

## Introduction to Article 210—Branch Circuits

This article contains branch-circuit requirements such as those for conductor sizing and identification, GFCI, AFCI and overcurrent protection, and receptacle and lighting outlet requirements. It consists of three parts:

- ▶ Part I. General Provisions
- ▶ Part II. Branch-Circuit Ratings
- ▶ Part III. Required Outlets

### 210.8 Ground-Fault Circuit-Interrupter Protection for Personnel

For over 30 years GFCI requirements have been added to the *NEC*, and this *Code* cycle continues that trend. The term “listed Class A GFCI” replaced “ground-fault circuit-interrupter” throughout the rule. It is now clear that the path of measurement for a power-supply cord is related to the receptacle and not the appliance from which it came. An interesting Exception was added for exhaust fans, nondwelling GFCI requirements have taken over in food service areas, and protection is required for all outlets in garages, accessory buildings, boathouses, and aquariums. These rules now basically say that where there is water you need a GFCI!

### Analysis



CLARIFIED

The term “ground-fault circuit-interrupter” throughout this section was changed to “listed Class A GFCI” because acronyms are now permitted to be used in the *NEC*. The addition of “Class A” to GFCI clarifies that the device must trip at the nominal 5 mA ( $\pm 1$  mA) required for the protection of personnel. In addition, the words “of an appliance” were removed from the charging text clarifying that the measurement applies to all power-supply cords plugged into a receptacle—not

just appliance cords. Furthermore, the phrase “shortest path without passing through a window” was removed to alleviate confusion resulting from a cord passing through an interior opening similar to a window.



EXPANDED

The specific mention in 210.8(A) and (B) of the list items included in those first level subdivisions was replaced with a general reference to the “following locations.”



EXPANDED

List item (A)6 was expanded to address GFCI protection for any cord-and-plug-connected appliance in kitchens by deleting the reference to the receptacles serving the countertop.



NEW

A new list item (A)7 requires areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking to have GFCI-protected receptacles. The remaining list items became 8 through 12.



RELOCATED

The Exceptions that previously followed the list items in 210.8(A) were relocated to follow the last list item and clarifications were made as to when the Exception(s) applies, but there were no technical changes.

**NEW**

A new Exception No. 4 to 210.8(A) was added to say that the internal receptacle in a bathroom exhaust fan does not require GFCI protection, unless required by the installation or listing instructions. This receptacle is not accessible and not used as a convenience receptacle, so this rule makes sense.

**EXPANDED**

In 210.8(B), the word “kitchens” was added as list item (2) and removed from list item (3) clarifying that all areas with permanent provisions for food serving, beverage service, or cooking must be protected.

List item (4) was added to include buffet areas and beverage serving areas in the GFCI requirements. This is kind of an open-ended rule using the term “area” instead of a specific distance, as is used in list item (7), and may cause some problems with enforcement. Only time will tell.

List item (7) expands the requirement in other than dwellings to protect electric appliances and not just receptacles located within 6 ft of a sink. This lets us know that the rule is about the hazard from both the appliance and its supplying receptacle.

A new rule in (13) requires GFCI protection for receptacles within 6 ft of the top inside edge or conductive support framing of aquariums, bait wells, and similar aquatic vessels.

**RELOCATED**

All the Exceptions that previously followed the list items in 210.8(B) were relocated to follow the last list item, and clarifications were made as to when the Exception(s) applies, but there were no technical changes.

**EXPANDED**

Changes in 210.8(D) now require GFCI protection to be provided for the branch circuit or the outlet supplying listed appliances rated 150V to ground and 60A or less. This rule previously referenced others to determine if protection was required—now you can just read the list here.

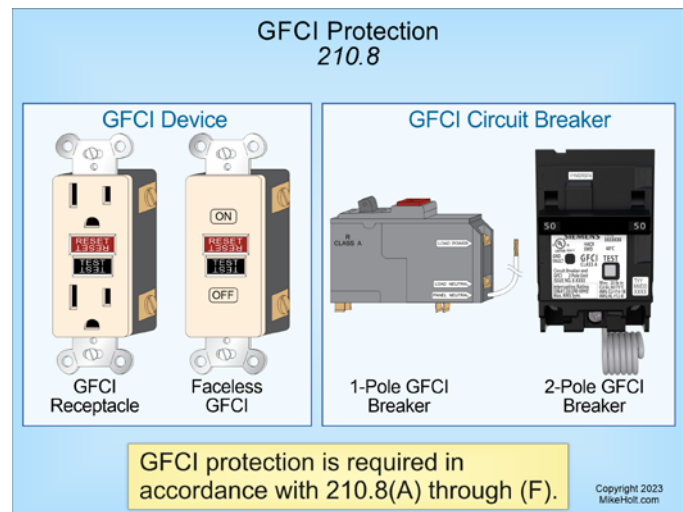
Five more appliances have been added in addition to the seven that were in the Article 422 appliances requiring GFCI protection and inserted here in (D) They include electric ranges, wall-mounted ovens, counter-mounted cooking units, clothes dryers, and microwave ovens. This expansion of the GFCI requirements applies to both cord-and-plug-connected and hardwired equipment.

