



TECHNICAL SERVICES DEPARTMENT

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Electrical Cable Type and Dimensional Considerations for Compatibility with Listed Cable Fittings (Connectors) and Box Cable Clamps

The objective of this Bulletin is to increase awareness of the distinction between types of circular electrical cables in relation to their conductor fill, and the compatibility of cables of varying diameters with listed fittings (connectors) and box clamps. Additionally, this Bulletin offers practical guidance for selecting cable fittings and box clamps that accommodate a range of cable diameters.

A key fundamental criterion for designing an electrical branch or feeder circuit is proper selection and sizing of electrical conductors. Another fundamental is routing of electrical conductors in the circuit and providing the degrees of protection necessary for efficiency and safety in the application, and in accordance with the *National Electrical Code® (NEC®)*.

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It is very common throughout the design, specification, procurement, installation, and inspection of branch and feeder circuits to reference consistently the conductor sizes and number of conductors (e.g. 14/2, 12/4, 10/3) when describing cable used in the circuit. This constant reference only to conductors can cause misunderstanding of important distinctions between cable constructions. In addition, dimensional variations between cable types and cables from different manufacturers can lead to misapplication of cable fittings (connectors) and box clamps depended upon to secure the cables as required at boxes and enclosures. Mechanical securement, electrical bonding and environmental sealing are among important safety considerations that could be compromised through such misapplication.

After final installation, a wiring system comprised of Armored Cable (Type AC), Metal-Clad Cable (Type MC) and even Flexible Metal Conduit (Type FMC) may be hard to distinguish from each other. Even at the point of procurement, AC and MC are often confused. These cable systems are not always interchangeable despite that they may contain the same exact size and number of electrical conductors. Their suitability as an equipment grounding conductor (EGC) in accordance with *NEC®* Section 250.118 may vary, as may other permitted uses. Armored Cable

is required to have an anti-short bushing assembled at the time of installation whereas this bushing is not required for metal-clad cable (see NEMA Engineering Bulletin No. 90)

Correct specification, procurement, installation, and inspection of listed fittings (connectors) or box clamps not only depend on clear identification of the appropriate cable type, but also on the outside diameter of the cable, or cable diameter range. Typical listed fittings and box clamps cover a range of cable diameters. Because of the sometimes wide variation in outside diameters among cable types, and among cables from different manufacturers, even those containing the same number and size of conductors, it is unreliable to select and install a fitting or box clamp on a cable using only the conductor fill as the selection criterion.

A cable fitting is typically provided with the following information:

Trade Size (Metric Designator) example: $\frac{1}{2}$ (16) [See A of Figure 1.]

This size attribute refers solely to the knockout size in a box or enclosure to which the fitting is intended to be mechanically attached. See A of Figure 2.

Diameter Range example: 0.370 – 0.580 in. [See B of Figure 1.]

This diameter specification is a required marking for listed cable fittings and designates the outside diameter of cable or range of diameters for which a cable fitting, or box clamp, is listed. For metal-jacketed cables, such as Types AC and MC, this diameter is over the metal armor or sheath but excludes any nonmetallic outer covering or jacket. See B of Figure 2. For a fitting that is also listed for environmental sealing on cables designed for use in wet locations, the diameter range for sealing on the cable's outer jacket may also be indicated.

Conductor Range example: 14/2 – 10/3 [See C of Figure 1.]

This conductor marking, where provided, is for reference only. Since cable diameters can vary widely, as previously described, the listed cable diameter range for the fitting or box clamp needs to be confirmed against the cable's actual diameter prior to installation and again at inspection.

For certain cable fittings, the conductor range of some cables may be precluded by the opening size of the required bushing in the throat of the fitting where the insulated (de-armored/de-sheathed) conductors pass through that opening as a bundle to enter into the box or enclosure. See C of Figure 2.

Sizing Connectors and Box Clamps to Cables

Since the diameter of cables can vary even along a continuous length, it is recommended that a connector or box clamp be selected that accommodates the nominal over-armor diameter of the cable within the mid-range of the diameters marked for the connector or clamp. This selection approach will help assure ease of assembly and optimal performance.

In summary:

A greater awareness is needed as to the important distinctions between cable types and the importance of verifying the listed cable diameter range of fittings (connectors) and box clamps against the actual diameter of the specific cable to be installed. Over-reliance on conductor size and number of conductors alone as the common reference for all types of cables through the design, specification, procurement, installation, and inspection of electrical branch circuits is undependable in assuring component compatibility and system safety.

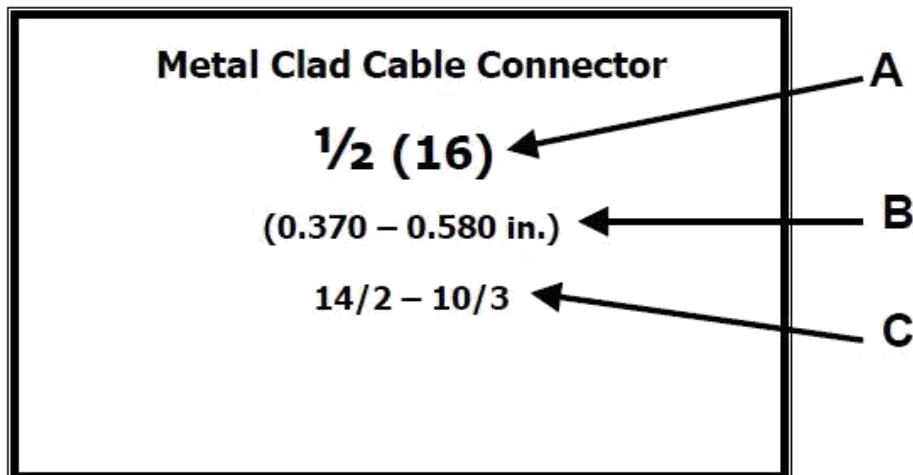


Figure 1
Typical Cable Connector Product Label

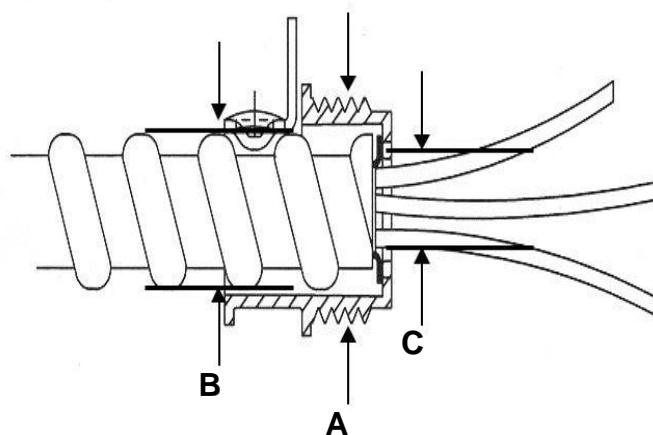


Figure 2
Typical Cable Connector

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