



Increase Electrical Safety With Ground Fault Circuit Interrupters

Using And Troubleshooting a GFCI

A properly wired home is a safer home. An important part of your electrical safety is the proper installation and use of GFIs... ground fault circuit interrupters.

Now required by code in most states, think of the GFI as an electrical lifesaver... gathering dust on the wall until the moment of your greatest need!

[Click on any topic below or scroll down for all topics.](#)

[What is a GFI?](#)

[How does a GFI work?](#)

[Are there different types of GFIs?](#)

[How do you test a GFI?](#)

[I have a GFI in my bathroom that seems to trip more often than it used to, especially when I use the hair dryer. Do GFI's wear out?](#)

[I have seen portable GFIs that you can plug into any outlet. Do they work as well as the ones installed in my house?](#)

[Does a GFI need to be grounded to work properly? I want to put one in my bathroom, but my outlet is ungrounded.](#)

[Are there any situations where a GFI will not protect me from a dangerous shock?](#)

[What is a GFI?](#)

A GFI, or ground fault circuit interrupter, is an automatic device that offers personal protection against electrical shock. They are installed in areas where known electrical shock hazards exist... outdoor outlets and fixtures, swimming pools, saunas and hot tubs, outlets in kitchens, basements, bathrooms, and garages. Wherever there is the potential for contact between a person and an electrical appliance in or near moisture, water, or water pipes, a GFI should be protecting the circuit... and you!

[Back to Question List](#)

[How does a GFI work?](#)

Inside of a GFI is a sensor that detects changes in current to the appliance by comparing the current flowing **to** the appliance and the current flowing **from** the appliance. A drop off in the current equivalent to about 5 milliamperes turns off all power by tripping a relay within the GFI within a few hundredths of a second. You might hardly even feel the shock, it happens so quickly!

However, there is still a danger since 5 milliamperes can cause a "jerk reflex" or spasm in the muscles. This is not too bad if you are standing on the ground but potentially dangerous if you are on a ladder or roof!

GFI's can be reset to restore power to the affected circuit. If the problem still exists, though, the GFI will not reset.

[Back to Question List](#)

[Are there different types of GFIs?](#)

The three basic types used in homes are the **GFI outlet**, the **GFI circuit breaker** and the **portable GFI**. All perform the same function each has different applications and limitations.

The GFI outlet (shown above) is intended as a replacement for a standard electrical outlet. It protects any appliance plugged into it, and can also be wired to protect other outlets that are connected to it.

IMPORTANT: A GFI outlet is not difficult to install, but the instructions for installation and testing must be followed precisely to insure the GFI works properly!!



The GFI circuit breaker controls an entire circuit, and is installed as a replacement for a circuit breaker on your home's main circuit board. Some homes are wired so that all bathrooms or all outdoor fixtures are on the same circuit. Rather than install multiple GFI outlets, one GFI circuit breaker can protect the entire circuit.

If you decide that the GFI circuit breaker is your best option, you must purchase one that is a match for your main electrical panel. If you have an older panel that utilizes fuses, you cannot use a GFI

circuit breaker and must use GFI outlets instead.

Resetting a GFI circuit breaker is a little different than resetting an outlet-type GFI. There is no "reset" switch. Instead, the GFI breaker is reset by first switching the breaker to the full "off" position, then to the full "on" position to restore power.

There is also a **portable GFI** that is often used by contractors. They are discussed in another part of this article. Click [HERE](#) to go there now!

[Back to Question List](#)

[How do you test a GFI?](#)

All GFIs, whether local or central, have two testing-related buttons on them. One button is appropriately labeled TEST, and one is labeled RESET. Turn on an appliance or light fixture connected to the GFI. Press the TEST button, and the appliance should immediately turn off. If it does not, either the GFI is miswired, there is a problem with other wiring in the same circuit, or the GFI has malfunctioned and should be replaced. Pressing the RESET button will restore power to the appliance or circuit.

Conversely, if you have a GFI that has tripped and will not reset, you may have a wiring short in the circuit, a defective appliance on the circuit, or the GFI itself has become defective.

The easiest way to troubleshoot a GFI is to obtain a GFI tester, available at most hardware stores. It plugs into the GFI outlet, and will supply you with a "snapshot" of your connections, indicating wiring problems and/or the condition of the GFI. Another way to troubleshoot is to simply purchase a new GFI and install it.