**EXPANDED**

The rule in 210.8(F) for outdoor outlets was new last cycle and caused a big problem with air-conditioning units in areas outside of dwelling units. This battle continued during the 2023 revision and four new items were added to the list. Dwelling unit receptacles rated 50A or less in garages, accessory buildings, outdoors, and in bathhouses already had GFCI protection requirements, but this change requires the outlet to be protected and GFCI protection must be added for unprotected existing equipment that is replaced.

## 210.8 GFCI Protection

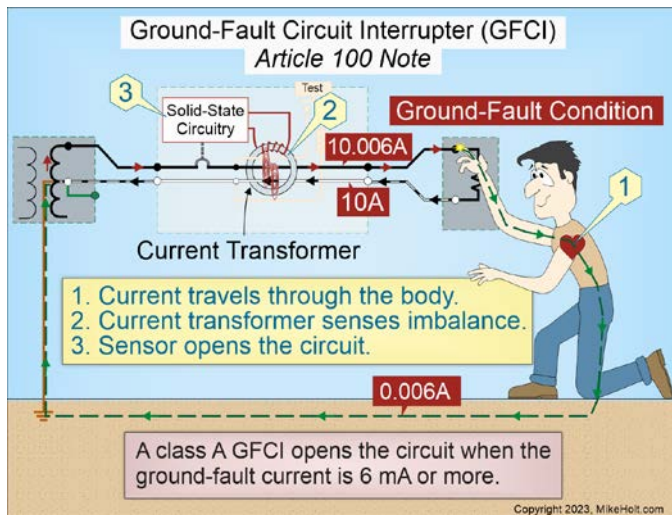
A listed ground-fault circuit interrupter (GFCI) must provide protection as required in 210.8(A) through (F). The GFCI protective device must be in a readily accessible location. ▶[Figure 210-10](#)



▶[Figure 210-10](#)

### Author’s Comment:

- ▶ According to Article 100, a “Ground-Fault Circuit Interrupter” (GFCI) is a device intended to protect people by opening a circuit when a current imbalance is 6 mA or higher and does not open when the current to ground is less than 4 mA. ▶[Figure 210-11](#)
- ▶ The GFCI protection required by 210.8(A) and (B) can be provided using either a breaker with GFCI protection or a receptacle with GFCI protection. However, the use of a GFCI receptacle is somewhat limited by the requirement that the GFCI must be readily accessible.



▶ Figure 210-11

- ▶ According to Article 100, “Readily Accessible” means capable of being reached quickly without having to climb over or remove obstacles, or resort to the use of portable ladders. ▶ Figure 210-12



▶ Figure 210-12

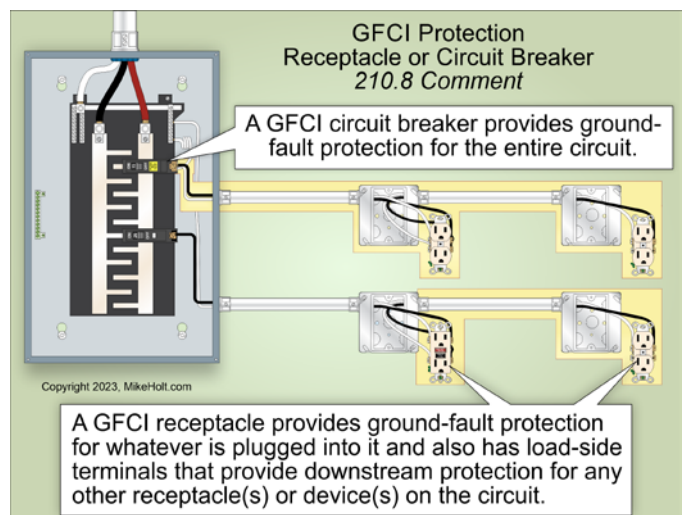
For the application of 210.8(A)(8), 210.8(A)(10), 210.8(B)(7), 210.8(B)(13), and 210.8(B)(15), the distance (from the sink or bathtub/shower) is measured as the shortest path the power-supply cord connected to the receptacle will follow without piercing a floor, wall, ceiling, or fixed barrier. ▶ Figure 210-13



