

Metal-Clad Cable - Type MC

A detailed examination of Section(s) 330.10 and 330.12 of the 2020 National Electrical Code®



Detailed examination of the permitted and prohibited uses of Metal-Clad Cable

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In this article let's examine the permitted uses of Metal-Clad Cable: Type MC and what the National Electrical Code (NEC) informs us concerning those permitted uses. In the 2020 version of the NEC we have section .10 Uses Permitted and .12 Uses Not Permitted to give the manufacturer, project designer, electrical contractor, and ultimately electrician informed guidance.

In 330.10, there are (12) twelve specific permitted uses and/or location giving specific guidance to the user of the NEC. Within the itemized list, there is constant industry confusion as to the allowances. For example, item (3) says metal-clad cable is for use "Indoors or outdoors" which seems very location specific only to have item (11) explain that in wet locations the construction of the metal-clad cable has to be a specific way or it can't be used in a wet location, which could be inside or outside, yet never mentions damp locations.

Therefore, this is why we are starting this journey to explain all the items and explain them in a way the end user can understand.

This section is broken into (2) subdivisions consisting of a (A) and (B). The (A) General Uses will be where we spend our attention as well as in 330.12.

Item (1) - For Services, feeders, and branch circuits.

Translation: The use of metal-clad cable is acceptable for all of the circuits we encounter in the electrical system. The use of metal-clad for service entrance cable is directly stated in 230.43(13) and by virtue of the statement in item 1 for feeders and branch circuits.

Item (2) – For power, lighting, control, and signal circuits.

Translation: It is common and acceptable within the NEC to use metal-clad cable for power circuits, such as those supplying electrical equipment and receptacles for cord and plug connected devices as well as the general illumination systems within a building or structure.

However, the use of metal-clad cable is also very common for use in control circuits to motors and other electrical equipment, and as stated in item (2), even signal circuit for the various signaling applications within modern buildings for control automation, such as provided for in Article 725 – Class 1, Class 2, and Class 3 Remote-Control, Signaling, and Power-limited Circuits.

Item (3) – Indoors or Outdoors.

Translation: The use of metal-clad cable is quite common and accepted for all types of indoor uses. However, the use of metal-clad cable outdoors is acceptable as stated in item (3) with some caveats we will discuss later in this article. It is one thing to say something is permitted in a specific location but perceptive user of the NEC knows that the story never ends with a statement of use outdoors as other rules will apply to specific locations of use and various conditions of use, such as damp or wet locations.

Now, this item (3) permits this use of metal-clad outdoors but that is not all we need in terms of acceptance. Let us just accept at this point that metal-clad cable can be used in indoor and outdoor locations for now.

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Item (4) – Exposed or Concealed.

Translation: The use of metal-clad cable is acceptable for exposed work, such as running on the surface of a wall or ceiling as long as the cable is not subject to physical damage. Now, this term “physical damage” is not a defined term in the NEC so the local inspectors will be the ultimate judge of acceptance so installers beware.

The concealed in the item (4) permits the use of metal-clad cable within the walls, ceilings, and floors of a building that to be “concealed” or encapsulated, so to speak by the buildings finished surface coverings, such as gypsum board, plywood, etc.

Item (5) – To be direct buried where identified for such use.

Translation: It should go without saying that if you direct bury something it would have to be rated for a “wet” location but what is not often stated is the fact cables that are directly buried have to face conditions of exposure that normal cables would not be subjected to.

Now, metal-clad cable rated for direct burial starts when extruded jacketing placed over traditional metal-clad cable containing wet location rated inner conductors, the cable is then undergoes tests for impact and crush resistance as required by UL 1569, the UL/ANSI Standard for Metal-Clad Cable, for traditional interlocked metal-clad cable.

However, the extruded jacketed interlocked metal-clad cannot rupture during the testing phase.

If the jacketed interlocked metal-clad cable passes all standard tests in addition to no rupture of the extruded jacketing then it is successful and the direct burial language is included on the printing on the extruded jacketing.

Item (6) – In cable tray where identified for such use.

Translation: The NEC tells the installers what cables are permitted within a cable tray. That section is 392.10, which is also titled “used permitted”. The users of the NEC are directed to view Table 392.10(A) where metal-clad cable is listed.

However, metal-clad cable manufacturers who desire to list their metal-clad cable for use in cable trays (CT Use) are required to perform various flame tests, such as UL 1685 Method 1, which is the 70,000 BTU flame test for minimum industry acceptance. If desired, some will continue on to an even higher-level test in Method 2 of the same UL 1685 standard. It is also important to know that other tests, such as IEEE 1202 or FT4 are equivalent to the Method 2 as well. Just remember the base test UL 1685 method 1 is all that is required to be “CT Use”.

Item (7) - In any raceways.

Translation: Yes, it is perfectly acceptable to install metal-clad cable within a raceway, such as Rigid Metal Conduit (RMC), Intermediate Metal Conduit (IMC), Electrical Metallic Tubing (EMT), and Rigid Polyvinyl Chloride Conduit (PVC). Why would you do this?

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Remember that statement about metal-clad cable being not rated where subject to “physical damage”. Well, the aforementioned raceways are rated for such conditions. Therefore, placing the metal-clad cable inside of short sections of those raceways will add the protection necessary to be considered protected from such exposure damage.

