ELECTRICAL SAFETY

Introduction

The following sections provide general safety guidelines and procedures for electrical safety. This chapter covers the following topics:

General Electrical Safety

The danger of injury through electrical shock is possible whenever electrical power is present. When a person's body completes a circuit and thus connects a power source with the ground, an electrical burn or injury is imminent. Most fatal injuries result from high-voltage exposure; however, people can sustain severe injuries from low voltage power if it has a high current flow.

Electrical safety is important in every work environment. The following sections cover circuit breaker loads, electrical grounding, electrical safety guidelines, and electrical emergency response.

Definitions

The following definitions help clarify general electrical safety:

Amps: The standard unit for measuring electrical current.

Watt: A unit of electrical power, equal to the power developed in a circuit by a current of amp flowing through a potential difference of one volt.

Voltage: Electromotive force expressed in volts.

Circuit Breaker: A device that automatically interrupts the flow of an electrical current.

Breaker Box: An insulated box on which interconnected circuits are mounted.

Electrical Panel: An insulated panel on which electrical wires are mounted.

Current Flow: The rate of flow of an electrical charge, generally expressed in amps.

Electrical Load: The amount of power delivered by a generator or carried by a circuit.
A device to which the power is delivered.

Ground-Fault Circuit Interrupter (GFCI): A GFCI detects grounding problems and shuts electricity off to prevent a possible accident.

High Voltage: The term high voltage applies to electrical equipment that operates at more than 600 volts (for terminal to terminal operation) or more than 300 volts (for terminal to ground operation). Low voltage, high current AC or DC power supplies are also considered to be high voltage.

Hazardous Energy Sources: This term applies to stored or residual energy such as that in capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or water pressure.

Lockout: The placement of a lock on an energy-isolating device. This act prevents workers from operating a piece of equipment until the lock is removed.

Tagout: The placement of a tag on an energy-isolating device. A tagout device is a prominent warning device of a lockout.

Energy-Isolating Device: A mechanical device that prevents the transmission or release of energy.

Examples include the following:

- ·Manually operated circuit breakers
- ·Disconnect switches
- ·Line or block valves

Pushbuttons, selector switches, and other control circuit devices do not isolate energy. Energy-isolating devices should be lockable by means of a hasp or other type of attachment. It should not be necessary to dismantle or reassemble a device to lock it.

Authorized Employee: A person who locks out or tags out equipment for service or maintenance. Authorized employees have been formally trained in proper lockout/tagout procedures.

Circuit Breaker Loads

Most office and laboratory locations have 20 amp circuit breakers that serve two or more outlets. These breakers can handle most office equipment; however, the widespread use of personal computers and associated hardware can create an electrical overload. To determine your current electrical load, follow these steps:

1. Check office/laboratory equipment for a manufacturer's rating label that indicates total watts or amps. Take special care to check appliances that use electricity to generate heat.

2. Convert the watts rating to amps:
   Amps = Watts ÷ 120 Volts

3. Total the amps for each circuit.

4. If the total equals more than 15 amps per 20 amp circuit, you may be overloading the circuit. Move enough equipment to a different circuit to reduce the circuit load; otherwise, have the Office of Facilities Management (OFM) inspect the circuit wiring.

Electrical Grounding

Proper electrical grounding can help prevent electrical injury. Most electrical equipment is grounded with either a three-prong plug or a two-prong plug and insulation. Because a grounding system may be defective without your knowledge, use a GFCI to ensure electrical safety. GFCIs are required in moist or potentially damp environments.

Electrical Panels

Electrical panels or breaker boxes require special safety considerations, including the following:

- Know where your panel box is located.
- Do not tape circuit switches to keep a breaker from tripping.
- Ensure that breaker circuits are accurately labeled within panel boxes. Ensure that panel box doors are securely attached.
- Do not block panel boxes. There should be at least 30 inches of clear space in front of a panel box.
- Report tripped breakers and refer any electrical questions to OFM.

