



Integrity Home Inspection Services, LLC

www.myintegrityhomeinspection.com

NEC 406.3

406.3 General Installation Requirements. Receptacle outlets shall be located in branch circuits in accordance with Part III of Article 210. General installation requirements shall be in accordance with 406.3(A) through (F).

(A) Grounding Type. Receptacles installed on 15 and 20 ampere branch circuits shall be of the grounding type. Grounding-type receptacles shall be installed only on circuits of the voltage class and current for which they are rated, except as provided in Table 210.21(B)(2) and Table 210.21(B)(3).

Exception: Non grounding-type receptacles installed in accordance with 406.3(D).

(B) To Be Grounded. Receptacles and cord connectors that have equipment grounding conductor contacts shall have those contacts connected to an equipment grounding conductor
Exception No. 1: Receptacles mounted on portable and vehicle-mounted generators in accordance with 250.34.

Exception No. 2: Replacement receptacles as permitted by 406.3(D).

(C) Methods of Grounding. The equipment grounding conductor contacts of receptacles and cord connectors shall be grounded by connection to the equipment grounding conductor of the circuit supplying the receptacle or cord connector.

FPN: For installation requirements for the reduction of electrical noise, see 250.146(D).

The branch-circuit wiring method shall include or provide an equipment grounding conductor to which the equipment grounding conductor contacts of the receptacle or cord connector are connected.

FPN No. 1: See 250.118 for acceptable grounding means.

FPN No. 2: For extensions of existing branch circuits, see 250.130.

(D) Replacements. Replacement of receptacles shall comply with 406.3(D)(1), (D)(2), and (D)(3) as applicable.

(1) Grounding-Type Receptacles. Where a grounding means exists in the receptacle enclosure or an equipment grounding conductor is installed in accordance with 250.130(C), grounding-type receptacles shall be used and shall be connected to the equipment grounding conductor in accordance with 406.3(C) or 250.130(C).

(2) Ground-Fault Circuit Interrupters. Ground-fault circuit-interrupter protected receptacles shall be provided where replacements are made at receptacle outlets that are required to be so protected elsewhere in this Code.

(3) Non-Grounding-Type Receptacles. Where attachment to an equipment grounding conductor does not exist in the receptacle enclosure, the installation shall comply with (D)(3)(a), (D)(3)(b), or (D)(3)(c).

(a) A non-grounding-type receptacle(s) shall be permitted to be replaced with another non-grounding-type receptacle(s).

(b) A non-grounding-type receptacle(s) shall be permitted to be replaced with a ground-fault circuit interrupter type of receptacle(s). These receptacles shall be marked "No Equipment Ground." An equipment grounding conductor shall not be connected from the ground-fault circuit interrupter-type receptacle to any outlet supplied from the ground-fault circuit-interrupter receptacle.

(c) A non-grounding-type receptacle(s) shall be permitted to be replaced with a grounding-type receptacle(s) where supplied through a ground-fault circuit interrupter. Grounding-type receptacles supplied through the ground-fault circuit interrupter shall be marked "GFCI Protected" and "No Equipment Ground." An equipment grounding conductor shall not be connected between the grounding type receptacles.

(E) Cord-and-Plug-Connected Equipment. The installation of grounding-type receptacles shall not be used as a requirement that all cord-and-plug-connected equipment be of the grounded type.

FPN: See 250.114 for types of cord-and-plug-connected equipment to be grounded.

(F) Non interchangeable Types. Receptacles connected to circuits that have different voltages, frequencies, or types of current (ac or dc) on the same premises shall be of such design that the attachment plugs used on these circuits are not interchangeable.

406.4 Receptacle Mounting. Receptacles shall be mounted in boxes or assemblies designed for the purpose, and such boxes or assemblies shall be securely fastened in place unless otherwise permitted elsewhere in this Code.

(A) Boxes That Are Set Back. Receptacles mounted in boxes that are set back from the finished surface as permitted in 314.20 shall be installed such that the mounting yoke or strap of the receptacle is held rigidly at the finished surface.



(B) Boxes That Are Flush. Receptacles mounted in boxes that are flush with the finished surface or project therefrom shall be installed such that the mounting yoke or strap of the receptacle is held rigidly against the box or box cover.

