

SAFE SCIENCE: BE PROTECTED!

By Dr. Ken Roy

WANTED: ELECTRICITY - GFCI

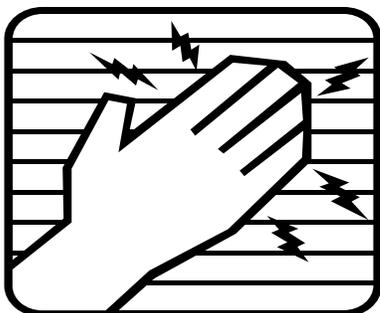
A Member of the Dirty Dozen Science Lab Gang

Getting A Charge Out Of Science Class?



A science teacher planned to demonstrate the process of electrolysis for his physical science class. He gathered the materials and set up the electrolysis apparatus. After explaining the theory behind the process, he then plugged in the electrical converter. He continued to explain the process to his class viewing the demonstration. While talking, his arm hit a beaker full of water on the laboratory bench. The beaker spilled on to the lab bench and splashed the nearby electrical receptacle being used in the demonstration.

His immediate impulse was to stop the water from going to the floor by damming it up with his hands. He received a serious shock and was almost electrocuted!



This was a demonstration that his students would never forget!

How could this have happened he later wondered, given the receptacle was protected by a circuit breaker? Good question! This kind of activity, though often unreported, happens more than one would imagine. It is not exactly the kind of charge a teacher wants to get out of his or her class.

II. Getting Grounded In Truth?

Circuit breakers protect the science lab and building, not the teachers or students! They are designed to prevent electrical fires by tripping if too much electricity tries to flow through the circuits wires. Too much electricity means too much resistance. Too much resistance means too much heat. Too much heat means FIRE!

Although the human body is a poor conductor of electricity, a wet surface and as little as 1/5-Amp can cause serious injury in the right situation. The job of protecting the body of the teacher or student is that of a ground fault circuit interrupter (**GFCI** or **GFI**). This device has the

function of constantly comparing current flowing from the Hot wire to Neutral wire. If the GFCI senses an imbalance of approximately 5 milliAmps in the current flow, the switch is open and the current stops flowing in about 1/40 of a second.

A note of caution about the operation of circuit breakers and GFCIs should be stated. These electrical devices, if not exercised on a scheduled basis, may corrode and not trip if called on to do their task over time. Preventative maintenance is important in this situation. This can easily be done by simply flipping the breaker several times every month or two. Users of the circuit should be advised, in case computers or other technologies are being operated during the exercising of the breaker.

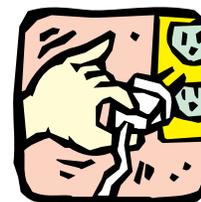
Why Are You So Wired?

Occupational Safety and Health Standards for General Industry (OSHA) states the following in 29 CFR part 1910.303(b): Electrical equipment shall be free from recognized hazards that are likely to cause death or serious physical harm to employees. Application of this electrical standard by OSHA is the basis of science labs in middle and high schools requiring GFCI protection. Teachers and supervisors involved with renovations or new science laboratory facilities need to insure that such protection is provided. Existing laboratory facilities should also have such protection for teachers and students.

There are three options for GFCI protection. A regular wall receptacle can be replaced with a GFCI receptacle. The second option is to install a GFCI circuit breaker in the service panel. The third option (though temporary) is a portable GFCI device, which can be placed between the wall receptacle and the electrical device. It plugs into an existing three prong grounded outlet and converts that receptacle to a ground fault protected receptacle. Remember however that the GFCI will only provide protection downstream from the GFCI to the end of the circuit.

In The Battery Of Situations, Will There Always Be Protection?

A student in a biology class plugged in a microscope lamp. The student was shocked and dazed, according to the horrified science teacher. The teacher was perplexed in that the GFCI had just been tested and proved to be fully operational. Yet, the student was shocked.



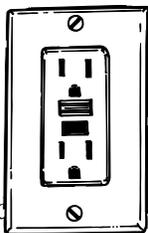
Users should understand that the GFCI does not protect the individuals from line-to-line contact hazards. This is what happens when a person holds two hot wires or a hot and a neutral wire at the same time. In the case of the student, he had his fingers on the metal prongs of the plug when pushing it into the wall receptacle. This constituted a line-to-line contact. Students and teachers need to be made aware of this danger in safety training workshops.

What Can Be Done Currently?

If a teacher is unsure if his or her laboratory is GFCI protected, two things can be done.

First, the supervisor of facilities can be contacted

and asked to survey the lab for GFCI protection. Secondly, hardware or electrical stores usually carry GFCI test devices for about \$4.00. They are very simple to operate and a whole lab can be tested within a few minutes.



GFCI Outlet

GFCI protection is the law and needs to be enforced for the protection of teachers and students from being shocked or electrocuted. Be an advocate and work with administration to bring your lab into code compliance. It is highly recommended that either the teacher, administrator or facility director check with a licensed electrician or local building inspector for applications of the National Electrical Code and OSHA standards in your school facility.

Additional Resources:

The National Electrical Code - 1999 Edition

OSHA 29 CFR Part 1910.303(b)

NFPA-45 The Standard on Fire Protection for Laboratories Using Chemicals -2000 edition.

Authors note: Special thanks goes to John Dembishack, Inspector/Plan Reviewer, Office of the State Fire Marshals, State of Connecticut, United States of America, for his technical assistance in writing this article. Also, special thanks goes to the Richard Snedeker, School Facilities Unit, Department of Education, State of Connecticut, United States of America, for his technical assistance.

LIVE LONG AND PROSPER SAFELY!

Dr. Ken Roy

Director of Science & Safety

Glastonbury Public Schools;

Authorized OSHA Instructor

Glastonbury, CT 06033-3099, USA

Email: royk@glastonburyus.org