▶ Figure 210-13

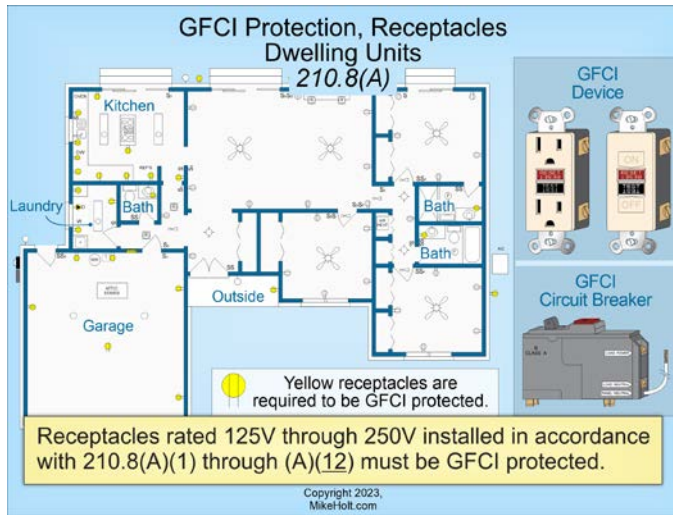
#### Author's Comment:

- ▶ The reference to windows and doors was removed to ensure receptacles within the measured distance as required in 210.8, even if passing through a window or door, are afforded GFCI protection.
- ▶ The GFCI circuit breaker provides ground-fault protection starting at the breaker, so the entire circuit has ground-fault protection. A GFCI receptacle provides ground-fault protection for whatever is plugged into it and also has load-side terminals that provide downstream protection for any other receptacle(s) or device(s) on the circuit. ▶ Figure 210-14



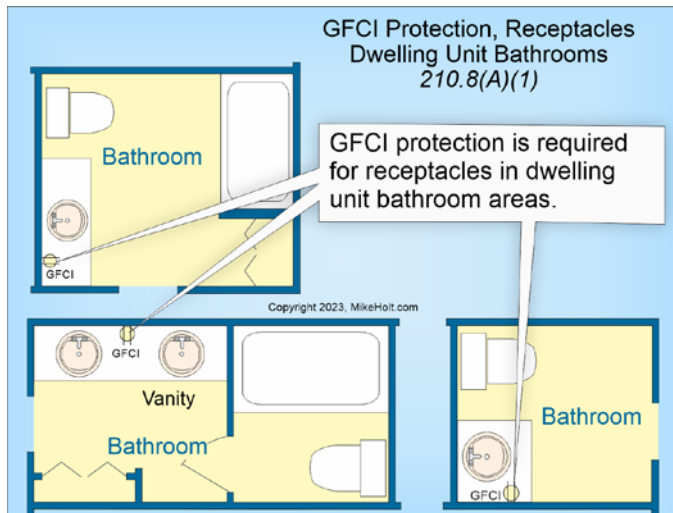
▶ Figure 210-14

**(A) Dwelling Units.** Receptacles installed in the following dwelling unit locations must be GFCI protected. ▶[Figure 210-15](#)



▶[Figure 210-15](#)

**(1) Bathrooms.** GFCI protection is required for receptacles in dwelling unit bathroom areas. ▶[Figure 210-16](#)

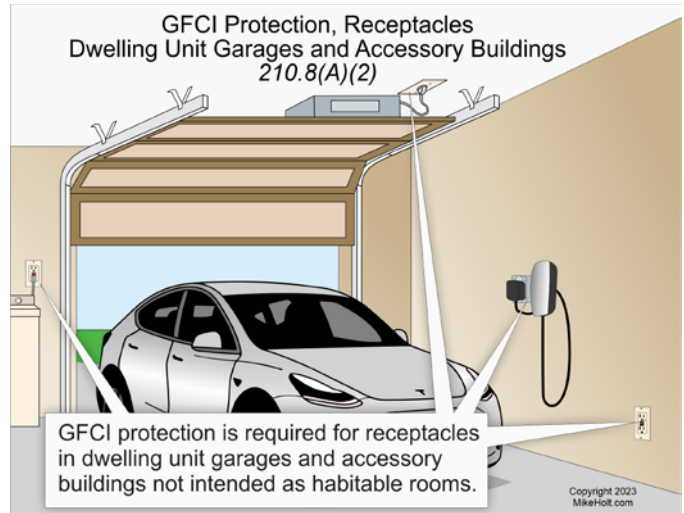


▶[Figure 210-16](#)

**Author's Comment:**

- ▶ According to Article 100, a “Bathroom Area” is an area that includes a sink (basin) and one or more of the following: a toilet, urinal, tub, shower, bidet, or similar plumbing fixture.

