enameled, or otherwise properly coated inside and out to prevent corrosion.

Informational Note: See 300.6 for limitation in the use of boxes and fittings protected from corrosion solely by enamel.

(B) Thickness of Metal. Sheet steel boxes not over 1650 cm^3 (100 $in.^3$) in size shall be made from steel not less than 1.59 mm (0.0625 in.) thick. The wall of a malleable iron box or conduit body and a die-cast or permanent-mold cast aluminum, brass, bronze, or zinc box or conduit body shall not be less than 2.38 mm (3⁄32 in.) thick. Other cast metal boxes or conduit bodies shall have a wall thickness not less than 3.17 mm (⅛ in.).

Exception No. 1: Listed boxes and conduit bodies shown to have equivalent strength and characteristics shall be permitted to be made of thinner or other metals.

Exception No. 2: The walls of listed short radius conduit bodies, as covered in 314.16(C)(2), shall be permitted to be made of thinner metal.

(C) Metal Boxes Over 1650 cm^3 (100 $in.^3$). Metal boxes over 1650 cm^3 (100 $in.^3$) in size shall be constructed so as to be of ample strength and rigidity. If of sheet steel, the metal thickness shall not be less than 1.35 mm (0.053 in.) uncoated.

(D) Equipment Grounding Conductor Provisions. A means shall be provided in each metal box for the connection of an equipment grounding conductor. The means shall be permitted to be a tapped hole or equivalent.

For device boxes and other standard outlet boxes, the means for connecting the equipment grounding conductor is usually provided by the box manufacturer in the form of a 10-32 tapped hole marked "GR" or "GRD," or the equivalent symbol (⏚), next to the hole.

314.101 Covers. Metal covers shall be of the same material as the box or conduit body with which they are used, or they shall be lined with firmly attached insulating material that is not less than 0.79 mm (1⁄32 in.) thick, or they shall be listed for the purpose. Metal covers shall be the same thickness as the boxes or conduit body for which they are used, or they shall be listed for the purpose. Covers of porcelain or other approved insulating materials shall be permitted if of such form and thickness as to afford the required protection and strength.

Δ **314.102 Bushings.** Covers of outlet boxes and conduit bodies having holes through which flexible cord pendants pass shall be provided with approved bushings or shall have smooth, well-rounded surfaces on which the cord will bear. Where individual conductors pass through a metal cover, a separate hole equipped with a bushing of suitable insulating material shall be provided for each conductor. Such separate holes shall be connected by a slot as required by 300.20.

314.103 Nonmetallic Boxes. Provisions for supports or other mounting means for nonmetallic boxes shall be outside of the box, or the box shall be constructed so as to prevent contact between the conductors in the box and the supporting screws.

314.104 Marking. All boxes and conduit bodies, covers, extension rings, plaster rings, and the like shall be durably and legibly marked with the manufacturer's name or trademark.

ARTICLE 315

Medium Voltage Conductors, Cable, Cable Joints, and Cable Terminations

Part I. General

315.1 Scope. This article covers the use, installation, construction specifications, and ampacities for Type MV medium voltage conductors, cable, cable joints, and cable terminations. This article includes voltages from 2001 volts to 35,000 volts ac, nominal and 2001 volts to 2500 volts dc, nominal.

This article is new for the 2023 edition. It consolidates medium voltage requirements that previously appeared in Article 311. Type MV cables are rated 2001 to 35,000 volts. MV cables installed in underground installations must comply with 305.15.

See also

315.36 and **315.44** for shielding requirements

315.6 Listing Requirements. Type MV cables, type MV cable joints, type MV cable terminations, connectors, and associated fittings shall be listed. The listing requirement for Type MV cable joints, cable terminations, and connectors shall be effective January 1, 2026.

Part II. Construction Specifications

315.10 Constructions and Applications. Type MV cables shall comply with the applicable provisions in 315.10(A) through (C).

(A) Conductor Application and Insulation. Conductor application and insulation shall comply with Table 315.10(A).

(B) Thickness of Insulation and Jacket for Nonshielded Insulated Conductors. Thickness of insulation and jacket for nonshielded solid dielectric insulated conductors rated 2001 volts to 5000 volts shall comply with Table 315.10(B).

(C) Thickness of Insulation for Shielded Insulated Conductors. Thickness of insulation for shielded solid dielectric insulated conductors rated 2001 volts to 35,000 volts shall comply with Table 315.10(C) and 315.10(C)(1) through (C)(3).

