STEEL TUBE INSTITUTE

Steel Conduit

TECH TALK

2020 NATIONAL ELECTRICAL CODE CHANGES

2020 NATIONAL ELECTRIC CODE® (NEC®) CHANGES

The National Electrical Code (NEC) is used in all 50 of the United States, as well as several countries in North, Central, and South America. It is updated every three years. As always, the National Electrical Code saw many changes in the 2020 edition, and this article discusses some of the changes that address steel conduit and tubing.

ARTICLE 100 DEFINITIONS

The definition of Equipment Grounding Conductor was revised for accuracy.
Grounding Conductor, Equipment (EGC). A conductive path(s) that is part of an effective ground-fault current path. It connects the normally noncurrent-carrying metal parts of equipment to each other and to the supply source, or to a grounding electrode, or both.

Info Note 1: The EGC both grounds and bonds equipment.

Info Note 2: The types of EGCs allowed are listed in 250.118.

Analysis: The equipment grounding conductor is the most prominent component of the effective ground-fault current path discussed in 250.4. The role of the effective ground-fault current path is to open circuit breakers or fuses during a fault, so its importance cannot be exaggerated. If an effective ground-fault current path does not exist, metal parts of electrical equipment will remain energized during a ground fault, which could result in injury or even death. The equipment grounding conductor, however, is not the entire effective ground-fault current path (as previous versions of the definitions implied). It is only a portion of it. Properly torqued terminations, raceway, and cable fittings made up tight, boxes properly installed, and many other components are all part of the effective ground-fault current path, and much like a chain, it is only as good as its weakest link.

ARTICLE 250 GROUNDING AND BONDING

A new exception was added to allow qualified persons to size equipment grounding conductors when their circuit conductors are increased in size.

250.122 Size of Equipment Grounding Conductors.

(B) Size Increases. If the ungrounded conductors of a circuit are for any reason other than as required by 310.15(B) or (C), the equipment grounding conductor (of the wire type) must be increased in proportion, based on the circular mil of the conductors.