Item (8) – As aerial cable on a messenger.

Translation: Here is one of the most misunderstood applications of metal-clad cable. In Article 396 Messenger-Supported Wiring, a section directs the installer to view Table 396.10(A). This table provides a list of cable types permitted to be supported by a messenger support system.

The messenger support system is typically comprised of a support wire that extends from one building or structure to another, and securely fastened to the building or structure with the sole purpose of supporting weight of an electrical cable assembly permitted in Table 396.10(A).

While Article 392 appears to permit metal-clad cable on a messenger support system, the installer should never forget to follow all the installation requirements found in Article 330 as well.

Compliance with the NEC in most cases will mean compliance with multiple articles, sections, and subdivisions in tandem to ensure total compliance.

Item (9) – In hazardous (classified) locations where specifically permitted by other articles in this Code.

Translation: The use of metal-clad cable in hazardous (classified) locations is governed by the articles in the NEC that focus on such conditions, such as Article 500 – Hazardous (Classified) Locations Classes I, II, and III, Divisions 1 and 2. In fact, there are individual articles for each of the hazardous classes and within those specific articles, metal-clad cable is permitted. This is why the item (9) states “where specifically permitted”.

It is important to point out that our electrical industry has (3) different types of metal-clad cables available. There are Continuous (smooth), Corrugated, and Interlocked sheathed cables available. Each sheathing style has their own unique advantages, disadvantages, and installation limitations.

Item (10) – In dry locations and embedded in plaster finish on brick or other masonry except in damp or wet locations.

Translation: Standard metal-clad cables are listed for dry locations only. This would be installations within the walls, ceilings, and floors of a building or structure for the most part while not being exposed to damp or wet conditions. In fact, UL 1569 does not even mention “damp” in the entire UL/ANSI Standard, which leaves users of the code to deal with dry and wet locations only. Clearly, a product listed for a wet location would also be acceptable for damp locations as well.

Now, you can embed standard metal-clad cable (not jacketed metal-clad cable in item 10) in plaster wall finish as long as the wall itself is not located in a damp or wet physical location.

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Therefore, if you have a remodeling project and an interior wall is brick or masonry but is not located or exposed to a damp or wet location then it is acceptable to embed standard metal-clad cable in the plaster material without any worries to the armor or conductors contained within.

Item (11) – In wet locations where a corrosion-resistant jacket is provided over the metallic covering and any of the following are met.

- a. The metal 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.

Translation: The first step to using metal-clad cable in wet and subsequently damp locations as well, is to provide the “corrosion-resistant jacket” to the standard metal-clad cable product.

Once you achieve the “jacketing” step the manufacturer then chooses between options a, b, or c as previously mentioned. This is the final stage of being acceptable for wet (and damp) locations utilization.

In (a,) it says a “metallic covering” that is impervious to moisture. Well, that would be an example of Continuous “smooth” sheathing metal-clad cable. In (b.) the manufacturer could place an additional “jacket” under the armor, over the internal conductors and meet the requirement as well. However, it is (c.) the majority of the manufacturers utilize to meet the “wet” location ratings.

Option (c) states the insulated conductors of the jacketed metal-clad cable are to be listed for use in wet location applications. For example, THWN-2 and XHHW-2 are two examples of conductor insulation ratings that contain the “W” for wet location applications.

Item (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.

Translation: When you have conductors with current traveling on them, a magnetic rapidly expanding and collapsing field of voltage is created, sometimes call Phantom Voltage.

When these referenced circuit conductors are not kept in close proximity these fields, expand and generate voltage anomalies, can cause undesired consequences on the electrical system.

Therefore, as a result this item (12) it forces anyone using a metal-clad cable that contains only (1) one insulated conductor, which is permitted, to be physically grouped with the other phase conductors and associated grounded (and neutrals, where applicable) to reduce the detrimental effects of those magnetic expanding and collapsing fields.

Now it is time to examine the “uses not permitted” for metal-clad cable covered in section 330.12. We cannot fully embrace where you can use metal-clad cable until we understand where we cannot use metal-clad cable.

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Section 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 subject to any of the destructive corrosive conditions in (a) or (b), unless the metallic sheath or armor is resistant to the conditions or 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.

Translation: Welcome to the need for jacketed metal-clad cable. This is why it is necessary to extrude the jacketing material over the standard metal-clad cable. Not only does the extruded jacket, typically Polyvinyl Chloride material, which is highly resistant to corrosive conditions meet the demands of 330.12(2)(b) above, it also meets the “wet” location use in the permitted applications in 330.10(11) previously discussed. Since all locations outside aboveground and underground are considered wet locations the “direct burial” markings are critical and it meets 330.12(2)(a) as well.

In 330.12(1) you may noticed that statement about not locating metal-clad cable in locations where subject to “physical damage”. Well, the use of raceway to sleeve the metal-clad cable as previously discussed is often utilized to overcome that hurdle to the installation.

In conclusion, it is my hope that after reading this article you have a better understanding of the permitted and non-permitted uses of metal-clad cable and the advantages and limitations of one of the most popular wiring methods in the modern building era.

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