ARTICLE

250 GROUNDING AND BONDING

Introduction to Article 250—Grounding and Bonding

No other article can match this one for misapplication, violation, and misinterpretation. The terminology used in Article 250 has been a source of much confusion but has been improved during the last few *NEC* revisions. It is very important for you to understand the difference between grounding and bonding in order to correctly apply the provisions of this article. Pay careful attention to the definitions of important terms located in Article 100 that apply to grounding and bonding. Article 250 covers the grounding requirements for providing a path to the Earth to reduce overvoltage from lightning strikes, and the bonding requirements that establish a low-impedance fault current path back to the source of the electrical supply to facilitate the operation of overcurrent protective devices in the event of a ground fault.

This article is arranged in a logical manner as illustrated in Figure 250.1 in the *NEC*. It may be a good idea for you to just read through the entire article first to get a big picture overview. Then, study Article 250 closely so you understand the details and remember to check Article 100 for the definitions of terms that may be new to you. The illustrations that accompany the text in this textbook will help you better understand the key points.

250.6 Objectionable Current

(A) Arranged to Prevent Objectionable Current. Electrical systems and equipment must be installed in a manner that prevents neutral or circuit current from flowing on metal parts (objectionable current). ▸Figure 250–26

Arranged to Prevent Objectionable Current
250.6(A)

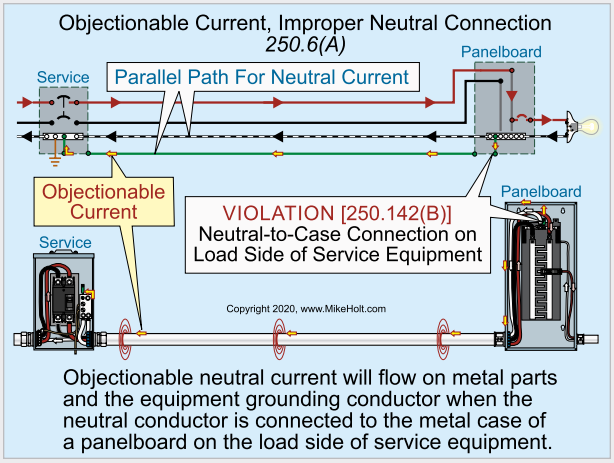
Electrical systems and equipment must be installed in a manner that prevents neutral or circuit current from flowing on metal parts.

▸Figure 250–26

Objectionable Current

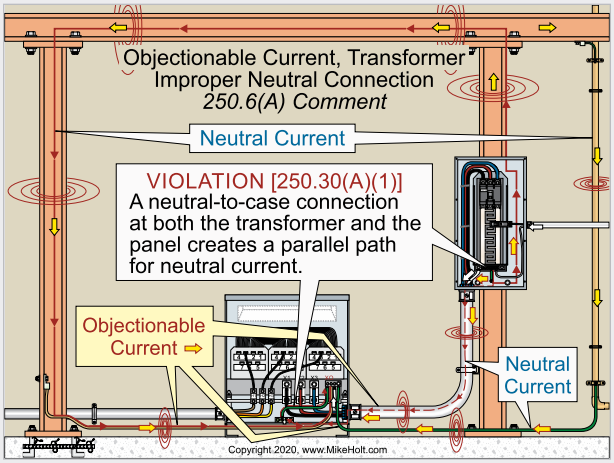
Objectionable neutral current occurs because of improper neutral-to-case connections or wiring errors that violate 250.142(B).

Panelboards. Objectionable neutral current will flow on metal parts and the equipment grounding conductor when the neutral conductor is connected to the metal case of a panelboard on the load side of the service disconnect. ▸Figure 250–27



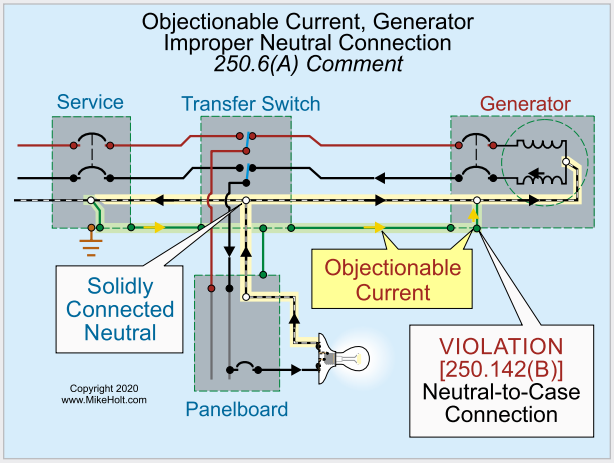
▸Figure 250–27

Transformers. Objectionable neutral current will flow on metal parts if the neutral conductor is connected to the circuit equipment grounding conductor at both the transformer and any other location on the load side of the system bonding jumper. ▸Figure 250–28