> Ex: Equipment grounding conductors can be sized by a qualified person if they provide an effective ground-fault current path, as required by 250.4(A)(5) or (B)(4).
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> **Analysis:** Section 250.122(B) has been the subject of massive amounts of debate for the last twenty years. Things came to a head in 2020, and initially resulted in its complete removal from the Code. The debate did not end there, however, as Table 250.122 was completely removed as well, changing the entire philosophy about sizing equipment grounding conductors. After the changes were made, several public comments were received in opposition to these changes, which is exactly how the Code change process is supposed to work—a change is made, the public reviews it and provides comments, the comments are acted upon. When the smoke cleared, 250.122(B) was put back into the Code and so was Table 250.122. New to this edition, and in effort to address the issues of 250.122(B), an exception was added that allows qualified persons to use their judgement when it comes to this section. Consider the following examples.
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> **Example 1:** What size equipment grounding conductor is required for a 50A branch circuit that uses 4 AWG ungrounded conductors due to voltage drop? All terminals are marked 75°C.
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> **Answer 1:** 4 AWG.
> Using 75°C rated terminals, a 50A circuit normally requires 8 AWG ungrounded conductors. According to Table 8 in Chapter 9, 8 AWG is 16,510 circular mils. The 4 AWG conductors used are 41,740. This means the conductors were increased by 253 percent (41,740/16,510 = 2.528). A 50A circuit requires a 10 AWG equipment grounding conductor (EGC), which is 10,380 circular mils. Multiplying that value by 253 percent results in an EGC that must be at least 26,261 circular mils. A 6 AWG is slightly too small, so a 4 AWG EGC, having 41,470 circular mils, is required. A 4 AWG EGC is larger than a 200A circuit would require, which seems a bit much for a 50A circuit.
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> **Example 2:** An air-conditioner is marked with a minimum circuit ampacity of 29A and a maximum overcurrent device rating of 50A. If 8 AWG is used for the ungrounded conductors, what size equipment grounding conductor is required (regardless of the overcurrent device rating)?
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> **Answer 2:** 8 AWG.
> The smallest allowable ungrounded conductor for this circuit is 10 AWG, which has an ampacity of 30A. The increase from 10 AWG to 8 AWG is an increase from 10,380 circular mils to 16,510 circular mils, which results in a multiplier of 1.59 (16,510/10,380 = 1.59). According to Table 250.122, the minimum EGC for this circuit would usually be 10 AWG, using any of the allowed overcurrent devices for this circuit (30A, 35A, 40A, 45A, or 50A). This means the 10 AWG must be increased by a factor of 1.59. As we know, 10,380 X 1.59 = 16,510, which is 8 AWG. Installed in a raceway this may not be a major problem, but if a cable such as Type NM is used, it would require a special-order product to have an 8 AWG equipment grounding conductor with 8 AWG circuit conductors. Is this really necessary in order to provide safety? Probably not. But that is what 250.122(B) requires.
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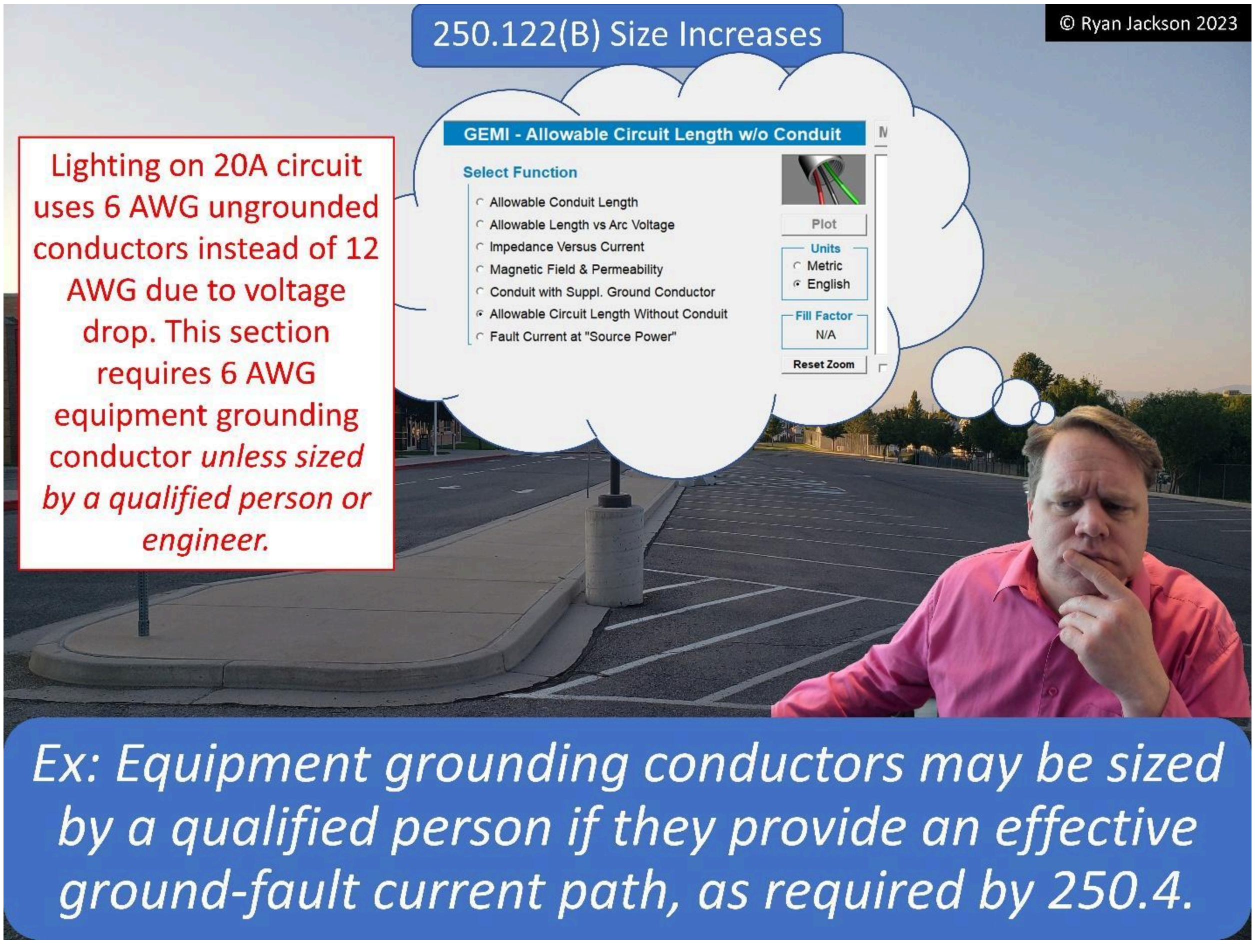
> Adding the exception in 250.122(B) allows a qualified person to determine the appropriate size of EGC when conductors are increased in size. Note that a qualified person does not have to be an engineer, but rather a person that has “skills and knowledge related to the construction and operation of the electrical equipment and installation…” as defined in Article 100. This was the source of some debate, but the deciding factor was the availability of the GEMI software from the Steel Tube Institute. This software allows a qualified person to input parameters such as the voltage of the circuit, the type and size of conductor, the rating of the overcurrent protective device, and the wiring method used. With the parameters, the software can tell the user an allowable size of equipment grounding conductor that would have low enough impedance to safely function. Note the difference that installing a steel conduit makes when using it!



