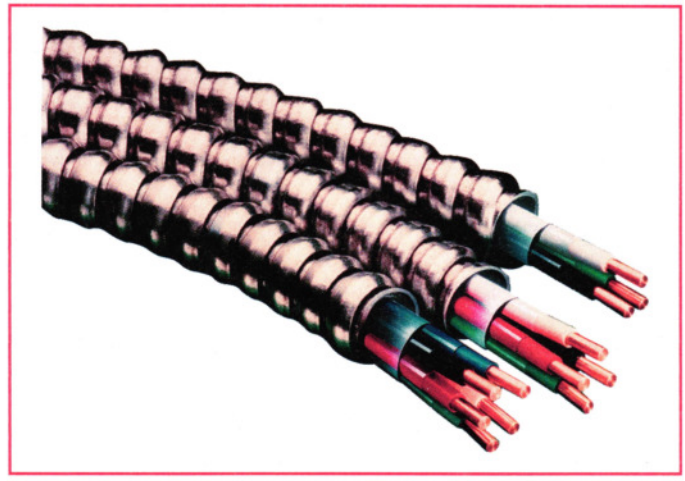


EXHIBIT 330.1 Several examples of Type MC cable. *(Courtesy of AFC Cable Systems, Inc.)*

Part II. Installation

330.10 Uses Permitted.

(A) General Uses. Type MC cable shall be permitted as follows:

(1) For services, feeders, and branch circuits.
(2) For power, lighting, control, and signal circuits.
(3) Indoors or outdoors.
(4) Exposed or concealed.
(5) To be direct buried where identified for such use.
(6) In cable tray where identified for such use.
(7) In any raceway.
(8) As aerial cable on a messenger.
(9) In hazardous (classified) locations where specifically permitted by other articles in this *Code*.
(10) In dry locations and embedded in plaster finish on brick or other masonry except in damp or wet locations.
(11) In damp or wet locations where a corrosion-resistant jacket is provided over the metallic covering and any of the following conditions are met:
   a. The metallic covering is impervious to moisture.
   b. A jacket resistant to moisture is provided under the metal covering.
   c. The insulated conductors under the metallic covering are listed for use in wet locations.
(12) Where single-conductor cables are used, all phase conductors and, where used, the grounded conductor shall be grouped together to minimize induced voltage on the sheath.

(B) Specific Uses. Type MC cable shall be permitted to be installed in compliance with Parts II and III of Article 725 and 770.133 as applicable and in accordance with 330.10(B)(1) through (B)(4).

Informational Note: The "Uses Permitted" is not an all-inclusive list.

(1) Cable Tray. Type MC cable installed in cable tray shall comply with 392.10, 392.12, 392.18, 392.20, 392.22, 392.30, 392.46, 392.56, 392.60(C), and 392.80.

(2) Direct Buried. Direct-buried cable shall comply with 300.5 or 305.15, as appropriate.

(3) Installed as Service-Entrance Cable. Type MC cable installed as service-entrance cable shall be permitted in accordance with 230.43.

(4) Installed Outside of Buildings or Structures or as Aerial Cable. Type MC cable installed outside of buildings or structures or as aerial cable shall comply with 225.10, 396.10, and 396.12.

330.12 Uses Not Permitted. Type MC cable shall not be used under either of the following conditions:

(1) Where subject to physical damage
(2) Where exposed to any of the destructive corrosive conditions in (a) or (b), unless the metallic sheath or armor is resistant to the conditions or is protected by material resistant to the conditions:
   a. Direct buried in the earth or embedded in concrete unless identified for direct burial
   b. Exposed to cinder fills, strong chlorides, caustic alkalis, or vapors of chlorine or of hydrochloric acids

330.15 Exposed Work. Exposed runs of cable, except as provided in 300.11(B), shall closely follow the surface of the building finish or of running boards. Exposed runs shall also be permitted to be installed on the underside of joists where supported at each joist and located so as not to be subject to physical damage.