Article 406: Receptacles

True or false? The NEC requires receptacles to be mounted with the neutral slot on the left. Keep your answer in mind as we take a closer look at Art. 406 requirements. Art. 406 covers the rating, type, and installation of receptacles, cord connectors, and attachment plugs (cord caps). One important requirement of Art. 406 is that you must ground (bond) the grounding terminal of a receptacle to a low-impedance fault current path [250.146, 250.148, and 406.3(C)]. You don't need to do this, however, if you're replacing a receptacle and if you comply with the applicable portions of 406.3(D).

The NEC specifies what that low-impedance path is by requiring you to connect the receptacle-grounding terminal to the branch-circuit equipment-grounding conductor (250.146). If you install an isolated ground receptacle, though, follow the requirements of 250.146(D).

Receptacle replacement requirements. If you have a grounding means in the enclosure, use a grounding-type receptacle — even if you're replacing a nongrounding-type receptacle [406.3(D)]. Make sure you ground (bond) the grounding terminal of that receptacle.

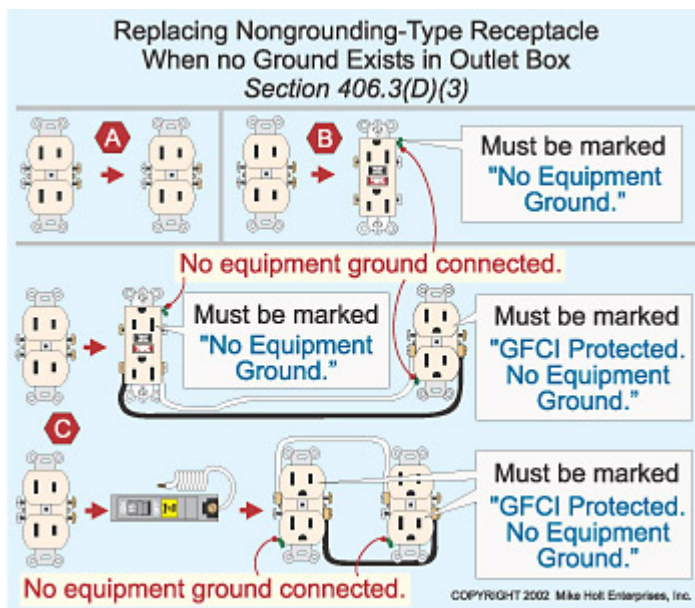


Fig. 1. In the event that the installation is in an enclosure with no grounding means, you have three options, two of which require markings that signify the absence of a ground.



If the enclosure doesn't have a grounding means — for example, if the box contains old 2-wire NM cable without a ground — you can use a nongrounding type receptacle (**Fig. 1**). You have two other options as well. You can use a GFCI receptacle if you make sure it's marked “No Equipment Ground,” or you can use a grounding-type receptacle if it's GFCI-protected and marked “GFCI Protected” and “No Equipment Ground.”

When you replace a receptacle in a location where GFCI protection is required, the replacement must be GFCI-protected. See 210.8 for GFCI protection requirements.

Test your understanding of this concept with this pop quiz. A relative asks you to replace a failed GFCI receptacle at his home, but you notice the home has a 2-wire system without a ground wire. Will that GFCI provide ground-fault protection?