**(2) Garages and Accessory Buildings.** GFCI protection is required for receptacles in dwelling unit garages and dwelling unit accessory buildings not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use. ▶[Figure 210-17](#)



▶[Figure 210-17](#)

**(3) Outdoors.** GFCI protection is required for receptacles located outdoors of a dwelling unit. ▶[Figure 210-18](#)



▶[Figure 210-18](#)

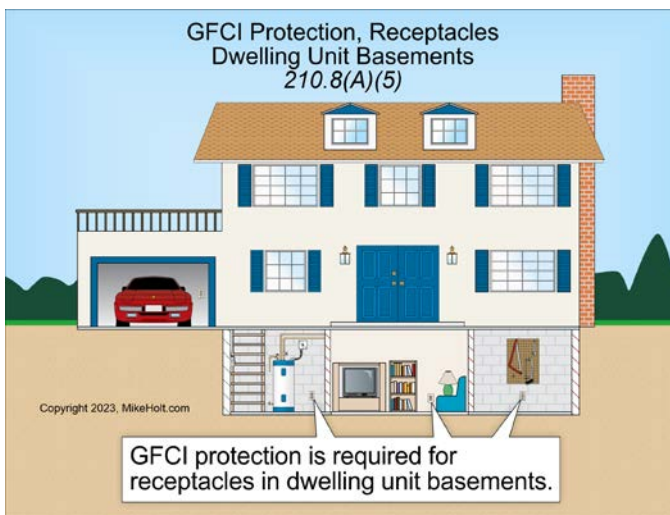
**(4) Crawl Spaces.** GFCI protection is required for receptacles in dwelling unit crawl spaces at or below grade. ▶[Figure 210-19](#)

**(5) Basements.** GFCI protection is required for receptacles in dwelling unit basements. ▶[Figure 210-20](#)

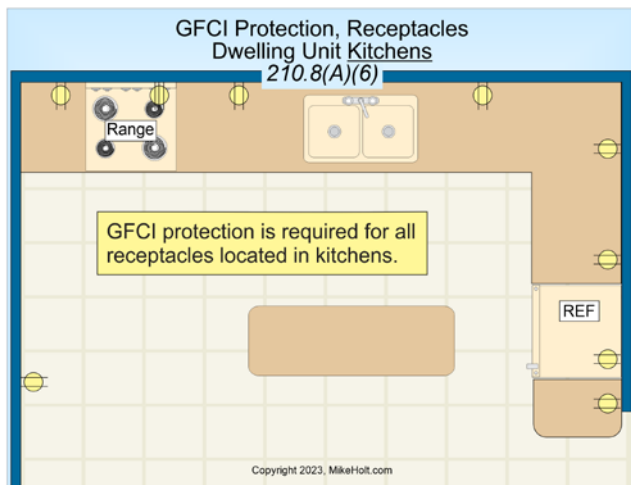
**(6) Kitchens.** GFCI protection is required for receptacles in dwelling unit kitchens. ▶[Figure 210-21](#)



▶ Figure 210-19



▶ Figure 210-20



▶ Figure 210-21

**Author's Comment:**

- ▶ Traditionally this requirement only applied to kitchen countertop receptacles, now any cord-and-plug-connected appliance in the kitchen such as the range receptacle, refrigerator receptacle, disposal receptacle, and microwave receptacles will require GFCI protection.

**(7) Food Preparation Areas.** GFCI protection is required for receptacles in areas with sinks with permanent provisions for food preparation, beverage preparation, or cooking.

**(8) Sinks.** GFCI protection is required for receptacles within 6 ft of the top inside edge of the bowl of a dwelling unit sink.

**(9) Boathouses.** GFCI protection is required for receptacles in a boathouse for a dwelling unit. ▶ Figure 210-22

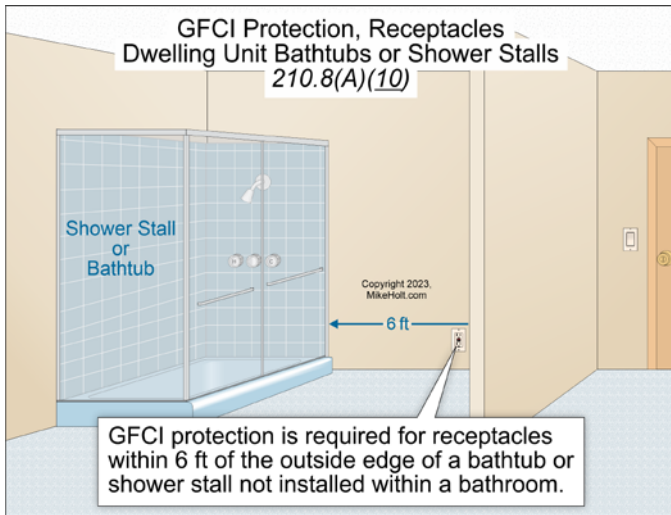


▶ Figure 210-22

**Author's Comment:**

- ▶ The Code does not require a receptacle to be installed in a boathouse, but if any are then they must be GFCI protected.

