ARTICLE

250 GROUNDING AND BONDING

Introduction to Article 250—Grounding and Bonding

Article 250 covers the general requirements for bonding and grounding electrical installations. The terminology used in this article has been a source of much confusion over the years so pay careful attention to the definitions pertaining to Article 250. Understanding the difference between bonding and grounding will help you correctly apply the provisions of this article. Because of the massive size and scope of Article 250, Figure 250.1 in the *NEC* is provided as a reference for the locations of the different types of rules. Of the ten parts contained in this article only parts one through seven are covered in this material. *Topics* covered in this material for Article 250 include:

- General Requirements for Grounding and Bonding
- Objectionable Current
- Protection of Clamps and Fittings
- System Grounding Requirements
- Bonding Jumpers
- Generator Bonding
- Grounding Electrode System
- Service Equipment Bonding
- Piping System and Structural Steel Bonding
- Equipment Grounding conductors (EGCs)

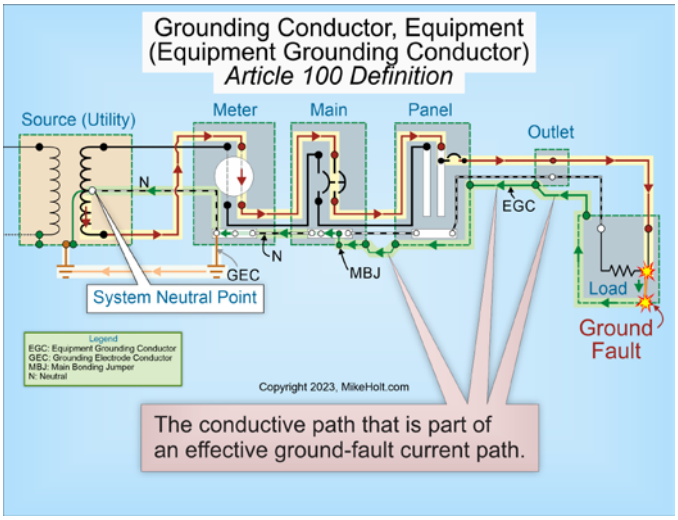
Article 250 consists of ten parts:

- Part I. General
- Part II. System Grounding
- Part III. Grounding Electrode System and Grounding Electrode Conductor (GEC)
- Part IV. Enclosure, Raceway, and Service Cable Connections
- Part V. Bonding
- Part VI. Equipment Grounding Conductors (EGC)
- Part VII. Methods of EGC Connections
- Part VIII. Direct-Current Systems
- Part IX. Instruments, Meters, and Relays
- Part X. Grounding of Systems and Circuits of over 1000 Volts

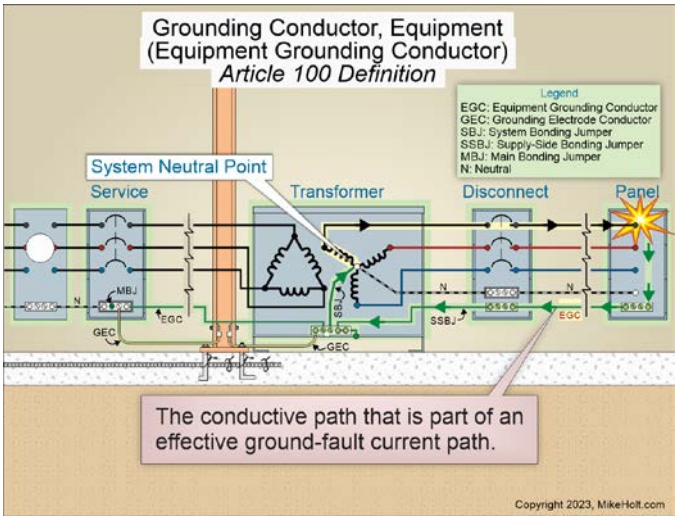
Part VI. Equipment Grounding Conductors

250.118 Types of Equipment Grounding Conductors

According to Article 100, "Equipment Grounding Conductor" a conductive path(s) that is part of an effective ground-fault current path. ▸Figure 250–213 and ▸Figure 250–214



