# Ground Fault Circuit Interruptors can prevent serious injury or even worse

A ground-fault circuit interrupter, or GFCI, has one big job and that is to help prevent electrocution.

If a person's body starts to receive a shock, the GFCI senses this and cuts off the power before he/she can become severely injured.

GFCIs are generally installed where electrical circuits within appliances may accidentally come into contact with water. They are most often found in kitchens, bath and laundry rooms, or even out-of-doors or in the garage where electric power tools might be used.

**What is a ground fault?**

According to the National Electrical Code, a "ground fault" is a conducting connection (whether intentional or accidental) between any electric conductor and any conducting material that is grounded or that may become grounded.

Ground faults can occur anywhere inside or outside of the home. The advantage of using GFCIs is that they detect the ground faults that cannot be detected by fuses or circuit breakers.

Being grounded means having a conducting connection to the earth. Unfortunately, humans can be the conducting material that is grounded or that may become grounded.

Because of this potential for shock, GFCI protection is used to protect human life. Circuit breakers and fuses only protect equipment—they do not protect people.

**How does a GFCI work?**

In a normal 120-volt outlet in the United States, there are two vertical slots and a round hole between them. The longer slot is called "neutral," while the shorter slot is "hot." The hole between is called "ground."

The GFCI will "sense" the difference in the amount of electricity flowing into the circuit to that flowing out, even in amounts of current as small as 4 or 5 milliamps. And, if working properly, it will react quickly (less than one-tenth of a second) to trip or shut off the circuit.

The circuit being protected by the GFCI does not require an equipment-grounding conductor (usually a bare wire in the circuit acting as a safety wire to carry current back to the service entrance panel if a fault occurs).

If replacement of a non-grounded two-wire receptacle becomes necessary, it may be a good idea to replace it with a GFCI-protected receptacle. The National Electrical Code addresses this issue in its Article 210. However, GFCIs will not protect personnel from shock when touching both the hot and neutral (or touching two hot wires) at the same time.

**What are the types of GFCIs?**

There are three types of GFCIs. The most often used "receptacle-type" GFCI, similar to a common wall outlet, is the type with which most consumers are familiar.

Additionally, circuit breaker GFCIs are often used as replacements for standard circuit breakers and provide GFCI protection to all receptacles on that individual circuit.

Temporary or "plug-in" GFCIs are frequently used in construction and in outdoor settings with electric tools, mowers, trimmers, and similar devices. They should not be used as a permanent alternative to a regular GFCI. Temporary GFCIs should be tested prior to every use.

**How should GFCIs be tested?**

Many consumers don't check their GFCIs to verify they are working. GFCIs are electronic devices that can be damaged or wear out. The electrical receptacle in a GFCI may continue to function, even if the GFCI circuit no longer works. If this is the case, have a qualified electrician replace as soon as possible.

GFCIs should be tested monthly to ensure they are in working condition. Whether you have a receptacle-type or circuit breaker-type GFCI, pushing the TEST button should turn off the power to the circuit.

For the receptacle-type GFCI, pushing the TEST button should cause the RESET button to pop up. (Remember to push the RESET button to reestablish power and protection.)

For the circuit breaker-type GFCI, pushing the TEST button should cause the handle to move to the tripped position. (Remember to reset the handle to reestablish power and protection.)

**When should you test GFCIs?**

GFCIs must be checked monthly to determine that they are operating properly. A portable GFCI should be used out-of-doors with various electrical power tools (i.e., drills, mowers, trimmers) and should be tested before each use!

**Where should GFCIs be used?**

It is recommended that GFCIs be installed in areas where appliances and power tools are used in close proximity to water.

Tap water or wet objects are able to conduct electricity very easily and can connect your body to a ground potential, thus increasing your chances of receiving a shock from a ground fault.

Appliances that have built-in GFCI protection, as now required for hair dryers, may not need additional GFCI protection, but there are still many appliances not provided with GFCI protection.

To follow the National Electrical Code requirements for 15 amp and 20 amp 125-volt receptacles in new homes, GFCI protection must be provided in bathrooms, garages, crawl spaces, unfinished basements, kitchens, wet bar sinks, and outdoors. Providing this protection in homes already built is also recommended.

**What is nuisance tripping of a GFCI?**

It takes only 5 mA (0.005 A) of current leakage from the hot wire to the ground to cause a GFCI to trip. A small amount of leakage current may be difficult to avoid in some normal circuits.

Hand-held power tools do not cause a tripping problem if the tool is maintained in good condition. Some stationary motors, such as a bathroom vent fan or fluorescent lighting fixtures, may produce enough leakage to cause nuisance tripping.

Another problem may be a long circuit with many splices. If possible, keep GFCI circuits less than 100 feet long. To avoid nuisance tripping, a GFCI should not supply:

* Circuits longer than 100 feet
* Fluorescent or other types of electric-discharge lighting fixtures
*Permanently installed electric motors

Installing a GFCI to prevent electrical shock from electrical equipment seems like a good idea, but nuisance tripping may become a serious problem. The installer must carefully consider the effects of loss of power to a circuit before installing GFCI protection, such as circuits with refrigerators, freezers, garage door openers, etc.

The most effective shock prevention system for electrical equipment and circuits is a good equipment grounding conductor run with the circuit wires and connected to all metal equipment.

**How does a GFCI differ from an AFCI?**

Arc-fault circuit interrupters (AFCIs) are a recently developed electrical safety device for homes to provide enhanced protection from fires resulting from unsafe home wiring conditions.

The 2002 edition of the National Electrical Code now requires AFCIs for bedroom circuits in new residential construction.

AFCIs should not be confused with ground-fault circuit interrupters or GFCIs. While both AFCIs and GFCIs are important safety devices, they have different functions. AFCIs are intended to address fire hazards; GFCIs address shock hazards. Combination devices that include both AFCI and GFCI protection in one unit may soon be available.

AFCIs can be installed in any 15- or 20-ampere branch circuit in a home and are currently available as circuit breakers with built-in AFCI features. In the near future, other types of devices with AFCI protection will be available. See "AFCIs" on this website for more information on this topic.

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