UMS Safety Support Updates, News and Other Topics of Interest
October 2017

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This Month's Safety Reminder – Electrical Safety

Electricity is lazy and unforgiving. Let me explain. It's lazy because it wants to find the path of least resistance to ground, and it's unforgiving because it doesn't take too much current to be fatal.

This month, we'll talk about Electrical Safety… specifically, Ground Fault Circuit Interrupters (GFCI) and how you can protect yourself from this lazy and unforgiving beast. Not only is this information pertinent for your workplace, but also at home.

What is a GFCI? A GFCI is an electrical safety device that detects the difference in current between the live wire and the neutral wire of a normally functioning circuit. The difference should be zero. If it senses a difference (a ground fault), it means that current is escaping – and trying to find an easier route (lazy, right?) of least resistance – say though the ground line or though you. The GFCI will compare the current level in the hot/live wire (going to) and the neutral wire (returning from). But if a difference is detected then the GFCI will interrupt (cut off) the circuit when the minimum current difference is 5mA (milliampere – one thousandth of an ampere) within as little as 1/40 of a second.

However, a GFCI does not protect a person from line-to-line hazards such as touching two "hot" wires (240 volts) at the same time or touching a "hot" and neutral wire at the same time. But it protects against the most common form of electrical shock hazard, the ground-fault.

The table below will give you an idea of how electrical current affects you. As you can see, death is possible at 50 – 100 mA. And did you notice the lowest overcurrent at which a typical fuse or circuit breaker will trip? 15 Amps (15000 mA). The fuse/circuit breaker is designed to protect the circuit from an overload condition that could result in a fire. They're not designed to protect you from electric shock, unless you have a circuit breaker with a GFCI.

Current	Reaction
< 1 mA	Generally not perceptible
1 mA	Faint tingle
5 mA	Slight shock felt; not painful but disturbing. Average individual can let go, but strong involuntary reactions can lead to other injuries.
6-25 mA (woman) 9-30 mA (men)	Painful shock, loss of muscular control. The freezing current or "let go" range. Individual cannot let go, but can be thrown away from the circuit if extensor muscles are stimulated.
50 – 150 mA	Extreme pain, respiratory arrest (breathing stops), severe muscular contractions. Death is possible.
1 – 4.3 Amps	Rhythmic pumping action of the heart ceases. Muscular contraction and nerve damage occur; death likely.
10 Amps	Cardiac arrest and severe burns occur. Death is probable.
15 Amps	Lowest overcurrent at which a typical fuse or circuit breaker opens a circuit!

We wanted to provide you with a simple explanation of GFCIs in this newsletter. But for more detailed information please review the attached brochure from the Consumer Product Safety Commission (CSPC) titled *What is a GFCI?* that you may use for your injury prevention / tool box meetings.

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Electrical Safety Training

There are three types of training that you should receive. They are:

Electrical Safety Awareness Training obtained through Annual Safety Training

Electrical Safety Related Work Practices (other than electricians): This training is required for workers (who are not qualified electricians) whose occupational exposure causes them to face a higher than normal risk of an electrical accident. Typical jobs at the university include: machine operators, loggers, material handling equipment operators, mechanics and repairers, painters, tradesman/craftsman, welders, and required for persons who enter areas where contact with live electrical wires is likely (i.e. where wires are exposed and/or unsecured).

Electrical Work Practices (Qualified persons/electricians): The qualified person must demonstrate (for example: experience, license, certificate, education, etc.) that they are permitted to work on or near exposed energized parts.

For more information on how to obtain the training, please contact your campus safety point of contact or the UMaine Safety and Environmental Management at 581-4055.

What Were They Thinking?

UMS campus work-area image(s)

NOTE: When we observe these hazards, we immediately notify the area supervisor or the campus Facilities Management.

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UMS Safety Support Updates, News and Other Topics of Interest ToolBox Talk

Topic(s) discussed during this toolbox talk		
Date:	Supervisor/Presenter/Trainer:	Signature
Employee Name (print)	**Department**	**Employee Signature**

CPSC Fact Sheet

WHAT IS A GFCI?

A ground fault circuit interrupter, called a GFCI or GFI, is an inexpensive electrical device that can either be installed in your electrical system or built into a power cord to protect you from severe electrical shocks. GFCIs have played a key role in reducing electrocutions. Greater use of GFCIs could further reduce electrocutions and mitigate thousands of electrical burn and shock injuries still occurring in and around the home each year.