▸Figure 250–213



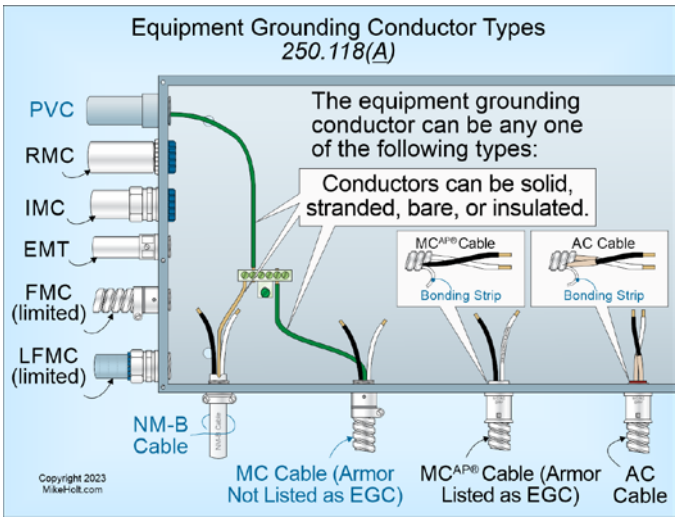
▸Figure 250–214

(A) Permitted. The equipment grounding conductor can be any one of the following types: ▸Figure 250–215

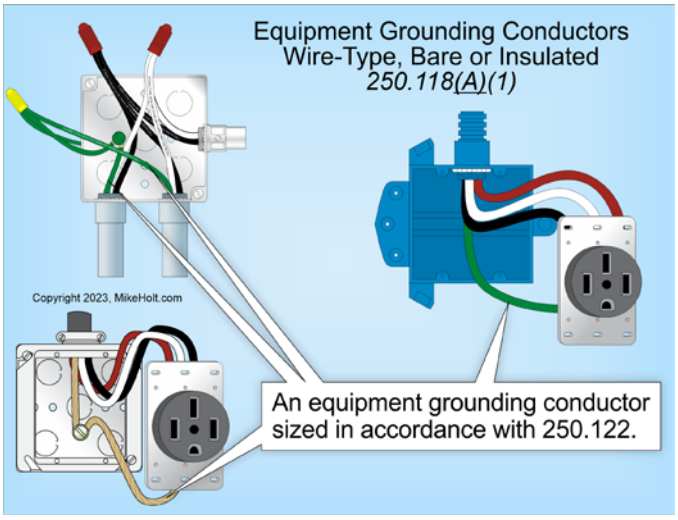
(1) Conductor sized in accordance with 250.122 ▸Figure 250–216

(2) Rigid metal conduit (RMC) ▸Figure 250–217

(3) Intermediate metal conduit (IMC) ▸Figure 250–218



▸Figure 250–215



▸Figure 250–216

▸Figure 250–217

▸Figure 250–218

(4) Electrical metallic tubing (EMT) ▸Figure 250–219

▸Figure 250–219

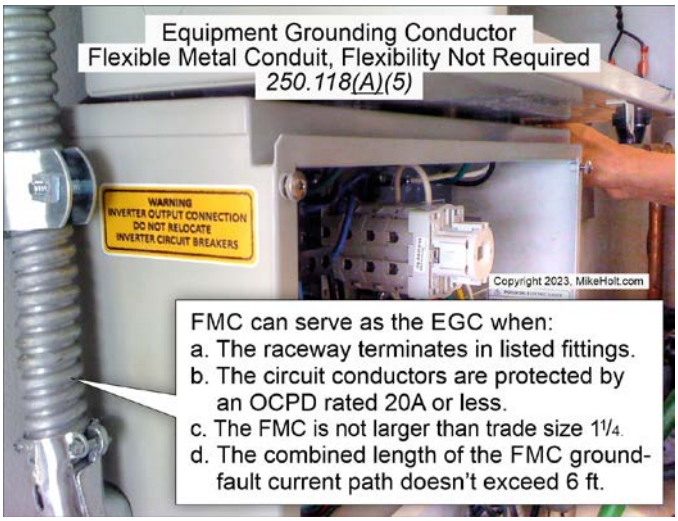
(5) Flexible metal conduit (FMC), where: ▸Figure 250–220

a. The raceway terminates in listed fittings.

b. The circuit conductors are protected by an overcurrent protective device rated 20A or less.