[Back to Question List](#)

[I have a GFI in my bathroom that seems to trip more often than it used to, especially when I use the hair dryer. Do GFI's wear out?](#)

Yes, they sure do! Over time, a GFI will become more sensitive to minor variations in current that are caused by certain types of appliances. Hair dryers and space heaters are notorious for stressing and tripping GFIs. Replacing the GFI will help solve this problem, though it may recur eventually as the new GFI ages.

[Back to Question List](#)

I have seen portable GFIs that you can plug into any outlet. Do they work as well as the ones installed in my house?



They can work as well as the ones installed in your house. In fact, some appliances such as hair dryers are now coming from the factory with GFIs built into the power cords. Portable GFI's are frequently used by contractors on worksites.

Portable GFIs do not need a ground to function, since they are designed the same as stationary ones. So if the GFI is operating properly, it will protect you even in ungrounded situations. However, if the tool or appliance you are using has a grounded three prong plug, you should never defeat it with an adapter unless you ground the adapter.

The GFI will offer no protection from the type of shock that can result from improper grounding of the tool!!

Always perform a safety test on your portable GFI each time before using it. Push the TEST button, which should kill power to the outlets. Then, press the reset button to restore power to the GFI outlets.

IMPORTANT NOTE: Do not use portable GFIs in place of permanent ones in your home! They are intended to be used in situations where you must bring power from an unprotected outlet into a hazardous situation. For example, if you ran an extension cord from a living room outlet (probably unprotected) to the front yard to cut lumber on the lawn!

[Back to Question List](#)

Does a GFI need to be grounded to work properly? I want to put one in my bathroom, but my outlet is an old, ungrounded type.

According to the NEC, it is allowable to install GFI's in ungrounded situations. This makes sense, since the GFI is not dependent of the ground to function. Remember, it does not measure shorts to the ground, it measures the current difference between the hot and neutral wires. A sudden difference, indicating that there is another path for the electricity to flow through... you, for example, causes the GFI to open the circuit and save you from permanently curly hair.

Of course, most safety-conscious electricians prefer not to install a grounded-type "three prong" outlet in an ungrounded situation. Think about it... once the outlet is installed, there is no way for anyone to know if the outlet is really grounded or not without testing it. Thus, there is a hidden shock hazard should an appliance or tool that needs grounding... has three-prong plug... is plugged into this outlet.

However, the NEC allows GFI's to be installed in ungrounded situations PROVIDED THAT the outlet is labelled "ungrounded". Though not "officially" approved in the NEC, the grounding hole in the GFI can be permanently defeated by using an epoxy or other adhesive to seal the hole.

Though a GFI will activate if a grounded appliance develops an electrical short circuit to ground... such as when YOU touch a metal saw and become the path to ground... you will experience a momentary electrical shock. This could be a minor tingle or could be more catastrophic, especially if you are on a ladder or roof. This excerpt is from an OSHA (Occupational Safety and Health Administration) article on wiring in nursing homes and the dangers to employees working with ungrounded outlets...

"The ground-fault circuit interrupter, on the other hand, is a fast-acting device which senses small current leakage to ground and, in a fraction of a second, shuts off the electricity and interrupts its faulty flow to ground. The rapid response of the GFCI is fast enough to prevent electrocution and this protection is independent of the condition of the grounding conductor.

A GFCI can prevent an electrocution; however, it cannot by itself prevent an initial electric shock to an employee before it interrupts the circuit. This initial shock could lead to injuries of an indirect or secondary nature in which involuntary muscular reaction could cause bruises, bone fractures, and even death resulting from collisions or falls. Therefore, GFCIs are in addition to, and not in lieu of, equipment grounding conductor requirements."

(Here is a link to the complete article:

[http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=FEDERAL REGISTER&p_id=13346](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=FEDERAL_REGISTER&p_id=13346))

[Back to Question List](#)

[Are there any situations where a GFI will not protect me from a dangerous shock?](#)

GFI's are not effective in certain circumstances. As mentioned earlier, they work by measuring the difference between the electrical current going INTO an appliance and the current going OUT of the appliance. This assumes that the person being shocked is grounded. If you were ungrounded and touched the hot and neutral wires at the same time, there would be no drop in current detected, so the GFI would not activate. Then, you would be at the mercy of the fuses or circuit breakers, which may or may not stop the current before its too late!

A second situation where a GFI will not protect you is when a second, unprotected circuit is involved in an accident. This can happen when a wire is accidentally drilled into or a

metal screw penetrates a wire hidden in the wall. Unless this second circuit is also protected, you are at full risk of electrocution, even if the tool itself is on a protected circuit!

<http://www.naturalhandyman.com/iip/infelectrical/infgfi.html>