Electrical Safety Guidelines

Follow these guidelines for general electrical safety:

- Be familiar with the electrical hazards associated with your workplace.
- Unplug electrical equipment before repairing or servicing it.
- If a prong breaks off inside an outlet, do not attempt to remove it yourself. Call OFM for assistance.
- Ensure that outlets are firmly mounted. Report loose outlets to OFM.
- Report all electrical problems, including tripped breakers, broken switches, and flickering lights, to OFM.
- All appliances used in UT Arlington buildings must be UL or FM (Factory Mutual) labeled.
- Do not use an appliance that sparks, smokes, or becomes excessively hot, unless the appliance is specifically designed to exhibit these characteristics.
- Portable electric heaters are prohibited and should not be used.
- Keep electrical equipment away from water, unless the appliance is specifically designed for use around water, such as a wet-dry shop vacuum.
- Use GFCIs whenever possible.
- Be aware of overhead power lines when working with tall equipment (e.g., grain augers, cranes, sailboats, etc.).
- Follow lockout/tagout procedures as appropriate. Refer to the Lockout/Tagout section of this chapter.

Follow these guidelines for electrical plug and cord safety:

- Do not use an adapter or extension cord to defeat a standard grounding device. (e.g., only place three-prong plugs in three-prong outlets; do not alter them to fit in a two-prong outlet.)
- The use of extension cords and multi-plug adapters is prohibited at UT Arlington. Do not use extension cords in place of permanent wiring. Request new outlets if your work requires equipment in an area without an outlet.
- Do not overload the circuit breaker.
- If multiple office equipment is necessary (computers, printers, etc.) use an approved power strip with surge protector and circuit breaker.
- Do not plug power strips into other power strips (daisy chain).
- Small household appliances such as microwaves, refrigerator, coffee pots, tea pot (kettle), toaster or toaster oven, etc… should be plugged directly into a wall receptacle at all times.
- Do not run electrical power cords above ceiling tiles or through walls.

- Keep electrical cords away from areas where they may be pinched and areas where they may pose a tripping or fire hazard (e.g., doorways, walkways, under carpet, etc.)
- Discard damaged cords, cords that become hot, or cords with exposed wiring.
- Never unplug an appliance by pulling on the cord; pull on the plug.

Electrical Emergency Response

The following instructions provide guidelines for handling three types of electrical emergencies:

1. **Electric Shock:**

   When someone suffers serious electrical shock, he or she may be knocked unconscious. If the victim is still in contact with the electrical current, immediately turn off the electrical power source. If you cannot disconnect the power source, try to separate the victim from the power source with a nonconductive object, such as a wood-handled broom.

   IMPORTANT:
   Do not touch a victim that is still in contact with a power source; you could electrocute yourself.

   Have someone call for emergency medical assistance immediately. Administer first aid, as appropriate.

2. **Electrical Fire:**

   If an electrical fire occurs, try to disconnect the electrical power source, if possible. If the fire is small, you are not in immediate danger, and you have been trained in fighting fires, use any type of fire extinguisher except water to extinguish the fire.

   IMPORTANT:
   Do not use water on an electrical fire.

3. **Power Lines:**

   Stay away from live power lines and downed power lines. Be particularly careful if a live power line is touching a body of water. The water could conduct electricity.

   If a power line falls on your car while you are inside, remain in the vehicle until help arrives.

Lockout/Tagout Procedures

Lockout/tagout procedures are used to isolate hazardous energy sources from electrical, hydraulic, or pneumatic machinery. Furthermore, when service or maintenance work is required, lockout and tagout devices help ensure personal safety from possible energy releases. All employees whose work involves hazardous energy sources must be trained in lockout/tagout procedures.

Before performing service or maintenance work on machines, turn them off and disconnect them from their energy sources. To further ensure employee safety, lockout and tagout energy-isolating devices.

The following sections provide information on lockout/tagout procedures. In addition to the procedures in this manual, UT Arlington maintains a Lockout/Tagout Program for the Control of Hazardous Energy.