CHAPTER THREE: WIRING METHODS AND MATERIALS

Changes made to Article 342 (Intermediate Metal Conduit, IMC), Article 344 (Rigid Metal Conduit, RMC), and Article 358 (Electrical Metallic Tubing, EMT) include addressing physical damage and dissimilar metals. Sections 342.10, 344.10, and 358.10 are the "uses permitted" for IMC, RMC, and EMT, and changes to these sections clarify where these raceways may be used. Sections 342.14, 344.14, and 358.14 cover dissimilar metals, and the changes to those sections all say the same thing, as they should.

342.10 Uses Permitted.
(E) Severe Physical Damage. IMC is allowed where subject to severe physical damage.

344.10 Uses Permitted.
(E) Severe Physical Damage. RMC is allowed where subject to severe physical damage.

358.10 Uses Permitted.
(E) Physical Damage. Steel and stainless steel EMT are allowed where subject to physical damage.

Analysis: These changes reiterate what has always been the case for IMC and RMC—They can be used anywhere, anytime, for any application covered in the National Electrical Code. From houses to hospitals, swimming pools to factories, the most robust wiring methods are IMC and RMC. Although the code does not "rank" the strength of the wiring methods, clearly IMC and RMC would be first and second. But third place would belong to EMT. The 2020 NEC makes it clear that EMT can be used where subject to moderate amounts of damage, provided it is not severe physical damage. No other wiring method is given this allowance, which is further evidence of why, when it comes to damage protection, nothing comes close to steel conduit and tubing.

342.14, 344.14, and 358.14 Dissimilar Metals. Where practicable, dissimilar metal contact must be avoided. In areas not subject to severe corrosive influences, galvanized steel IMC, RMC, and EMT can use aluminum or stainless steel fittings. Stainless steel IMC, RMC, and EMT may only be used with the following:

(1) Stainless steel fittings.
(2) Stainless steel boxes and enclosures.
(3) Galvanized, painted, powdered, or coated steel boxes and enclosures were not subject to corrosive influences.
(4) Stainless steel, nonmetallic, or approved accessories.

Analysis: The 2017 NEC introduced the use of stainless steel raceways and fittings in these sections. Galvanized fittings were not allowed with stainless steel raceways in any instance. This was overly restrictive as the bimetallic corrosion that this section protects against is minimal in normal (noncorrosive) environments. The 2017 also indicated that stainless steel raceways may only be used with stainless steel fittings and “approved accessories, outlet boxes, and enclosures.” This provides no real guidance, as everything covered in the NEC is required to be approved [110.2]. The Code is now clear that these “approved accessories, outlet boxes, and enclosures” are really just galvanized, painted, powdered, or coated steel.