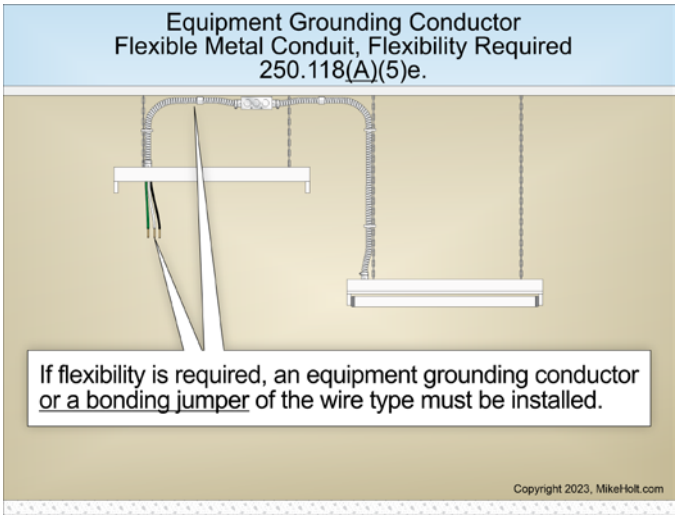
c. The size of the flexible metal conduit does not exceed 1¼ in.

d. The combined length of the flexible metal conduit in the same effective ground-fault current path does not exceed 6 ft.



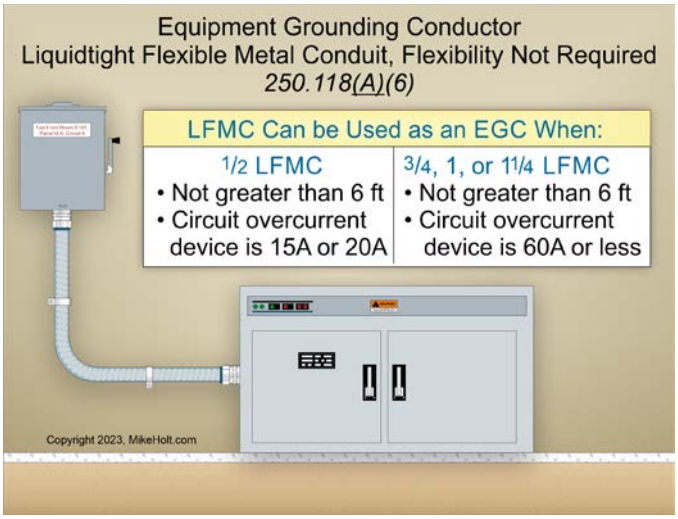
▸Figure 250–220

e. If flexibility is required to minimize the transmission of vibration from equipment or to provide flexibility for equipment that requires movement after installation, an equipment grounding conductor or a bonding jumper of the wire type must be installed with the circuit conductors in accordance with 250.102(E). ▸Figure 250–221



▸Figure 250–221

(6) Liquidtight flexible metal conduit (LFMC), where: ▸Figure 250–222



▸Figure 250–222

a. The raceway terminates in listed fittings.