**(10) Bathtubs or Shower Stalls.** GFCI protection is required for receptacles within 6 ft of the outside edge of a bathtub or shower stall not installed within a bathroom as defined in Article 100. ▶ Figure 210-23



▶Figure 210-23

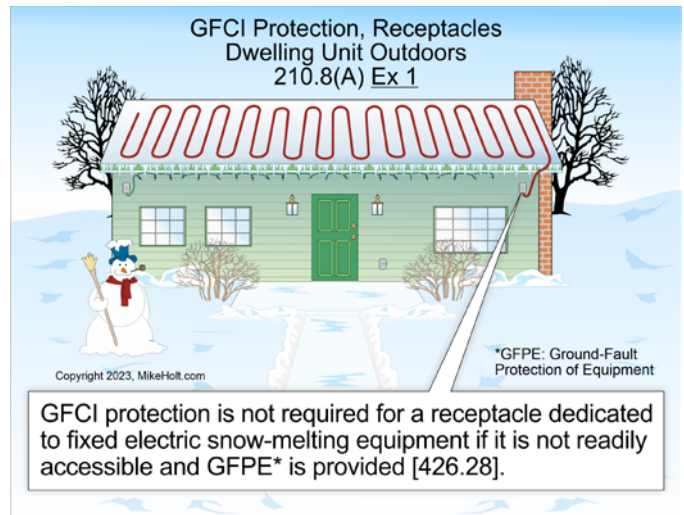
**(11) Laundry Areas.** GFCI protection is required for receptacles installed in the laundry area of a dwelling unit. ▶Figure 210-24



▶Figure 210-24

**(12) Damp and Wet Locations Indoors.** GFCI protection is required for receptacles installed in indoor damp and wet locations.

*Ex 1: GFCI protection is not required for a receptacle dedicated to fixed electric snow-melting equipment if the receptacle is not readily accessible and ground-fault protection of equipment (GFPE) is provided as required by 426.28 and 427.22. ▶Figure 210-25*



▶Figure 210-25

*Ex 2: A receptacle supplying only a permanently installed premises security system is permitted to omit ground-fault circuit-interrupter protection.*

*Ex 4: GFCI protection is not required for receptacles in dwelling unit bathroom exhaust fans, unless specified by the fan instructions.*

▶Figure 210-26



▶Figure 210-26

**Author's Comment:**

- ▶ The receptacle for exhaust fans is internal to the exhaust fan and is not accessible as a convenience cord-and-plug receptacle, therefore GFCI protection is not required.

**Author's Comment:**

- ▶ In accordance with the UL GPWX guide information, exhaust fans installed in the area directly above the footprint of the bathtub or shower must be GFCI protected.

**(B) Other Than Dwellings.** GFCI protection is required for 125V through 250V receptacles supplied by single-phase branch circuits 50A or less, and receptacles supplied by three-phase branch circuits 100A or less installed in the following locations:

**(1) Bathrooms.** GFCI protection is required for receptacles in bathroom areas. ▶[Figure 210-27](#)

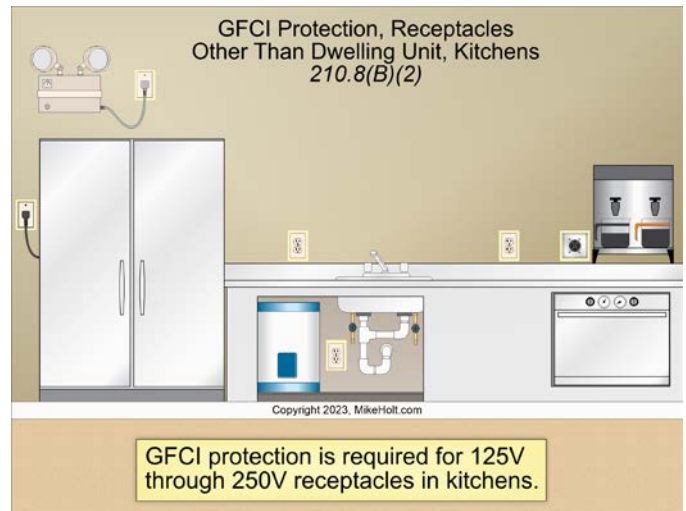
▶[Figure 210-27](#)**Author's Comment:**

- ▶ According to Article 100, a “Bathroom Area” is one that includes a sink (basin) and one or more of the following: a toilet, urinal, tub, shower, bidet, or similar plumbing fixture.