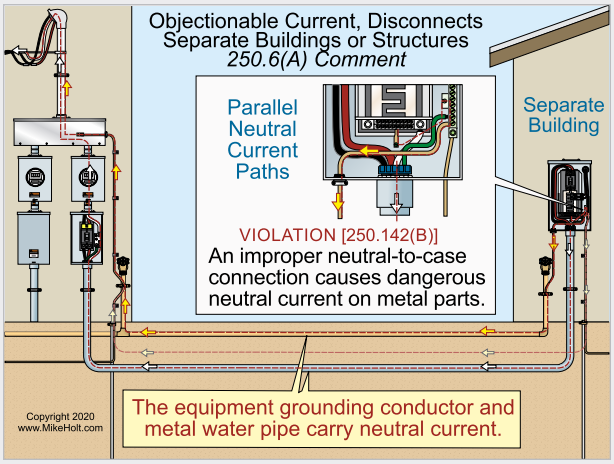
▸Figure 250–28

Generator. Objectionable neutral current will flow on metal parts and the equipment grounding conductor if a generator is connected to a transfer switch with a solidly connected neutral, and a neutral-to-case connection is made at the generator. ▸Figure 250–29



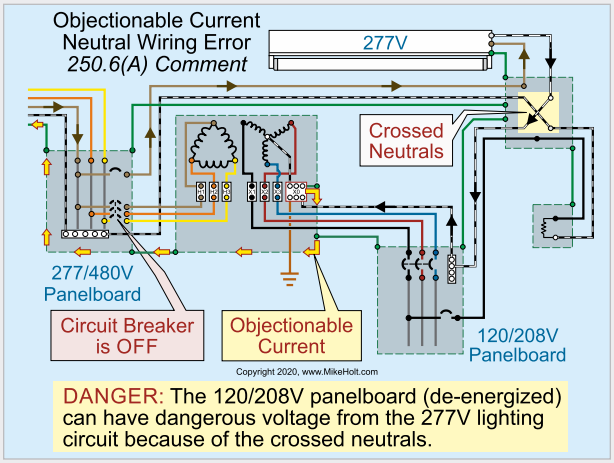
▸Figure 250–29

Disconnects. Objectionable neutral current will flow on metal parts and the equipment grounding conductor if the neutral conductor is connected to the metal case of a disconnect that is not part of the service disconnect. ▸Figure 250–30



▸Figure 250–30

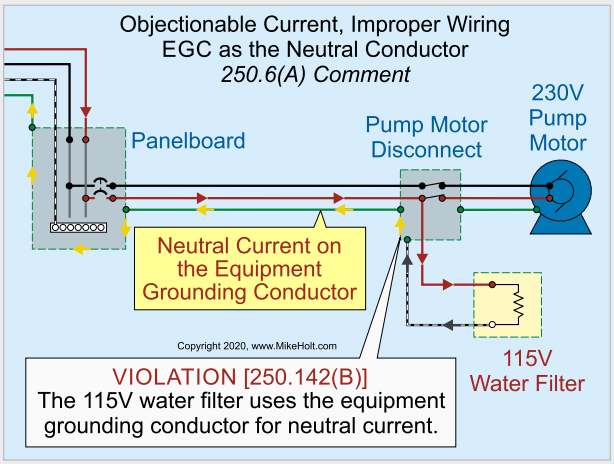
Wiring Errors. Objectionable neutral current will flow on metal parts and equipment grounding conductors if the neutral conductor from one system is used as the neutral conductor for a different system. ▸Figure 250–31



