Ground Fault Circuit Interrupters FACT SHEET

Number: LAB 02 Date: September 22, 2008

REGULATORY OVERVIEW

The use of ground fault circuit interrupters (GFCI) are regulated by *Massachusetts General Law* (*M.G.L. c. 143, § 3L*), which provides that all installation, repair and maintenance of wiring and electrical fixtures used for light, heat and power purposes in buildings and structures, *the Board of Fire Prevention Regulations of the Commonwealth of Massachusetts, Department of Fire Services* and the *National Fire Protection Association – National Electrical Code 70*.

Buildings "Other Than Dwelling Units" require all 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in (1) through (5) shall have ground-fault circuit-interrupter protection for personnel: (1) Bathrooms, (2) Kitchens, (3) Rooftops, (4) Outdoors and (5) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink.

Exception No 1 to (5): In industrial laboratories, receptacles used to supply equipment where removal of power would introduce a greater hazard shall be permitted to be installed without GFCI protection.

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Ground fault circuit interrupters (GFCI) can help prevent electrocution. The applications of GFCI in laboratory areas are recommended near all sinks, in greenhouses or similar applications and outdoor applications.

WHAT IS A GROUND FAULT CIRCUIT INTERRUPTER?

The ground-fault circuit interrupter, or GFCI, is a fast-acting circuit breaker designed to shut off electric power in the event of a ground-fault within as little as 1/40 of a second. It works by comparing the amount of current *going to* and *returning from* equipment along the circuit conductors. When the amount *going* differs from the amount *returning* by approximately 5 milliamperes, the GFCI interrupts the current.

The GFCI will *not* protect you from line contact hazards (i.e. a person holding two "hot" wires, a hot and a neutral wire in each hand, or contacting an overhead power line). However, it protects against the most common form of electrical shock hazard, the ground-fault. It also protects against fires, overheating, and destruction of wire insulation.

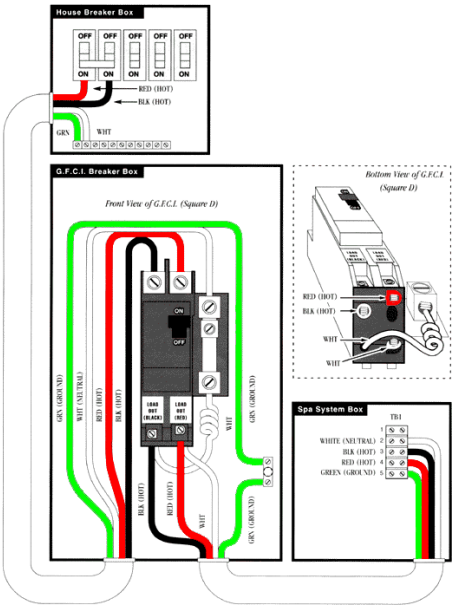
Effects of Electrical Current* on the Body[3]

Current	Reaction
1 milliamp	Just a faint tingle.
5 milliamps	Slight shock felt. Disturbing, but not painful. Most people can "let go." However, strong involuntary movements can cause injuries.
6–25 milliamps (women)† **9–30 milliamps** (men)	Painful shock. Muscular control is lost. This is the range where "freezing currents" start. It may not be possible to "let go."
50–150 milliamps	Extremely painful shock, respiratory arrest (breathing stops), severe muscle contractions. Flexor muscles may cause holding on; extensor muscles may cause intense pushing away. Death is possible.
1,000–4,300 milliamps (1–4.3 amps)	Ventricular fibrillation (heart pumping action not rhythmic) occurs. Muscles contract; nerve damage occurs. Death is likely.
10,000 milliamps (10 amps)	Cardiac arrest and severe burns occur. Death is probable.
15,000 milliamps (15 amps)	Lowest overcurrent at which a typical fuse or circuit breaker opens a circuit!

*Effects are for voltages less than about 600 volts. Higher voltages also cause severe burns.
†Differences in muscle and fat content affect the severity of shock.

SEVERAL TYPES OF GFCIS MAY BE INSTALLED IN/AROUND YOUR LABORATORY.

Wall Receptacle GFCI - This type of GFCI - the most widely used - fits into a standard outlet and protects against ground faults whenever an electrical product is plugged into the outlet. Wall receptacle GFCIs are most often installed in kitchens, bath and laundry rooms, and out-of-doors where water and electricity are most likely to be in close proximity. EH&S recommends the installation of GFCI for all outlets within six feet of a sink or water source.



Circuit Breaker GFCI - In laboratories equipped with circuit breakers, this type of GFCI may be installed in a panel box to give protection to selected circuits. Circuit breaker GFCIs should also be checked monthly. Keep in mind that the test will disconnect power to all lights and appliances on the circuit.

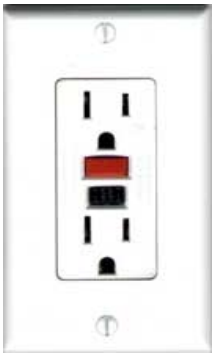
It is recommended that equipment outlets protected by circuit breaker GFCI, should be labeled or easily identifiable.

Portable GFCI - A portable GFCI requires no special knowledge or equipment to install. One type contains the GFCI circuitry in a self-contained enclosure with plug blades in the back and receptacle slots in the front. It can then be plugged into a receptacle, and the electrical products are plugged into the GFCI.

Another type of portable GFCI is an extension cord combined with a GFCI. It adds flexibility in using receptacles that are not protected by GFCIs. **Portable GFCIs should only be used on a temporary basis and should be tested prior to every use.**

If you have wall receptacles, to properly test GFCI receptacles in your laboratory:

- Push the "Reset" button located on the GFCI receptacle, first to assure normal GFCI operation.
- Plug a light (with an "ON/OFF" switch) into the GFCI receptacle and turn the light "ON."
- Push the "Test" button located on the GFCI receptacle. The light should go "OFF."
- Push the "Reset" button, again. The light or other electrical device should go "ON" again.



If the light or other electrical device remains "ON" when the "Test" button is pushed, the GFCI is not working properly or has been incorrectly installed (miswired). Receptacles maybe wired in a series, the GFCI will provide protection to the receptacles after the GFCI receptacle. If your GFCI is not working properly, call your Building Manager. A qualified electrician can assess the situation, rewire the GFCI if necessary or replace the device.

GFCIs are proven lifesavers, however, Laboratory staff must take a few minutes each month to do this simple test. By taking action, you can help protect yourself from the risk of electric shock.

RESOURCES:

Consumer Product Safety Commission
GFCIs Fact Sheet
CPSC Document #99
http://www.cpsc.gov/cpscpub/pubs/99.html

U.S. Department of Labor
Occupational Health & Safety Administration
Ground-Fault Circuit Interrupters (GFCI)
http://www.osha.gov/SLTC/etools/construction/electrical_incidents/gfci.html

GFCIs -- A SMALL INVESTMENT, A BIG LIFESAVER
UL Recommends Regular Testing of GFCIs
http://www.ul.com/consumers/groundfault.html

Electrical Safety: Safety and Health for Electrical Trades Student Manual. US Department of Health and Human Services (DHHS), National Institute for Occupational Safety and Health (NIOSH) Publication No. 2002-123, (2002, January).
http://www.cdc.gov/niosh/pdfs/02-123.pdf