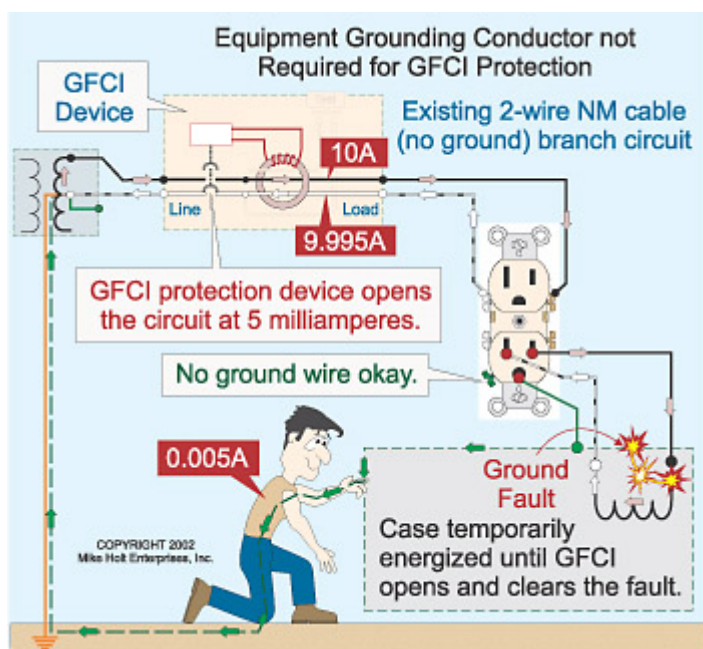


Fig. 2. You may be surprised to learn that a GFCI receptacle will perform as designed even if it isn't connected to an equipment grounding conductor.

The answer is yes. GFCI protection functions properly on a 2-wire circuit without an equipment-grounding conductor. The equipment-grounding conductor serves no purpose in the operation of the GFCI protection device (**Fig. 2**). The GFCI uses a small CT on the neutral and the hot but not on the ground. This information is probably in the instructions that come with the new GFCIs.

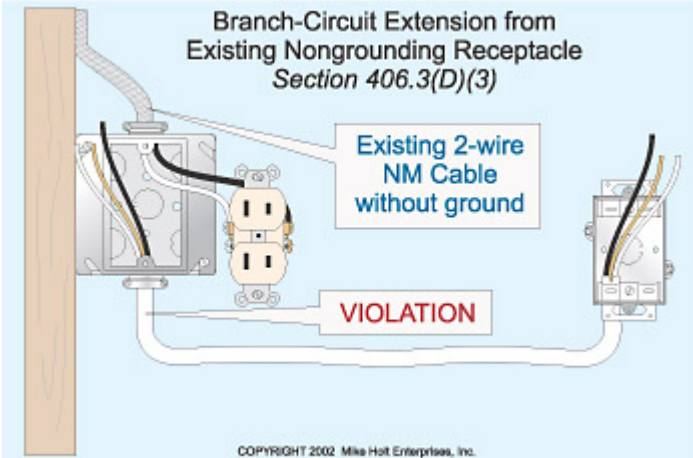


Fig. 3. Per the requirements of 250.130(C), branch-circuit extension from an ungrounded box isn't permitted from an existing ungrounded circuit.

Does this mean that if you extend a circuit from an ungrounded box you can install a GFCI? No. Permission to replace nongrounding type receptacles with GFCI-protected grounding-type receptacles doesn't apply to new outlets that extend from an existing ungrounded outlet box. Once you add a receptacle outlet (branch-circuit extension), the receptacle must be of the grounding type and be grounded per 250.130(C) (**Fig. 3**).

This requirement may seem inconsistent, but it's not. Here's the logic. Your existing two-wire system was installed per the Code that existed at the time. Today's NEC doesn't mandate ripping out existing 2-wire systems and replacing them just so you can add a GFCI. Nor does it allow you to add on to the 2-wire system and just throw in a GFCI. A 3-wire system is safer than a 2-wire system. So if you add to an existing system, what you add must be of the 3-wire configuration — not the 2-wire configuration.

Mounting. Have you ever wondered if you can mount a receptacle in a hobby box you just happen to have lying around or in a cutout in the side of a panel where there's plenty of room and the receptacle is obviously protected? Stop wondering — you can mount a receptacle only in a box designed for the purpose (406.4). Fasten that box securely in place (314.23).

If you mount a receptacle in a box that's set back from the wall surface, install it so the mounting yoke of the receptacle is held rigidly to the wall surface. If the receptacle sits back too far, break off the “ears” on the yoke and use them as shim washers on the receptacle mounting screws.

In walls or ceilings of noncombustible material, boxes can't be set back more than 0.25 inches from the finished surface. In walls or ceilings of combustible material, boxes must be flush with the finished surface (314.20). You can't have gaps greater than 0.125 inches at the edge of the box (314.21).