▶Figure 250–31

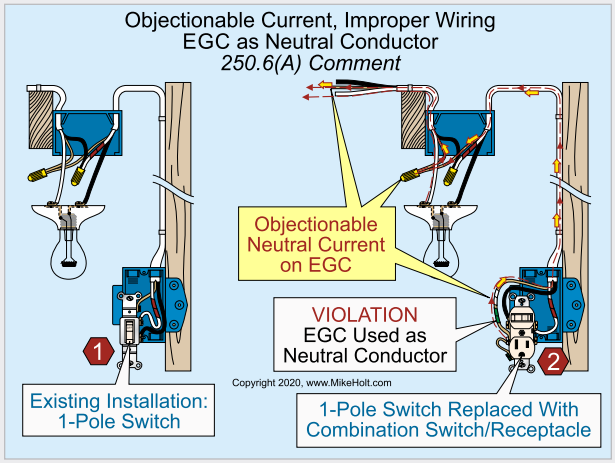
Improper Wiring. Objectionable neutral current will flow on the equipment grounding conductor if the circuit equipment grounding conductor is used as a neutral conductor, such as where:

- A 230V time-clock motor is replaced with a 115V time-clock motor, and the circuit equipment grounding conductor is used for neutral return current.
- A 115V water filter is wired to a 240V well-pump motor circuit, and the circuit equipment grounding conductor is used for neutral return current. ▶Figure 250–32



▶Figure 250–32

- The circuit equipment grounding conductor is used for neutral return current. ▶Figure 250–33

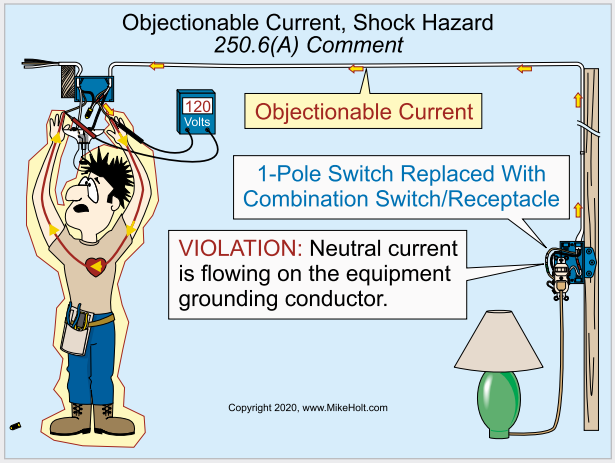


▶Figure 250–33

Dangers of Objectionable Current

Objectionable neutral current on metal parts can cause electric shock, fires, and the improper operation of electronic equipment and overcurrent protective devices such as GFPEs, GFCIs, and AFCIs.

Shock Hazard. When objectionable neutral current flows on metal parts or the equipment grounding conductor, electric shock and even death can occur from the elevated voltage. ▶Figure 250–34 and ▶Figure 250–35



▶Figure 250–34

Fire Hazard. When objectionable neutral current flows on metal parts, a fire can ignite adjacent combustible material. Heat is generated whenever current flows, particularly over high-resistance parts. In addition, arcing at loose connections is especially dangerous in areas containing easily ignitible and explosive gases, vapors, or dust. ▶Figure 250–36