**(2) Kitchens.** GFCI protection is required for 125V through 250V receptacles in kitchens. ▶[Figure 210-28](#)

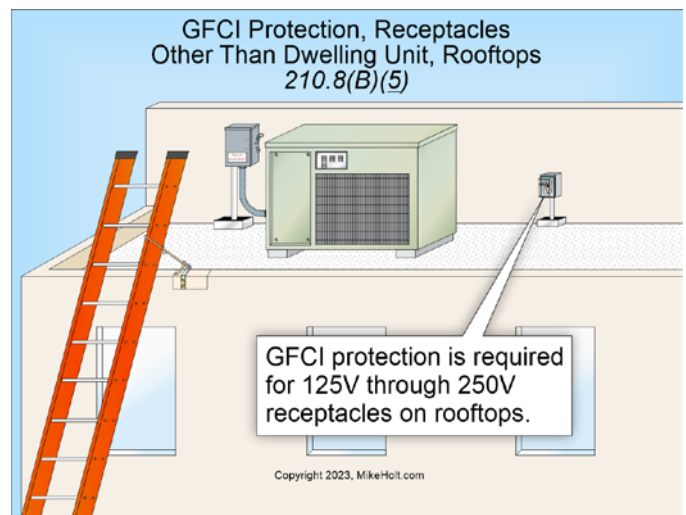
**(3) Food Preparation Areas.** GFCI protection is required for 125V through 250V receptacles in areas with sinks with permanent provisions for food preparation, beverage preparation, or cooking.

**(4) Buffet Serving Areas.** GFCI protection is required for 125V through 250V receptacles in buffet serving areas with permanent provisions for food serving, beverage serving, or cooking.

▶[Figure 210-28](#)**Author's Comment:**

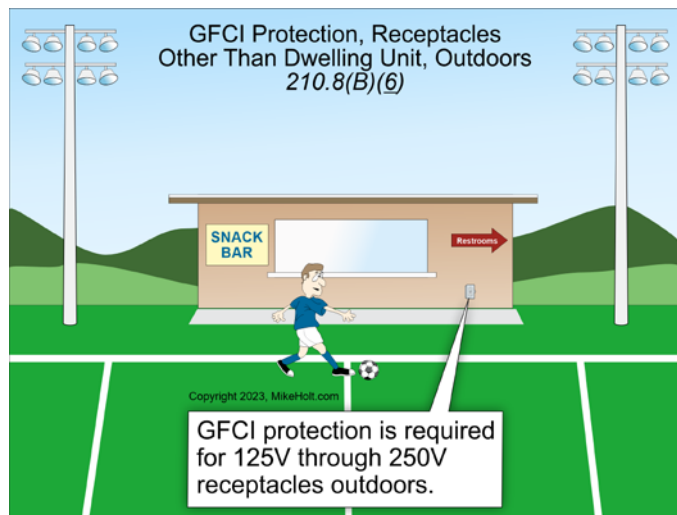
- ▶ This requires GFCI protection for receptacles in the break area of a commercial occupancy.

**(5) Rooftops.** GFCI protection is required for 125V through 250V receptacles on rooftops. ▶[Figure 210-29](#)

▶[Figure 210-29](#)

**(6) Outdoors.** GFCI protection is required for 125V through 250V receptacles outdoors. ▶[Figure 210-30](#)

**(7) Sinks.** GFCI protection is required for 125V through 250V receptacles and receptacles used for cord-and-plug-connected appliances located within 6 ft from the top inside edge of the bowl of a sink. ▶[Figure 210-31](#)



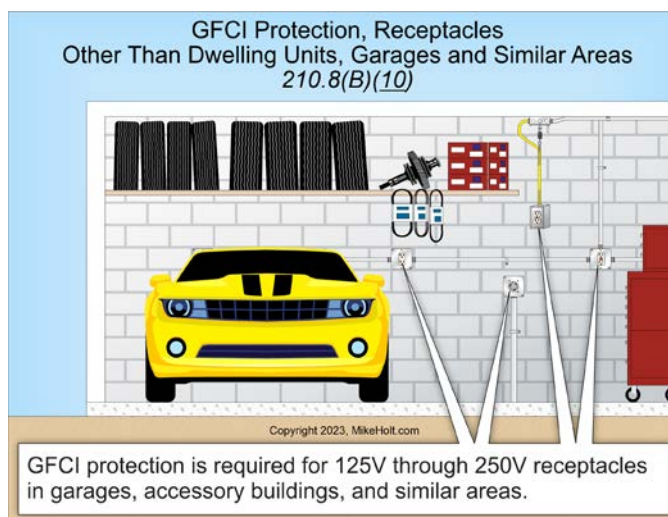
▶Figure 210-30



▶Figure 210-32



▶Figure 210-31



▶Figure 210-33

**(8) Indoor Damp or Wet Locations.** GFCI protection is required for 125V through 250V receptacles in indoor damp or wet locations.

**(9) Locker Rooms.** GFCI protection is required for 125V through 250V receptacles in locker rooms with showering facilities. ▶Figure 210-32

**(10) Garages and Similar Areas.** GFCI protection is required for 125V through 250V receptacles in garages, accessory buildings, service bays, and similar areas. ▶Figure 210-33

#### Author's Comment:

- ▶ According to Article 100, a "Garage" is a building or portion of a building in which one or more self-propelled vehicles can be kept for use, sale, storage, rental, repair, exhibition, or demonstration.