330.17 Through or Parallel to Framing Members. Type MC cable shall be protected in accordance with 300.4(A), (C), and (D) where installed through or parallel to framing members.

330.23 In Accessible Attics. The installation of Type MC cable in accessible attics or roof spaces shall also comply with 320.23.

In accessible attics, cable installed across the top of floor joists or within 7 feet of the floor or floor joists across the face of rafters or studs must be protected by guard strips. Where the attic is not accessible by a permanent ladder or stairs, guard strips are required only within 6 feet of the scuttle hole or opening.

330.24 Bending Radius. Bends in Type MC cable shall be so made that the cable will not be damaged. The radius of the curve of the inner edge of any bend shall not be less than required in 330.24(A) through (C).

(A) Smooth Sheath.

(1) Ten times the external diameter of the metallic sheath for cable not more than 19 mm (¾ in.) in external diameter
(2) Twelve times the external diameter of the metallic sheath for cable more than 19 mm (¾ in.) but not more than 38 mm (1½ in.) in external diameter
(3) Fifteen times the external diameter of the metallic sheath for cable more than 38 mm (1½ in.) in external diameter

(B) Interlocked-Type Armor or Corrugated Sheath. Seven times the external diameter of the metallic sheath.

(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.

330.30 Securing and Supporting.

(A) General. Type MC cable shall be supported and secured by staples; cable ties listed and identified for securement and support; straps, hangers, or similar fittings; or other approved means designed and installed so as not to damage the cable.

Type MC cable fittings shall be permitted as a means of cable support.

A difference exists between securing and supporting. Cable that runs horizontally through or on framing members or racks (spaced less than 6 feet apart) without additional securing is considered supported. Staples or cable ties are not required as the cable passes through or on these members. However, the cable must be secured (fastened in place) within 12 inches of the outlet box. Staples, cable ties, or clamps would be necessary to secure a cable. Both requirements are illustrated in Exhibit 330.2.

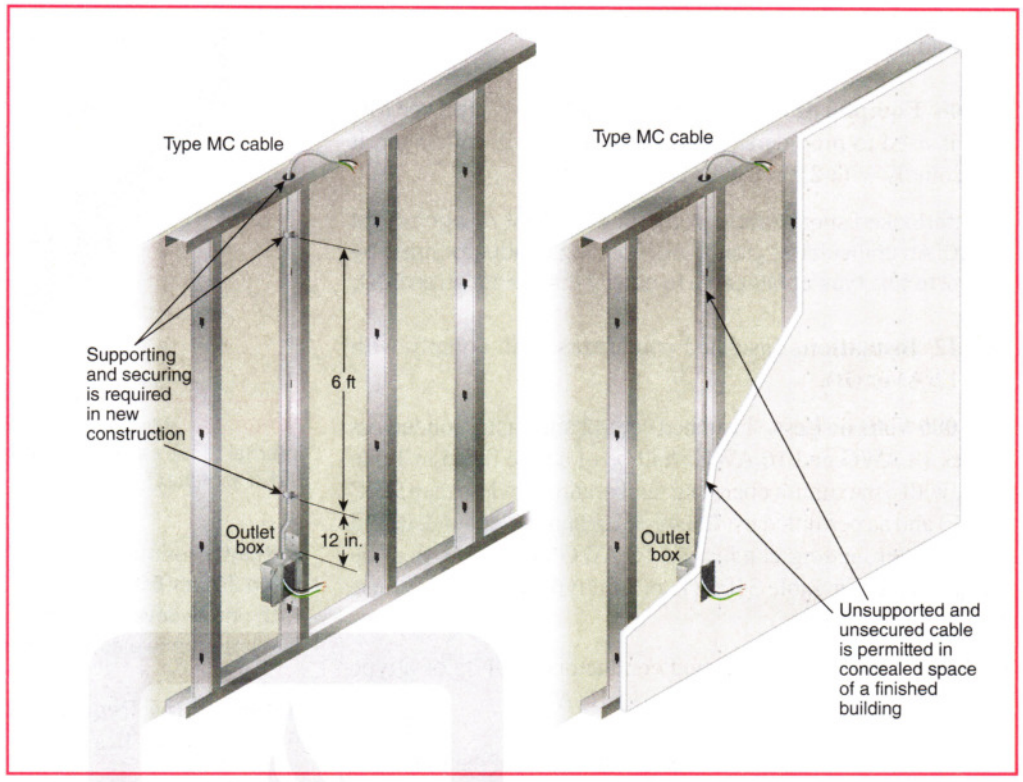
(B) Securing. Unless otherwise permitted in this *Code*, cables shall be secured at intervals not exceeding 1.8 m (6 ft). Cables containing four or fewer conductors sized no larger than 10 AWG shall be secured within 300 mm (12 in.) of every box, cabinet, fitting, or other cable termination. In vertical installations, listed cables with ungrounded conductors 250 kcmil and larger shall be permitted to be secured at intervals not exceeding 3 m (10 ft).