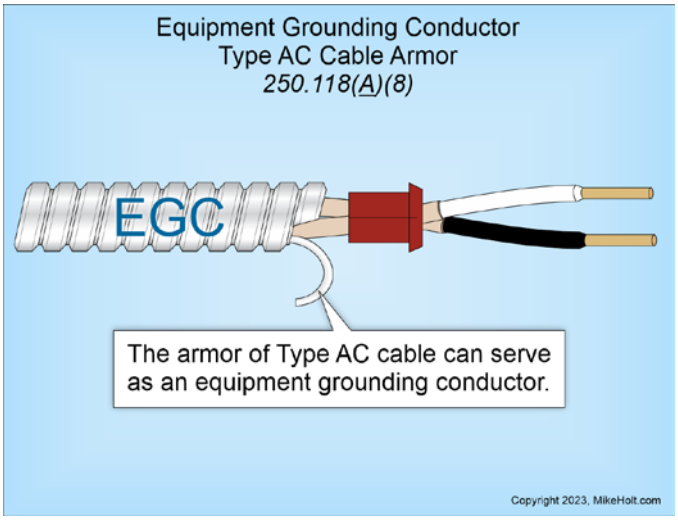
b. For ½ in., the circuit conductors are protected by overcurrent protective devices rated 20A or less.

c. For ¾ through 1¼ in., the circuit conductors are protected by overcurrent protective devices rated 60A or less.

d. The combined length of the liquidtight flexible metal conduit in the same effective ground-fault current path does not exceed 6 ft.

e. If flexibility is required to minimize the transmission of vibration from equipment or to provide flexibility for equipment that requires movement after installation, an equipment grounding conductor of the wire type or a bonding jumper must be installed with the circuit conductors in accordance with 250.102(E).

(8) Type AC cable ▸Figure 250–223



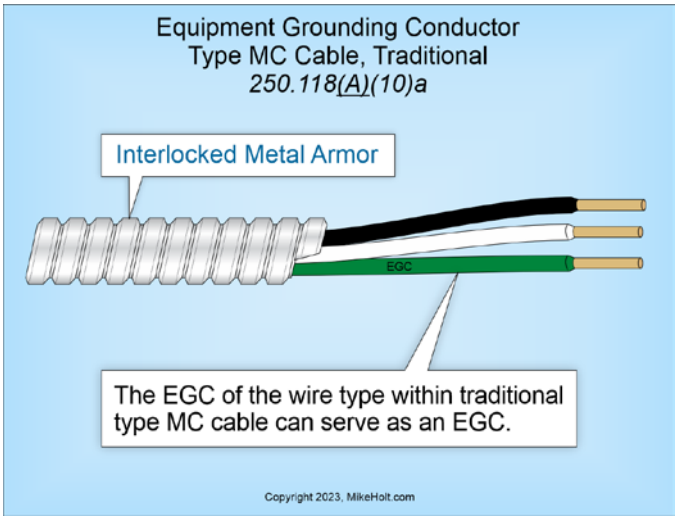
▸Figure 250–223

Author's Comment:

- The internal aluminum bonding strip of Type AC cable is not an equipment grounding conductor, but it allows the interlocked armor of the cable to serve as an equipment grounding conductor because it reduces the impedance of the armored spirals to ensure a ground fault will be cleared. It is the aluminum bonding strip in combination with the cable armor that creates the circuit equipment grounding conductor. Once the bonding strip exits the cable it can be cut off because it no longer serves any purpose.

(10) Type MC cable as follows:

a. An equipment grounding conductor of the wire-type is contained in traditional Type MC cable. ▸Figure 250–224



▸Figure 250–224

b. The combination of the metallic sheath and bare 10 AWG aluminum bonding/grounding conductor in MCAP. ▸Figure 250–225

Author's Comment:

- Once the bare aluminum grounding/bonding conductor of Type MC cable exits the cable, it can be cut off because it no longer serves any purpose. The effective ground-fault current path must be maintained using fittings specifically listed for Type MC$^{AP®}$ cable [330.6]. See 300.12, 300.15, and 330.108. ▸Figure 250–226

c. The metallic sheath of smooth or corrugated tube-type MC cable listed and identified as an equipment grounding conductor.

