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Ground-Fault Circuit Interrupters Protect You From Electrical Shock Hazards

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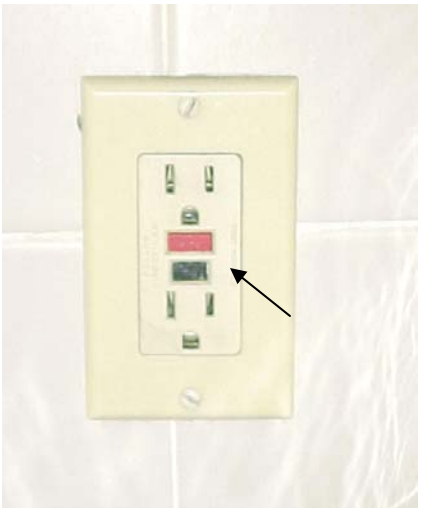

Figure 1 Outlet with GFCI protection

Purpose of the GFCI

A ground-fault circuit interrupter (GFCI) is used to protect people from electrical shock hazards caused by malfunctioning electrical appliances. If a person is using a defective electrical appliance and also touching a wet surface or very conductive surface, the person could become part of the grounding pathway for the fault current. This condition can send a dangerous electrical current through the body, causing serious electrical shock or death. An electrical current as small as 10 milliamperes (mA) across the chest of a person is reported to cause the heart to beat irregularly, possibly resulting in death.

According to the National Fire Protection Association's (NFPA) National Electrical Code (NEC), a GFCI is "a device intended for the protection of personnel that functions to de-energize a circuit or portion thereof within an established period of time when a current to ground exceeds the values established for a Class A device." It is installed in electrical outlets or in extension cord circuits which will quickly stop current flow in the circuit when the fault current exceeds a range of about 4 mA to 6 mA, as seen in Figure 1. In recent years, the Occupational Safety and Health Administration (OSHA) and the National Electrical Code have expanded the applications requiring GFCIs.

Figure 2 Kitchen outlet not meeting NEC GFCI protective requirements

Where are GFCIs Required to be Used?

OSHA and the NEC now require all bathroom and rooftop outlets to have GFCI protection. The NEC currently requires all kitchens, outdoor public areas, wet sinks, swimming pools, hot tubs, elevator pits, machinery rooms, hospital critical care, electrical life support equipment areas, snow melting equipment, and roof-mounted solar photovoltaic systems to have GFCI protection in the outlet receptacles for 125 volts single phase circuits or power circuits going to this equipment. See Figures 2 and 3 as examples of locations now covered under the NEC.

Outdoor electrical outlets and those in bathrooms and near kitchen sinks are the most common places where GFCIs are found, but GFCIs are protective in any wet or damp area where electrically powered tools, devices, or equipment are used. Both OSHA and the NEC require all temporary wiring circuits, like extension cords used on construction and similar work sites, to have GFCI protection in each circuit. Many newer extension cords now have built-in or integral GFCI protection as shown in Figures 4 and 5. Because building repair, renovation and similar construction type work often occurs outdoors, where conditions may be wet or damp, GFCIs provide a good means to protect workers using regular hand-held electric power tools and lights from electrical shock hazards caused by ground-faults.

GFCI Maintenance and Care

GFCIs need to be maintained in serviceable condition to prevent electrical shock and burn injuries. This means that they need to be tested at least annually to make sure they are providing the desired protection using the test button on the GFCI. GFCI outlets are typically recognizable by their red and/or black "reset" and "test" buttons as shown in Figure 1, or the two buttons shown in Figures 4 and 5. The test button should be used to check to see if the GFCI is working properly, as it will cause the red button to pop out when the circuit is opened. The same thing happens when an electrical appliance malfunctions with an electrical fault or short circuit current. The GFCI interrupts the circuit and stops the current flow to the appliance. When this occurs, you should unplug the appliance, and then press the "reset" button. If you try to plug the appliance back in and the GFCI pops again, then you should get the appliance serviced and repaired before trying to use it again, or replace it with a properly working unit. If you find a GFCI that does not work properly or you see that it has some physical damage, you need to notify your supervisor and the maintenance technician so that it can be promptly repaired and returned to service. While the GFCI has increased safety, one should never forget the danger that exists when water and electricity come in contact with each other.

A GFCI is not the sole safety device required on each circuit. There is also a requirement for overcurrent protection that is typically accomplished by using a circuit breaker in the panelboard. All circuits must have an effective grounding system with low impedance on the ground wire back to the panelboard.

Figure 3: Bathroom receptacle not meeting OSHA and NEC GFCI protection

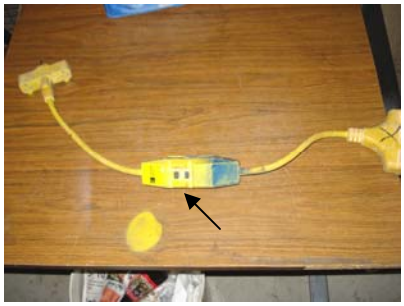

Figure 4: GFCI device for use with an extension cord for temporary service

Figure 5: GFCI built directly into an extension cord for temporary service

Fast Stats

- According to the U.S. Department of Labor's Bureau of Labor Statistics, in 2007, there were 1,480 workplace injuries from electrical shock and 1,100 injuries caused by contact with electric current that resulted in burns.
- The National Fire Protection Association report for 2008 states that electrical fires and electrical failures or malfunctions result in an average of 53,600 home fires each year. These fires cause more than 500 deaths, injure 1,400 people, and account for $1.4 billion in property damage.

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