(1) 100 Percent Insulation Level. Cables shall be permitted to be applied where the system is provided with relay protection

such that ground faults will be cleared as rapidly as possible but, in any case, within 1 minute. These cables are applicable to cable installations that are on grounded systems and shall be permitted to be used on other systems provided the above clearing requirements are met in completely de-energizing the faulted section.

(2) 133 Percent Insulation Level. Cables shall be permitted to be applied in situations where the clearing time requirements of the 100 percent level category cannot be met and the faulted section will be de-energized in a time not exceeding 1 hour. Cable shall be permitted to be used in 100 percent insulation level applications where the installation requires additional insulation.

(3) 173 Percent Insulation Level. Cables shall be permitted to be applied under all of the following conditions:

(1) In industrial establishments where the conditions of maintenance and supervision ensure only qualified persons service the installation
(2) Where the fault clearing time requirements of the 133 percent level category cannot be met
(3) Where an orderly shutdown is required to protect equipment and personnel
(4) Where the faulted section will be de-energized in an orderly shutdown

Cables shall be permitted to be used in 100 percent or 133 percent insulation level applications where the installation requires additional insulation.

Informational Note: See UL 1072, *Medium-Voltage Power Cable*, ANSI/ICEA S-93-639, *American National Standard for 5-46kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy*, and ICEA S-94-649 2013, *Standard for Concentric Neutral Cables Rated 5 through 46 kV for Medium Voltage Cables*.

315.12 Conductors.

(A) Minimum Size of Conductors. The minimum size of conductors shall be as shown in Table 315.12(A), except as permitted elsewhere in this *Code*.

(B) Conductor Material. Conductors shall be of aluminum, copper-clad aluminum, or copper unless otherwise specified.

Copper-clad aluminum conductors are manufactured so that copper forms a minimum of 10 percent of the cross-sectional area of a solid conductor or of each strand of a stranded conductor.

(C) Stranded Conductors. Where installed in raceways, conductors not specifically permitted or required elsewhere in this *Code* to be solid shall be stranded.

TABLE 315.10(A) *Conductor Application and Insulation Rated 2001 Volts and Higher*

Trade Name	Type Letter	Maximum Operating Temperature	Application Provision	Insulation	Outer Covering
Medium voltage solid dielectric	MV-90 MV-105*	90°C 105°C	Dry or wet locations	Thermoplastic or thermosetting	Jacket, sheath, or armor

*Where design conditions require maximum conductor temperatures above 90°C.

TABLE 315.10(B) *Thickness of Insulation and Jacket for Nonshielded Solid Dielectric Insulated Conductors Rated 2001 Volts to 5000 Volts*

	Dry Locations, Single Conductor						Wet or Dry Locations					
			With Jacket				Single Conductor					
	Without Jacket Insulation		Insulation		Jacket		Insulation		Jacket		Multiconductor Insulation*	
Conductor Size (AWG or kcmil)	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils
8	2.79	110	2.29	90	0.76	30	3.18	125	2.03	80	2.29	90
6	2.79	110	2.29	90	0.76	30	3.18	125	2.03	80	2.29	90
4–2	2.79	110	2.29	90	1.14	45	3.18	125	2.03	80	2.29	90
1–2/0	2.79	110	2.29	90	1.14	45	3.18	125	2.03	80	2.29	90
3/0–4/0	2.79	110	2.29	90	1.65	65	3.18	125	2.41	95	2.29	90
213–500	3.05	120	2.29	90	1.65	65	3.56	140	2.79	110	2.29	90
501–750	3.30	130	2.29	90	1.65	65	3.94	155	3.18	125	2.29	90
751–1000	3.30	130	2.29	90	1.65	65	3.94	155	3.18	125	2.29	90
1001–1250	3.56	140	2.92	115	1.65	65	4.32	170	3.56	140	2.92	115
1251–1500	3.56	140	2.92	115	2.03	80	4.32	170	3.56	140	2.92	115
1501–2000	3.56	140	2.92	115	2.03	80	4.32	170	3.94	155	3.56	140

*Under a common overall covering such as a jacket, sheath, or armor.