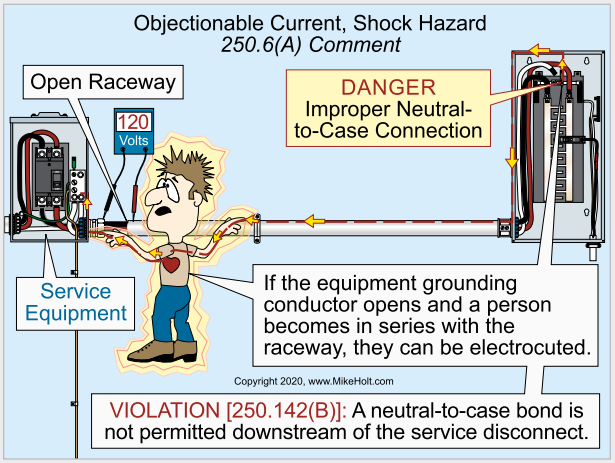


Figure 250–35

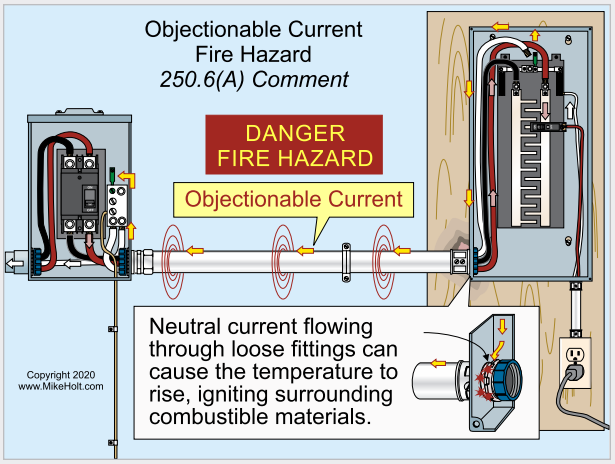


Figure 250–36

Improper Operation of Electronic Equipment. Objectionable neutral current flowing on metal parts of electrical equipment and building parts can create electromagnetic fields which negatively affect the performance of electronic devices; particularly medical equipment. Figure 250–37

When objectionable neutral current travels on metal parts and equipment grounding conductors because the neutral has been improperly bonded to metal parts, a difference of voltage will exist between all metal parts. This situation can cause some electronic equipment to operate improperly. Figure 250–38 and Figure 250–39

Operation of Overcurrent Protective Devices. When objectionable neutral current travels on metal parts, electronic overcurrent protective devices equipped with ground-fault protection can trip because some neutral current flows on the circuit equipment grounding conductor instead of on the neutral conductor.

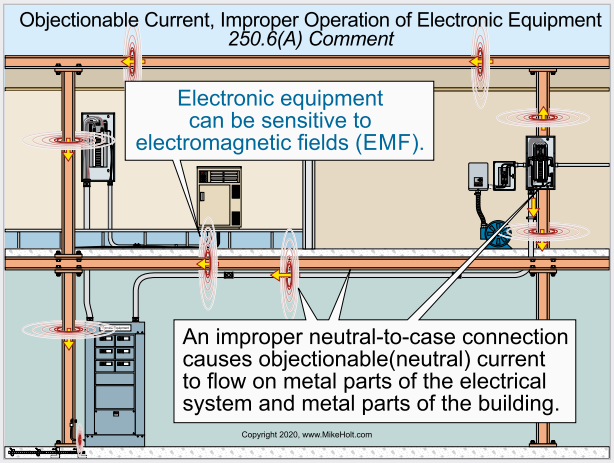


Figure 250–37

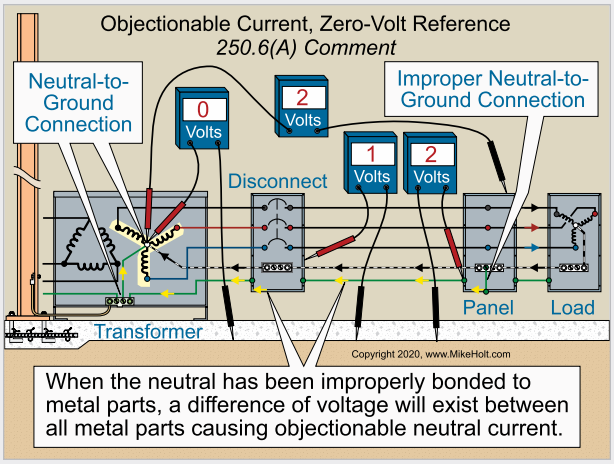


Figure 250–38

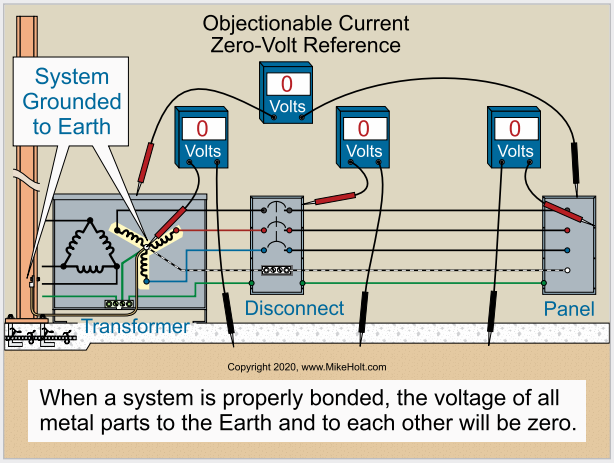


Figure 250–39