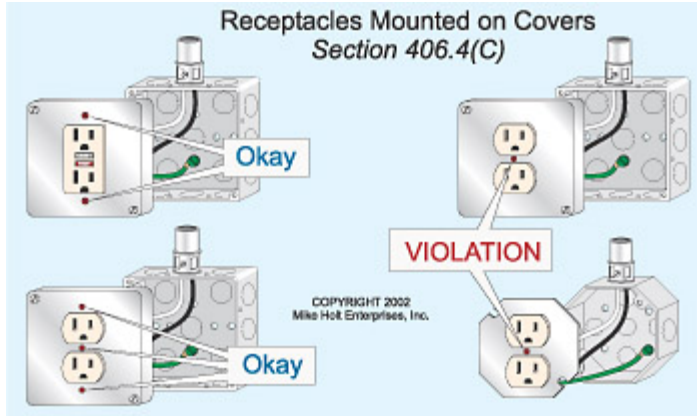


Fig. 4. Unless listed and identified for the use, receptacles supported by a cover must be held rigidly to the cover with more than one screw.

If you mount a receptacle in a box that's flush, install it so the mounting yoke of the receptacle is held rigidly against the box or raised box cover. If the receptacle mounts to the cover, it must be secured to the cover with two screws [406.4(C)] (**Fig. 4**).

Receptacle faceplates must completely cover the outlet opening and seat firmly against the mounting surface (406.5). If a metal faceplate is used, make sure it's grounded (bonded) by securing it to the receptacle.

Receptacles in damp or wet locations. You can install a receptacle next to, but not within, a bathtub or shower space. Receptacles must be located at least 5 feet from spas or hot tubs [680.21(A)(1) and 680.43(A)(1)].

Receptacles that are installed outdoors under roofed open porches, canopies, marquees, and similar areas but not subjected to beating rain or water runoff require enclosures that are weatherproof only when the attachment plug cap isn't inserted and receptacle covers are closed [406.8(A)]. Receptacles installed as such are considered to be in damp locations.

Those are the requirements for a damp location, but what if you think you have a wet location? Look up "location, wet" in Art. 100 to find the definition. If your location meets this definition, 406.8(B) applies. All 15A and 20A, 125V and 250V receptacles installed outdoors in a wet location must be within an enclosure and cover that's weatherproof at all times — even when an attachment plug is inserted.

Any other receptacle in a wet location must comply with one of the two following rules:

- If the equipment plugged into it isn't attended while in use, the receptacle must have an enclosure that's weatherproof with the attachment plug cap inserted or removed.



Integrity Home Inspection Services, LLC

www.myintegrityhomeinspection.com

- If the equipment plugged into it is attended while in use, the receptacle must have an enclosure that's weatherproof when the attachment plug is removed.

Suppose you flush-mount an outlet box on a wall surface in a wet location. In such a case, you must make the enclosure weatherproof by using a weatherproof faceplate assembly that provides a watertight connection between the plate and the wall surface.

Overlooked requirements. Familiarity with receptacles can cause you to overlook certain requirements. For example, what kind of receptacle can you use with aluminum wire, and how can you wire it? First, look for the marking CO/AL on the terminal screws. These markings are required for all receptacles rated 20A or less and designed for direct connection with aluminum conductors. If the receptacle is rated higher than 20A, see the manufacturer's instructions or contact the manufacturer to ensure you're not violating the UL Listing for that receptacle.

Here's another fact regarding UL. Per UL requirements, aluminum conductors can't terminate onto screwless (push-in) terminals of a receptacle. More than one installation has been rejected for this practice.

Suppose you wire a receptacle for isolated ground. Do you know how to identify the right kind of receptacle for such an application? It must have an orange triangle marking on its face [250.146(D)].

The requirements for isolated ground receptacles (IGRs) are also commonly forgotten. Keep these in mind:

- You can use IGRs only with an insulated grounding conductor installed with the circuit conductors.
- If you install an IGR in a nonmetallic box, you must cover it with a nonmetallic faceplate because you can't ground (bond) a metal faceplate in such an installation.

What about that question that opened this discussion? The answer is “false.” The NEC doesn't specify which way to orient a receptacle. The ground terminal can be up, down, or to the side. In the last few Code cycles, proposals to specify the mounting orientation were all rejected.

However, there's one exception to this non-specification. If you install a receptacle in a countertop or similar work surface in a dwelling unit, you can't install it in a face-up position.

No matter how much you think you know about Art. 406, you still might find a surprise or two in it, and that's a good reason to become familiar with it now rather than at inspection time. You'd hate to be cited for something as “simple” as a receptacle requirement, wouldn't you?