TABLE 315.10(C) *Thickness of Insulation for Shielded Solid Dielectric Insulated Conductors Rated 2001 Volts to 35,000 Volts*

Conductor Size (AWG or kcmil)	2001–5000 Volts		5001–8000 Volts						8001–15,000 Volts						15,001–25,000 Volts					
	100 Percent Insulation Level		100 Percent Insulation Level		133 Percent Insulation Level		173 Percent Insulation Level		100 Percent Insulation Level		133 Percent Insulation Level		173 Percent Insulation Level		100 Percent Insulation Level		133 Percent Insulation Level		173 Percent Insulation Level	
	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils
8	2.29	90	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6–4	2.29	90	2.92	115	3.56	140	4.45	175	—	—	—	—	—	—	—	—	—	—	—	—
2	2.29	90	2.92	115	3.56	140	4.45	175	4.45	175	5.59	220	6.60	260	—	—	—	—	—	—
1	2.29	90	2.92	115	3.56	140	4.45	175	4.45	175	5.59	220	6.60	260	6.60	260	8.13	320	10.67	420
1/0–2000	2.29	90	2.92	115	3.56	140	4.45	175	4.45	175	5.59	220	6.60	260	6.60	260	8.13	320	10.67	420

Conductor Size (AWG or kcmil)	25,001–28,000 Volts						28,001–35,000 Volts					
	100 Percent Insulation Level		133 Percent Insulation Level		173 Percent Insulation Level		100 Percent Insulation Level		133 Percent Insulation Level		173 Percent Insulation Level	
	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils
1	7.11	280	8.76	345	11.30	445	—	—	—	—	—	—
1/0–2000	7.11	280	8.76	345	11.30	445	8.76	345	10.67	420	14.73	580

TABLE 315.12(A) *Minimum Size of Conductors*

Conductor Voltage Rating (Volts)	Minimum Conductor Size (AWG)
	Copper, Aluminum, or Copper-Clad Aluminum
2001–5000	8
5001–8000	6
8001–15,000	2
15,001–28,000	1
28,001–35,000	1/0

Large-size conductors are required to be stranded for greater flexibility. This requirement does not apply to conductors outside of raceways, such as busbars.

315.14 Conductor Identification. Conductors that are intended for use as ungrounded conductors, whether used as a single conductor or in multiconductor cables, shall be finished to be clearly distinguishable from grounded and grounding conductors. Distinguishing markings shall not conflict in any manner with the surface markings required by 315.16(B)(1). Branch-circuit ungrounded conductors shall be identified in accordance with 210.5(C). Feeders shall be identified in accordance with 215.12.

315.16 Marking for Type MV Cables and Conductors.

(A) Required Information for Type MV Cables and Conductors. All conductors and cables shall be marked to indicate the following information, using the applicable method described in 315.16(B):

(1) The maximum rated voltage

(2) The proper type letter or letters for the type of wire or cable as specified elsewhere in this *Code*

(3) The manufacturer's name, trademark, or other distinctive marking by which the organization responsible for the product can be readily identified

(4) The AWG size or circular mil area

Informational Note: See Chapter 9, Table 8, Conductor Properties, for conductor area expressed in SI units for conductor sizes specified in AWG or circular mil area.

(B) Method of Marking for Type MV Cables and Conductors. One or more of the methods in 315.16(B)(1) through (B)(4) shall be used for marking of cable.

(1) Surface Marking. Cables shall be durably marked on the surface. The AWG size or circular mil area shall be repeated at intervals not exceeding 610 mm (24 in.). All other markings shall be repeated at intervals not exceeding 1.0 m (40 in.).

(2) Marker Tape. Metal-covered multiconductor cables shall employ a marker tape located within the cable and along its complete length.

(3) Tag Marking. Metal-covered, single-conductor cables shall be marked by means of a printed tag attached to the reel.

(4) Optional Marking of Wire Size. The information required in 315.16(A)(4) shall be permitted to be marked on the surface of the individual insulated conductors for multiconductor Type MC cable.

(C) Optional Markings. Cables shall be permitted to be marked to indicate special characteristics of the cable materials, such as limited smoke and sunlight resistance.

N 315.17 Marking for Type MV Cable Joints and Terminations.