**(11) Crawl Spaces.** GFCI protection is required for 125V through 250V receptacles in crawl spaces at or below grade level.

**(12) Unfinished Areas of Basements.** GFCI protection is required for 125V through 250V receptacles in the unfinished areas of basements.

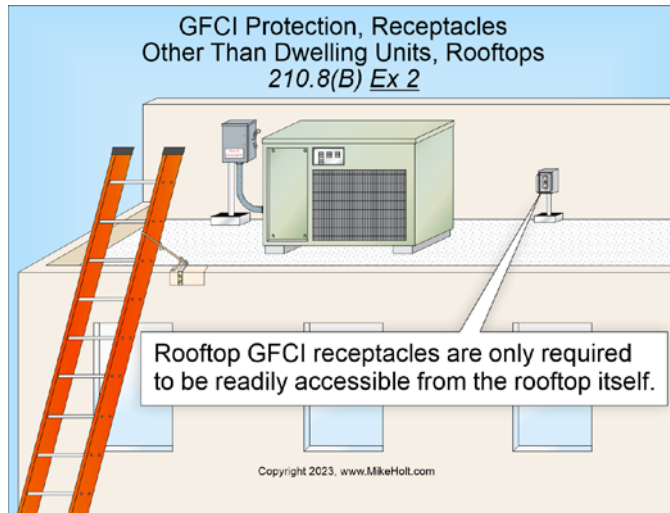
**(13) Aquatic Tanks or Bowls.** GFCI protection is required for 125V through 250V receptacles within 6 ft from the top inside edge or rim from the conductive support framing of the vessel or container for aquariums, bait wells, and similar open aquatic vessels or containers, such as tanks or bowls.

**(14) Laundry Areas.** GFCI protection is required for 125V through 250V receptacles in laundry areas.



**(15) Bathtubs and Shower Stalls.** GFCI protection is required for 125V through 250V receptacles installed within 6 ft of the outside edge of a bathtub or shower stall not installed in a bathroom as defined in Article 100.

*Ex 2: Rooftop GFCI receptacles are only required to be readily accessible from the rooftop itself.* ▶Figure 210-34



▶Figure 210-34

**(C) Crawl Space Lighting Outlets.** GFCI protection is required for 120V lighting outlets in crawl spaces.

**Author's Comment:**

- ▶ A lighting outlet is not required for a dwelling unit crawl space unless the space is used for storage or has equipment requiring servicing [210.70(C)].

**(D) Specific Appliance.** GFCI protection is required for the outlet supplying the following appliances rated 150V or less to ground, 60A or less, single- or three-phase:

- (1) Automotive vacuum machines
- (2) Drinking water coolers and bottle fill stations
- (3) High-pressure spray washing machines
- (4) Tire inflation machines
- (5) Vending machines
- (6) Sump pumps
- (7) Dishwashers
- (8) Electric ranges
- (9) Wall-mounted electric ovens

(10) Counter-mounted electric cooking units

(11) Clothes dryers

(12) Microwave ovens

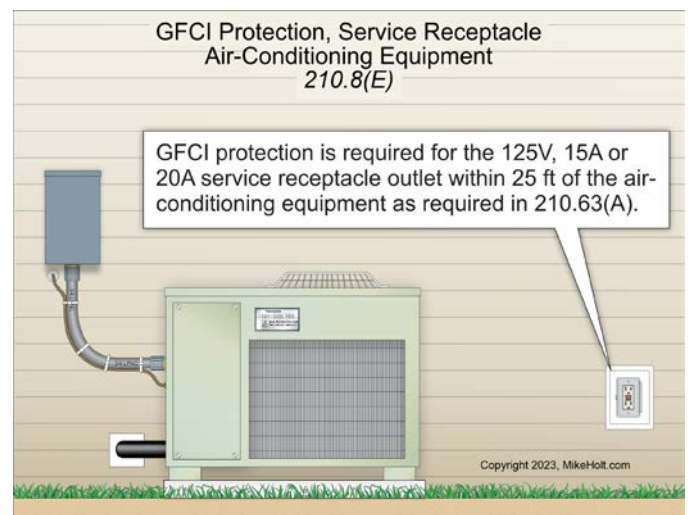
**Author's Comment:**

- ▶ The appliances in list items 210.8(D)(8) through (12) are commonly installed as hardwired outlets and the GFCI protection requirements of 210.8(A) and (B) only apply to receptacles. The shock hazards exist whether appliances are hardwired, or cord-and-plug-connected and therefore GFCI protection must be provided for the appliance branch circuit or outlet.

**(E) Equipment Requiring Servicing.**

**Air-Conditioning Equipment.** GFCI protection is required for air-conditioning equipment 125V, 15A or 20A service receptacle outlets installed within 25 ft of the equipment as specified in 210.63(A).