(C) Supporting. Unless otherwise permitted in this *Code*, cables shall be supported at intervals not exceeding 1.8 m (6 ft).

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 1.8 m (6 ft) intervals.

Δ **(D) Unsupported Cables.** Type MC cable shall be permitted to be unsupported and unsecured where the cable complies with any of the following:

EXHIBIT 330.2 Type MC cable supported and secured at intervals not exceeding 6 feet and within 12 inches of the box [per 330.30(B)] and Type MC cable to be fished in walls, floors, or ceilings [per 330.30(D)(1)].



(1) Is fished between access points through concealed spaces in finished buildings or structures and supporting is impractical
(2) Is not more than 1.8 m (6 ft) in length from the last point of cable support to the point of connection to luminaires or other electrical equipment and the cable and point of connection are within an accessible ceiling
(3) Is Type MC of the interlocked armor type in lengths not exceeding 900 mm (3 ft) from the last point where it is securely fastened and is used to connect equipment where flexibility is necessary to minimize the transmission of vibration from equipment or to provide flexibility for equipment that requires movement after installation

330.31 Single Conductors. Where single-conductor cables with a nonferrous armor or sheath are used, the installation shall comply with 300.20.

330.80 Ampacity. The ampacity of Type MC cable shall be determined in accordance with 310.14 or 315.60 for 14 AWG and larger conductors and in accordance with Table 402.5 for 18 AWG and 16 AWG conductors. The installation shall not exceed the temperature ratings of terminations and equipment.

(A) Type MC Cable Installed in Cable Tray. The ampacities for Type MC cable installed in cable tray shall be determined in accordance with 392.80.

(B) Single Type MC Conductors Grouped Together. Where single Type MC conductors are grouped together in a triangular or square configuration and installed on a messenger or exposed with a maintained free airspace of not less than 2.15 times one conductor diameter (2.15 × O.D.) of the largest conductor contained within the configuration and adjacent conductor configurations or cables, the ampacity of the conductors shall not exceed the allowable ampacities in the following tables:

(1) Table 310.20 for conductors rated 0 volts through 2000 volts
(2) Table 315.60(C)(1) and Table 315.60(C)(2) for conductors rated over 2000 volts

(C) Thermal Insulation. Where more than two Type MC cables containing two or more current-carrying conductors in each cable are installed in contact with thermal insulation, caulk, or sealing foam without maintaining spacing between cables, the ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1).

Part III. Construction Specifications

330.104 Conductors. For ungrounded, grounded, and equipment grounding conductors, the minimum conductor sizes shall be 14 AWG copper, nickel, or nickel-coated copper and 12 AWG aluminum or copper-clad aluminum.

For control and signal conductors, minimum conductor sizes shall be 18 AWG copper, nickel, or nickel-coated copper, 14 AWG copper-clad aluminum, and 12 AWG aluminum.

Nickel and nickel-coated copper are used as conductors in some fire-rated Type MC cables and are listed in Table 310.4(1) for