N (A) Required Information for Type MV Cable Joints, Terminations, and Connectors. All Type MV cable joints, cable terminations, and connectors shall be marked to indicate the following information, using one or more of the methods described in 315.17(B)(1) or (B)(2), and shall be permitted to be optionally marked as described in 315.17(C):

(1) The maximum rated voltage.
(2) The proper type letter or letters for the type of wire or cable as specified elsewhere in this *Code* that the cable joint or cable terminations is listed for use with.
(3) The manufacturer's name, trademark, or other distinctive marking by which the organizations responsible for the product can be readily identified.
(4) The conductor AWG size or circular mil area size, or range of sizes, that the cable joint or cable terminations is listed for use with.
(5) The cable outer diameter size, or size range, that the cable joint or cable termination is listed for use with.
(6) Connectors shall be marked with the following information; the marking shall also be on the unit container (the smallest container in which the connector is packaged):
   a. The manufacturer's name, trademark, or other distinctive marking by which the organization responsible for the product can be readily identified
   b. The manufacturer's catalog number
   c. The conductor AWG size or circular mil use range, and die number if applicable
   d. The type of conductor material(s) the connector is for use with

N (B) Method of Marking for Type MV Cable Joints, Terminations, and Connectors. One or both of the methods in 315.17(B)(1) or (B)(2) shall be used for the marking of cable joints, terminations, or connectors.

N (1) Surface Marking. Type MV cable joints, terminations, or connectors shall be durably marked on the surface.

N (2) Tag Marking. Type MV cable joints, terminations, or connectors shall be marked by means of a durably printed tag or label attached to joint or termination.

N (C) Optional Markings. Type MV cable joints and cable terminations shall be permitted to be marked to indicate special characteristics, such as limited smoke and sunlight resistance.

Part III. Installation

Δ 315.30 Installation. A qualified person(s) with documented training and experience shall perform the installation and testing of Type MV cable. A qualified person(s) with documented training and experience in the installation of Type MV cable joints shall perform the installation of Type MV cable joints. A qualified person(s) with documented training and experience in the installation of Type MV cable terminations shall perform the installation of Type MV cable terminations.

Informational Note No. 1: See ANSI/NECA/NCSCB 600-2020, *Standard for Installing and Maintaining Medium-Voltage Cable*, and IEEE 576, *Recommended Practice for Installation, Termination, and Testing of Insulated Power Cables as Used in Industrial and Commercial Applications*, for information about accepted industry practices and installation procedures for medium-voltage cable.

Informational Note No. 2: Where medium-voltage cable is used for dc circuits, low frequency polarization can create hazardous voltages. When handling the cable these voltages could be present or could develop on dc stressed cable while the circuit is energized. Solidly grounding the cable prior to contacting, cutting or disconnecting cables in dc circuits is a method to discharge these voltages.

Δ 315.32 Uses Permitted.

N (A) Type MV Cable. Type MV cable shall be permitted for use on power systems rated up to and including 35,000 volts, nominal, as follows:

(1) In wet or dry locations.
(2) In raceways.
(3) In cable trays, where identified for the use, in accordance with 392.10, 392.20(B), (C), and (D), 392.22(C), 392.30(B)(1), 392.46, 392.56, and 392.60. Type MV cable that has an overall metallic sheath or armor, complies with the requirements for Type MC cable, and is identified as "MV or MC" shall be permitted to be installed in cable trays in accordance with 392.10(B)(2).
(4) In messenger-supported wiring in accordance with Part II of Article 396.
(5) As exposed runs in accordance with 305.3. Type MV cable that has an overall metallic sheath or armor, complies with the requirements for Type MC cable, and is identified as "MV or MC" shall be permitted to be installed as exposed runs of metal-clad cable in accordance with 305.3.
(6) Corrosive conditions where exposed to oils, greases, vapors, gases, fumes, liquids, or other substances having a deleterious effect on the conductor or insulation shall be of a type suitable for the application.
(7) Conductors in parallel in accordance with 310.10(G).
(8) Type MV cable used where exposed to direct sunlight shall be identified for the use.
(9) Direct buried in accordance with 315.36.

N (B) Type MV Cable Joints and Terminations. Type MV cable joints and terminations shall be permitted for use on power systems rated up to and including 35,000 volts, nominal, as follows:

(1) Type MV cable joints and terminations, used where exposed to direct sunlight, shall be identified for the use.
(2) Direct buried.
(3) Where used intermittently or continuously submerged in water at a depth not exceeding 7 m (23 ft) type MV cable joints and terminations shall be identified for the use.