▶Figure 210-35



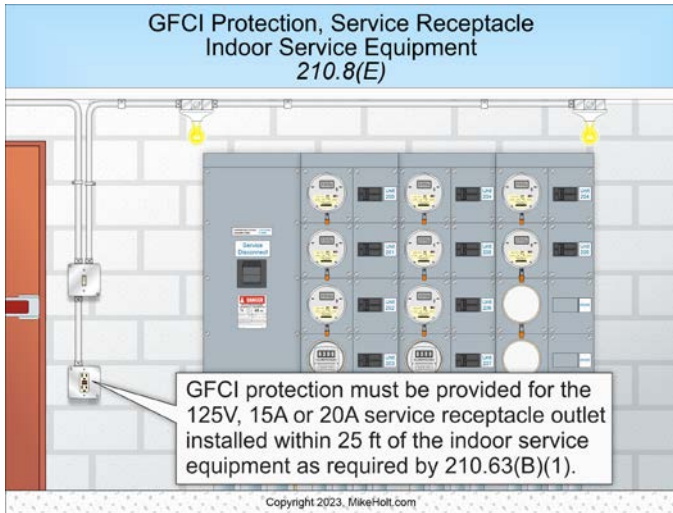
▶Figure 210-35

**Indoor Service Equipment.** GFCI protection must be provided for indoor service equipment 125V, 15A or 20A service receptacle outlets as required by 210.63(B)(1). ▶Figure 210-36

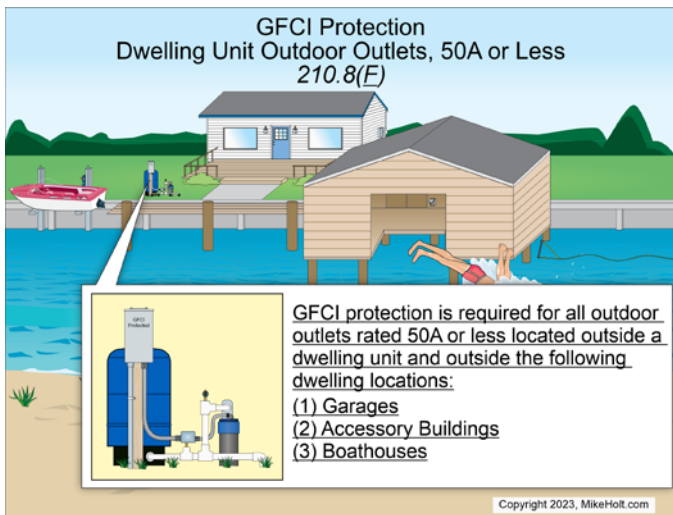
**Indoor Switchboards, Switchgear, Panelboards, and Motor Control Centers.** GFCI protection must be provided for 125V, 15A or 20A service receptacles as required by 210.63(B)(2) for indoor switchboards, switchgear, panelboards, and motor control centers.

**(F) Outdoor Dwelling Unit Outlets.** GFCI protection is required for all outlets rated 50A or less located outside the following dwelling spaces:

▶Figure 210-37



▶ Figure 210-36



▶ Figure 210-37

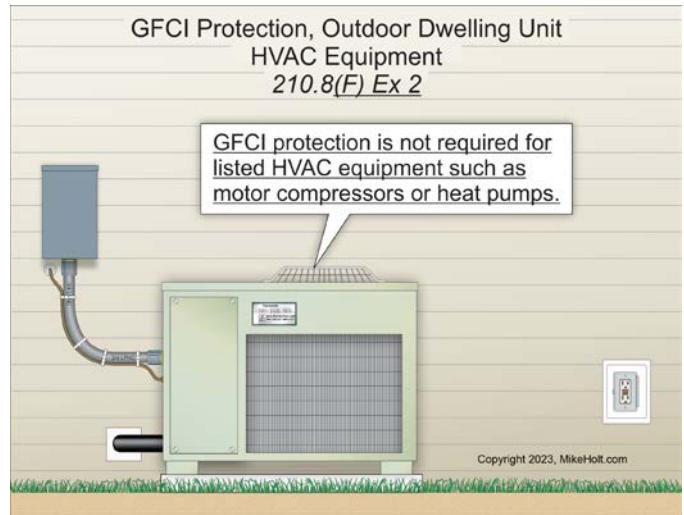
- (1) Garages.
- (2) Accessory Buildings.
- (3) Boathouses.

**Author's Comment:**

- ▶ According to Article 100, an "Outlet" is a point on the wiring system at which current is taken to supply utilization equipment.

If equipment connected to any of the above outlets is replaced, the circuit to the outlet must be GFCI protected.

*Ex 2: GFCI protection is not required for listed HVAC equipment, such as motor compressors or heat pumps.* ▶ Figure 210-38



▶ Figure 210-38