Ground fault protection is integrated into GFCI receptacles and GFCI circuit breakers for installation into your electrical system, especially for circuit outlets in particularly vulnerable areas such as where electrical equipment is near water. Portable GFCIs are also available to provide on-the-spot ground fault protection even if a GFCI is not installed on the circuit.

The GFCI is designed to protect people from severe or fatal electric shocks but because a GFCI detects ground faults, it can also prevent some electrical fires and reduce the severity of other fires by interrupting the flow of electric current.

What Is A Ground Fault?

A ground fault is an unintentional electrical path between a power source and a grounded surface. Ground faults most often occur when equipment is damaged or defective, such that live electrical parts are no longer adequately protected from unintended contact. If your body provides a path to the ground for this current, you could be burned, severely shocked or electrocuted.

How Do They Work?

A GFCI constantly monitors current flowing through a circuit. If the current flowing into the circuit differs by a very small amount (as little as 0.006 amperes) from the returning current, the GFCI interrupts power faster than a blink of an eye to prevent a lethal dose of electricity. GFCIs are designed to operate before the electricity can affect your heartbeat. A GFCI works even on two-slot receptacles.

Here's an example: A bare wire inside an appliance touches its metal case. The case is then charged with electricity. If you touch the appliance with one hand while another part of your body is touching a grounded metal object, such as a water faucet, you will get shocked. If the appliance is plugged into an outlet protected by a GFCI, the power will be shut off before a fatal shock can occur.

Where to Install/Use

The circuits that require GFCI protection are designated by the *National Electrical Code* (*NEC*).[1] The NEC typically only applies to new construction/major renovations. The coverage of GFCI protection has gradually increased over the years.

NEC GFCI requirements (and effective date):

- Underwater pool lighting (since 1968)
- Receptacles:
    - Outdoors (since 1973)
    - Bathrooms (since 1975)
    - Garages (since 1978)
    - Kitchens (since 1987)
    - Crawl spaces and unfinished basements (since 1990)
    - Wet bar sinks (since 1993)
    - Laundry and utility sinks (since 2005)

Also consider portable GFCI protection:

- Whenever operating electrically-powered garden equipment (mower, hedge trimmer, edger, etc.)
- With electric tools (drills, saws, sanders, etc.) for do-it-yourself work in and around the house

CPSC Fact Sheet

How to Install

Circuit breaker and receptacle-type GFCIs may be installed in your home by a qualified electrician. Receptacle-type GFCIs may be installed by consumers with adequate knowledge and skills to conform to proper electrical wiring practices and the instructions accompanying the device. When in doubt about the proper procedure, contact a qualified electrician; do not attempt to install it yourself.

A portable GFCI gets plugged into a receptacle just like any other cord-and-plug-connected device.

How to Test

Test every GFCI:

- After installation
- At least once a month
- After a power failure[2]
- According to the manufacturer's instructions.

If you do not have the instructions follow this procedure:

- Plug a lamp into the outlet and turn the lamp on.
- Press the GFCI's test button. Did the light go out? If not, the GFCI is not working or has not been correctly installed. Contact a qualified electrician to correct the wiring and/or replace the defective GFCI.
- Press the reset button. Did the light come back on? If not, replace the GFCI.

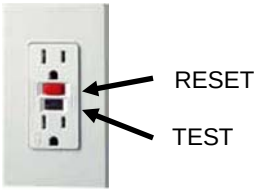
Types of GFCIs

CIRCUIT BREAKER

- A circuit breaker with a built-in GFCI may be installed in a panel box to add protection to the circuits it supplies.
- Protects against both a ground fault and a circuit overload
- Protects the wiring and every outlet, lighting fixture, or appliance on the branch circuit that it supplies.

RECEPTACLE

- Used in place of the standard duplex receptacle.
- Fits into a standard outlet box and protects against ground-faults for whatever is plugged into the outlet and other electrical outlets further "down stream" in the branch circuit.
- Can even replace older ungrounded, two-slot receptacles with new GFCI receptacles. Must use supplied label "NO EQUIPMENT GROUND GFCI PROTECTED" to identify that the receptacle is not grounded.



PORTABLE

- Used where installed GFCIs are not practical.
- One type contains the GFCI circuitry in a plastic enclosure with plug blades in the back and receptacle slots in the front. It can be plugged into a receptacle, then the electrical product is 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.

[1] The *NEC* is published by the National Fire Portection Association (NFPA 70). It is the most widely adopted building code for requirements for electrical system installations in the U.S. It may be adopted into law by states, counties or local jurisdictions for enforcement by inspection authorities and is currently revised every three years.
[2] Blackouts and other power disturbances can sometimes damage a GFCIs ability to function properly.

092010 Pub. 099