Applying Lockout/Tagout Devices

Only authorized employees may apply lockout/tagout devices. The following steps provide a brief outline of approved application procedures:

1. Notify employees that the equipment requires service or maintenance and is scheduled for shutdown and lockout/tagout.

2. Use established procedures to identify the type, magnitude, and hazards of the equipment's energy source. Make sure you know the proper methods for controlling the energy source.

3. If the equipment is currently operating, shut it down using normal shutdown procedures.

4. Isolate the equipment from its energy source by activating the energy-isolating device(s). Either lockout or tagout the energy-isolating device(s).

5. Dissipate or restrain stored and residual energy using methods such as grounding, repositioning, blocking, bleeding, etc. (Capacitors, springs, hydraulic systems, and air/gas/water pressure system may contain stored or residual energy.)

6. Ensure that all employees are removed from the equipment. Then, test the equipment for successful isolation by attempting to operate it.

IMPORTANT:
After verifying isolation, return the controls to neutral or off.

Removing Lockout/Tagout Devices

When service and maintenance are completed, authorized employees may remove lockout/tagout devices and return equipment to normal operations. The following steps provide a brief outline of approved removal procedures:

1. Inspect the work area and remove any nonessential items. Make sure the isolation equipment is intact and in good working condition.

2. Ensure that all employees are safely removed from the equipment.

3. Verify that the equipment controls are in neutral or off.

4. Remove the lockout/tagout devices and re-energize the equipment.

   NOTE:
   The removal of some forms of blocking may require the equipment to be re-energized before safe removal.

5. Notify employees that the equipment is ready for operation.

High Voltage Procedures

In addition to the guidelines associated with general electrical safety and lockout/tagout procedures, there are more stringent safety requirements for high voltage procedures.

The following list provides high-voltage safety tips. For more information, please refer to Title 29 Section 1910.269 of the Code of Federal Regulations or NFPA 70 (National Electric Code).

Ensure that only authorized employees work around high voltage equipment. Label entrances with a High Voltage Sign.Before entering a power supply or associated equipment enclosure to work on hazardous energy sources, complete the following:

- De-energize the equipment.
- Open and lockout the main input power circuit breaker.
- Check for auxiliary power circuits that could still be energized.
- Inspect automatic shorting devices for proper operation.
- Short the power supply with grounding hooks. Ensure that terminal voltage ratings can withstand surges caused by electrical faults or switching transients.
- Be careful around output circuits even when the input power is off. Parallel power sources and energy storage devices can still be dangerous.
- Be careful when working with power supplies that serve more than one area.
- Before working in a high voltage area, inspect the power supply and check all protective devices.
- Do not work alone near high voltage.
- Label equipment to identify power sources.
- Label input power sources to identify connected power supply loads.
- Attach emergency shutdown instructions and phone numbers to equipment that is remotely controlled or unattended while energized.

Minimum Clear Working Space

The following tables from the National Electric Code provide minimum depth of clear working space in front of electrical equipment:

OUTDOOR CONDUCTOR - CLEARANCES

For outside wiring, all conductors will comply with clearances specified below:

MINIMUM CLEARANCE	Low Voltage 0-750 Volts
Above and along thoroughfares	20 feet
Above areas where it is possible to drive vehicles	16 feet
Above areas accessible to pedestrians only	12 feet
Above structures	8 feet
Distance away from windows, doors, scaffolds or similar locations will be maintained not less than:	3 feet

WORKING CLEARANCES

VOLTAGE TO GROUND MINIMUM CLEAR DISTANCE (FEET)

*CONDITIONS	(i)	(ii)	(iii)
0-150	2-1/2	2-1/2	3
151-600	2-1.2	3-1/2	4

Where *conditions (i), (ii), and (iii) are as follows:

i. Exposed live parts on one side and no live or grounded parts on the other side of the working space, or exposed live parts on both sides effectively guarded by suitable wood or other insulating materials. Insulated wire or insulated bus bars operating at not over 300 volts shall not be considered live parts.

ii. Exposed live parts on one side and grounded parts on the other side. Concrete, brick, or tile walls will be considered as grounded surfaces.

iii. Exposed live parts on both sides of the workspace [not guarded as provided in condition with the operator between.