

## DESCRIPTION

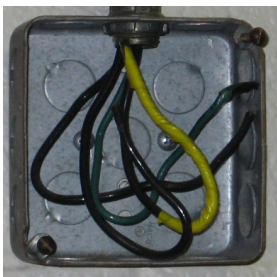
Because we use electricity on a daily basis, it is easy to become comfortable and fail to recognize the many hazards associated with it. Hazards associated with electricity and electrical devices include fire, arc explosions, burns, shocks and death (electrocution). Contact with current from a standard receptacle may be lethal. Understanding some simple concepts can greatly minimize the risks associated with electricity.

## APPROVED ELECTRICAL PRODUCTS

Ensure that all electrical devices and components are listed or labeled by a nationally-recognized testing laboratory such as Underwriters Laboratories (UL), Factory Mutual (FM) or equivalent. Listed/labeled equipment undergoes testing to help ensure that it is safe for use. The use of the equipment must be consistent with the listing/labeling conditions and the manufacturers' instructions. Electrical equipment that is not listed or labeled such as that built or modified in-house must be inspected and approved for use by a qualified person who can provide assurance that the equipment is properly constructed and safe for use. The group that fabricates or modifies the electrical equipment is responsible for insuring that it is safe for use. Budget constraint is not an acceptable reason for fabricating or modifying equipment in house if listed/labeled equipment is available for purchase.



## GUARDING OF LIVE PARTS



have covers installed.

Electrical components including switches, outlets, junction boxes, wire raceways, circuit breaker panels, etc. must be guarded to prevent accidental contact with live electricity. If you observe exposed wiring, please contact your building administrator to

## GUARDING OF LAMPS

Lamps used for general illumination located within seven feet of the floor must have a cage or guard to



prevent breakage of bulbs and contact with live electrical parts.

## EXTENSION CORDS

Extension cords may not be used as a substitute for permanent outlets. They may only be used for temporary applications. The cords must be labeled as having been tested by a nationally-recognized testing laboratory and be rated for the load they are supplying. Extension cords may not be connected to one another since the conductors are sized for the specific length of cord. Overheating and fire can occur when multiple cords are connected to one another. Cords may not be run through doorways, windows, holes in walls, floors, ceilings, etc.

## OUTLET SPLITTERS

The use of plug-in outlet splitters that convert 2 outlets to 4 or 6 is discouraged. Some of these devices can pull away from the outlet which can lead to overheating and has resulted in fires as shown in the adjacent photo. Ideally, additional outlets should be installed as required by a qualified electrician. If outlet splitters must be used, ensure that they are labeled as having been tested by a nationally-recognized testing laboratory and that they are properly rated for the load they will supply. Outlet splitters must be attached to the outlet with a screw that replaces the outlet face plate screw and secures the splitter firmly to the outlet.



## INSPECTION/REPAIR OF CORDS

Inspect all cords for missing ground prongs and worn/frayed jacketing or exposed conductors. Cords found to be defective must not be used. Cords should be destroyed and disposed of or repaired/replaced by a qualified electrician. Electrical tape may not be used to repair worn or frayed cords. The outer cord jacket is specifically designed to prevent wear of the inner conductors. Breaks in the outer covering can place stress on the inner conductors which can result in a fault that can cause a shock or fire.



## GROUND-FAULT CIRCUIT INTERRUPTER (GFCI)

A ground-fault circuit interrupter (GFCI) is a device that is designed to quickly detect a ground fault and interrupt power in order to prevent a lethal shock. Typically, the device exists within a branch circuit breaker or an individual outlet. GFCIs are required by code in areas close to sinks and other sources of water. A GFCI outlet should be tested monthly by plugging a device into it and pushing the test button on the outlet. The device



should shut off. Power to the device should be restored when the reset button on the outlet is pushed. If the GFCI is found to be defective, discontinue use of the outlet and label it

“Defective-Do Not Use” and contact your building administrator or submit a Facilities Services work request to have the outlet repaired or replaced.

## POWER STRIPS/SURGE PROTECTORS



Power strips/surge protectors must have built-in circuit breakers. They must be connected directly to a wall outlet and never be connected to one another or an extension cord. The ampere & voltage capacity of the device must be clearly indicated and it must be labeled as having been tested by a nationally-recognized testing laboratory. Applied load must be within the acceptable range listed on the device. Light-duty household-type devices are not appropriate for use in University facilities. Heavy-duty devices with various cord lengths are available from industrial and laboratory supply vendors in Penn’s Ben Buys online purchasing system.

## GROUNDING

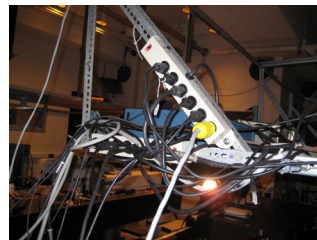


Circuits, devices and enclosures must have a permanent and continuous path to ground. Ensure that ground prongs on power cords are intact and have not been broken off or removed as shown here. All outlets must have the provision for three prong plugs.

Contact your building administrator to have two prong outlets converted to three prong grounded or GFCI outlets. Plug adapters should not be used.

## ELECTRICITY IN THE LABORATORY

It is important to evaluate the quantity and locations of electric receptacles required to properly support current research. As the electrical demands of research increase, the lab infrastructure must be updated to accommodate these changes. The use of extension cords may not be substituted for inadequate quantity or placement of



permanent outlets. Contact your building administrator to facilitate the installation of permanent receptacles as required. Electrical work in the laboratory, including experiments and

equipment, must be completed under the direction of a “qualified person” as defined by NFPA 70E Article 100 to ensure safety and code compliance.

## CONTROL OF HAZARDOUS ENERGY

When electrical equipment is serviced, it must be placed into an electrically safe condition prior to starting the work. Electricity must be isolated and secured in accordance with Penn’s [Control of Hazardous Energy \(Lockout/Tagout\) Program](#).

## ELECTRICAL SAFETY AT PENN

Penn’s Environmental Health and Radiation Safety Office (EHRS) maintains the [University’s Electrical Safety Program](#). The program defines roles, responsibilities and procedures to minimize the risks associated with electricity.

## REFERENCES

- Occupational Safety & Health Administration- (OSHA) Safety & Health Topics – Electrical - <https://www.osha.gov/SLTC/electrical/>
- Penn EHRS – Electrical Safety Programs <https://ehrs.upenn.edu/health-safety/general-safety/electrical-safety>
- National Fire Protection Association – NFPA 70E Standards for Electrical Safety in the Workplace - <http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=70e>