University of Illinois Materials Research Lab (MRL)

November 2018

Important Dates and Reminders

MRL Internal Lab Safety Audits

- Finishing this month
- Correct any findings that were addressed during the audit

DAILY REMINDERS

- Use buddy system when working in labs
- Do not leave labs unlocked
- Be aware of your surroundings
- Remove lab PPE before leaving lab spaces. PPE is not allowed in public areas

Safety Newsletter

This month's topic is **Electrical Safety in the Laboratory.**

Background & Definitions for Electrical Safety

Every year, people are killed or injured while working with electrical circuits at home or at work. Before jumping into a bunch of information about electrical safety, it is good to go over basic background information and definitions.

Current: The movement of electrical charge measured in ampere (amps).

Voltage: Measure of electrical force or potential difference in volts.

Watt: Unit of electric power, equals the voltage multiplied by current (W=V x A).

Resistance: Opposition to current flow measured in ohms.

Conductors: Materials that have little resistance to electricity.

Insulators: Materials that have high resistance to electricity.

Grounding: A conductive connection to the earth serving as a sink for the current that is used as a protective measure against static electricity build-up.

The relation between voltage, current and resistance is given by Ohm's law:

E (volts) = I (amps) x R (Ohms)

The three wires inside an electrical cord are color coded:

- Black: Live AC voltage,
- White: Neutral return,
- Green: Ground, no current.

Hazards

Injuries caused by electricity include electrical shock, burns, and falls due to electrical shocks and burns. Electrocution is a fatal electrical shock. Electrical shock occurs when current passes through the body. The severity of the shock depends on: Amount of current flowing through the body, path of current through the body, length of time the body is in the circuit. Low voltage or low current does NOT mean low hazard! Less than 10 milliampere can cause a painful shock and loss of muscular control, and 50 milliampere can be fatal.

For **fire hazards**, too much current flowing through a wire can cause a power cord to overheat and start a fire. Sparks from electrical equipment can ignite flammable materials.

General Rules

- Use electrical cords only if they are in good condition. Cords must not be cracked, frayed, or have corroded prongs.
- Do not use 3-to-2 prong adapters unless other grounding provisions have been made. Plug 3-prong plugs into 3-prong outlets.
- Use power strips that have circuit breakers or fuses. Do not link power strips in series. Do not conceal cords behind or attach electrical cords to building surfaces.
- Do not block access to electrical panels.

Useful Contacts

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- Do not leave cables and cords unsecured and hanging in areas where they can pose a trip and movement hazard. Place cords so that they are not subjected to mechanical stress or temperatures that could damage the insulation.
- Do not leave electrical circuits exposed. Use electrical tape to insulate wires or use a guard as cover to prevent accidental contact.
- Do not install standard electrical equipment in locations where flammable gases, vapors, dusts, or other easily ignitable materials are present. If electrical equipment is used in a chemical fume hood, elevate it to allow efficient air flow.
- Keep electrical equipment at a minimum in high-moisture areas (e.g., wash rooms, cold rooms).

Extension Cords

Extension cords are not a replacement for permanent wiring. Install outlets in areas where electricity is needed permanently. Extension cords should NOT run through holes in walls, ceilings, floors, doors, or through windows and should be inspected before each use. Use only 3-prong extension cords with a listing from Underwriters Laboratories (UL) or other reputable testing labs.

Ground Fault Circuit Interrupters (GFCI)

A **GFCI** is an outlet device that senses current taking a wrong path (detects a grounding fault) and then disconnects the circuit to prevent electrical shocks. For example, a GFCI outlet trips (disconnects the circuit) when water splashes onto an operating heat gun. To protect users from electrical shocks caused by water, all electrical outlets within 6 feet of water must use GFCI protection (according to National Fire Protection Association 70 210.8 B5). Portable GFCIs are available if no GFCI wall outlet is present. If working in a wet area that is normally dry, a portable GFCI should be used.

Working with Electricity

Whenever possible, completely de-energize the system before performing any work. If work has to be performed on “hot” components, you need to be qualified for this type of work. Contact your school’s electronics shops or people responsible for facilities and services for help.

Wear Personal Protective Equipment (PPE) and follow the techniques below when working with electricity:

- NEVER wear rings, watches, bracelets, necklaces, or other electrically conductive jewelry.
- Avoid being grounded. Stay at least 6 inches away from all metal materials, walls, and water sources. Wear shoes with thick, insulating soles or use non-conductive mats.
- Probe hot wires and components with only one hand to prevent current from passing through your chest cavity and injuring your heart. Place the other hand at your side, in a pocket, or in a belt loop away from conducting materials.
- Use tools designed for electrical work that have a non-conductive cover. Electrically insulated gloves are also available.
- Use voltmeters with appropriate rating for the voltage to be tested. A standard voltmeter could explode when subjected to a high voltage.