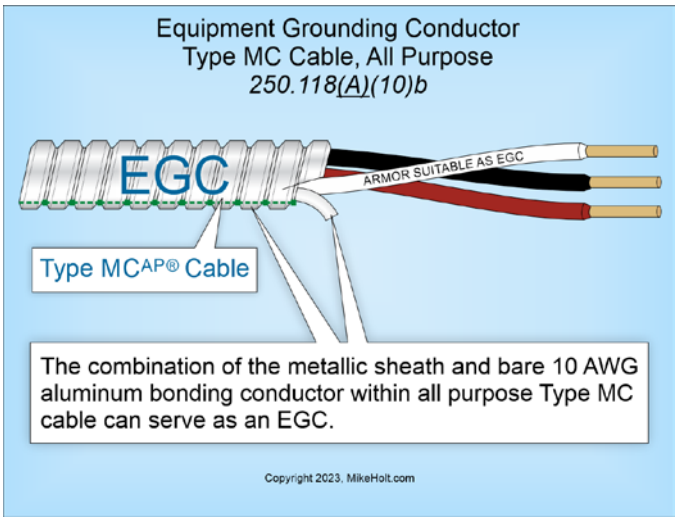


Figure 250–225

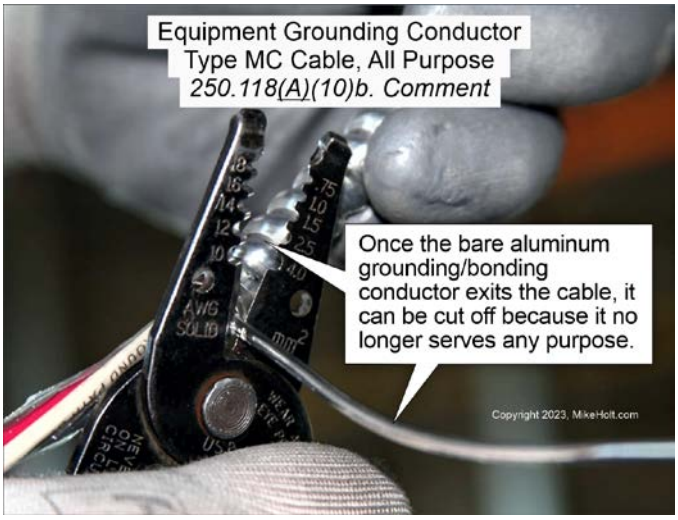


Figure 250–226

(11) Metal cable trays in accordance with 392.10 and 392.60 Figure 250–227

(13) Listed metal raceways, such as metal wireways Figure 250–228

(14) Surface metal raceways listed for grounding Figure 250–229

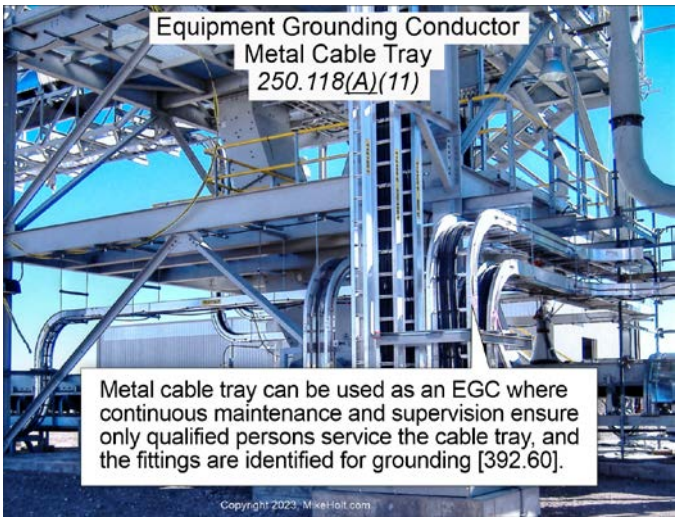


Figure 250–227

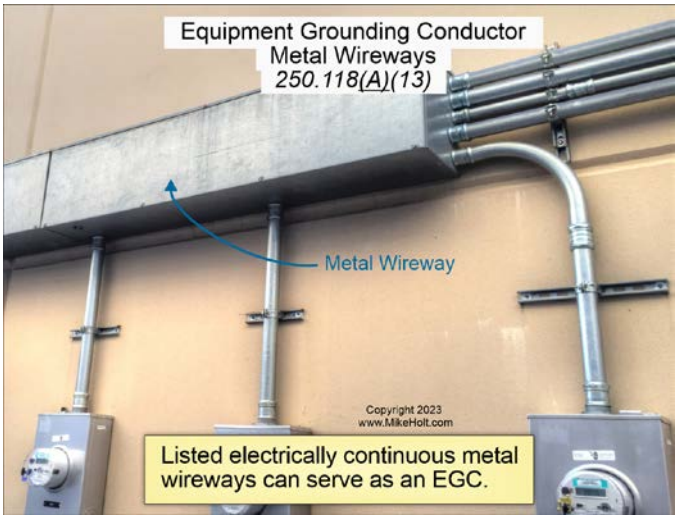


Figure 250–228

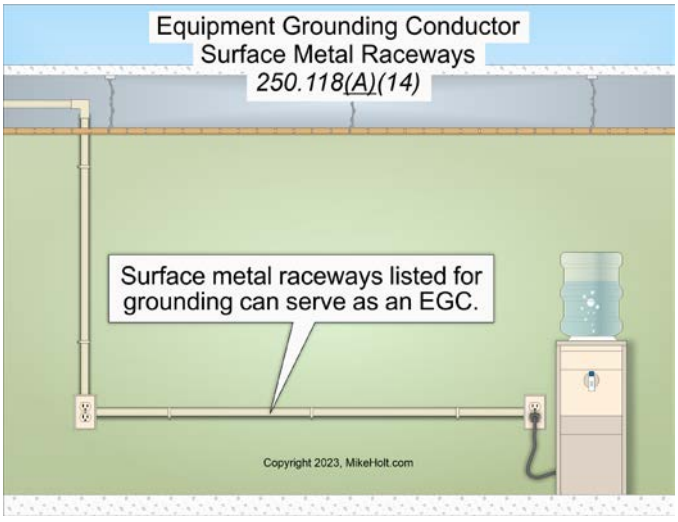
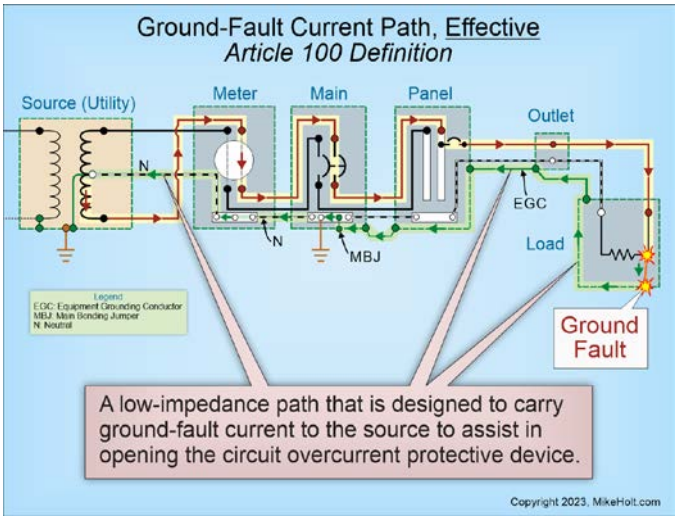


Figure 250–229

According to Article 100, "Effective Ground-Fault Current Path" is an intentionally constructed low-impedance conductive path designed to carry ground-fault current during a ground-fault event to the power source. The purpose of the effective ground-fault current path is to assist in opening the circuit overcurrent protective device in the event of a ground fault. ▸Figure 250–230



▸Figure 250–230

Author's Comment:

- In accordance with "*UL Guide Information DWTT*," listed offset nipples and metal fittings for metal cable, conduit, and tubing are considered suitable for grounding circuits where installed in accordance with the *NEC*, except as noted for flexible metal conduit fittings and liquid-tight flexible metal conduit fittings.