# Electrical Safety Program

**Purpose**

This Electrical Safety program is designed to prevent electricity-related injuries and property damage. This program also provides for proper training of maintenance employees to ensure they have the requisite knowledge and understanding of correct electrical work practices and procedures. Only employees qualified in this program may conduct adjustment, repair or replacement of electrical components or equipment. Electricity has long been recognized as a serious workplace hazard, exposing employees to dangers that include electric shock, electrocution, burns, fires and explosions. *References: NFPA 70E, Electrical Safety Requirements for Employee Workplaces, National Electrical Code (NEC) and OSHA Standard (Electrical Safety) 29 CFR 1910.331 to 1910.339.*

This document outlines the pieces and requirements of a professional electrical safety program for any organization or work location.

 **Responsibilities**

**Management**

* Provide training for qualified and unqualified employees.
* Conduct inspections to identify electrical safety deficiencies.
* Guard against and promptly correct all electrical deficiencies.
* Ensure all new electrical installations meet all codes and regulations.

**Employees**

* Report electrical deficiencies immediately.
* Do not work on electrical equipment unless authorized and trained.
* Properly inspect all electrical equipment prior to use.

**Hazard Control**

**Engineering controls**

* All electrical distribution panels, breakers, disconnects, switches and junction boxes are completely enclosed.
* Watertight enclosures are used where there is any possibility of moisture entry either from operations or weather exposure.
* Electrical distribution areas are guarded against accidental damage by locating them in specifically designed rooms, or guarded with substantial guard posts, rails and other structural means.
* A clear approach and 3-foot side clearance is maintained for all distribution panels.
* All conduit is fully supported throughout its length. Nonelectrical attachments to conduit are prohibited.
* All nonrigid cords are provided strain relief where necessary.

**Administrative controls**

* Only trained and authorized employees conduct repairs to electrical equipment.
* Contractors performing electrical work must be licensed for the rated work.
* Areas under new installation or repair are guarded with physical barriers and warning signs to prevent unauthorized entry.
* Access to electrical distribution rooms is limited to those employees who have a need to enter.
* All electrical control devices are properly labeled.
* Work on energized circuits is prohibited unless specifically authorized by senior facility management.
* All employees follow established electrical safety procedures and precautions.

**Protective equipment**

* All employees qualified to work on electrical equipment wear rated safety shoes / boots.
* All tools used for electrical work are properly insulated.
* Electrical-rated gloves are available for work on electrical equipment.
* Electrical-rated matting is installed in front of all distribution panels in electrical utility rooms.

**Electrical Equipment**

**Examination**

Continually ensure that electrical equipment is free from recognized hazards that can cause harm, injury or death to employees.

Safety of equipment is determined using the following points:

* Suitability for installation and use is in conformity with the applicable OSHA subpart provisions.
* Suitability of equipment for an identified purpose is evidenced by listing or labeling its identified purpose.
* Appropriate mechanical strength and durability of parts designed to enclose and protect other equipment.
* Electrical insulation.
* Heating effects while in use.
* Arcing effects.
* Classification by type, size, voltage, current capacity and specific use.
* Other factors that contribute to the practical safeguarding of employees using, or likely to come in contact with, the equipment.

**Identification of disconnecting means and circuits**

A disconnecting means is a switch that is used to disconnect the conductors of a circuit from the source of electric current. Disconnect switches are important because they enable a circuit to be opened, stopping the flow of electricity, and thus can effectively protect workers and equipment.

Each disconnect switch or overcurrent device required for a service, feeder or branch circuit must be clearly labeled to indicate the circuit's function, and the label or marking should be located at the point where the circuit originates.

For example, on a panel that controls several motors or on a motor control center, each disconnect must be clearly marked to indicate the motor to which that circuit is connected.

All labels and markings must be durable enough to withstand weather, chemicals, heat, corrosion or any other environment to which they may be exposed.

**Definition of Terms**

**Qualified worker:** An employee trained and authorized to conduct electrical work.

**Unqualified worker:** An employee who has not been trained or authorized by management to conduct electrical work.

**Training**

**Training for unqualified employees**

Training for unqualified employees covers general electrical safety precautions and aims to provide an awareness and understanding of electrical hazards.

**Electrical safety rules for unqualified employees**

* Do not conduct any repairs to electrical equipment.
* Report all electrical deficiencies to your supervisor.
* Do not operate equipment if you suspect an electrical problem.
* Be alert: Water and electricity do not mix.
* Be alert: Even low voltages can kill or injure you.
* Do not use cords or plugs if the ground prong is missing.
* Do not overload electrical receptacles.

**Training for qualified employees**

Training for qualified employees includes specific equipment procedures and requirements of:

Electrical Safety, 29 CFR 1910.331 to 1910.339.

**Personal Protective Equipment**

Employees working in areas where the potential for contact with exposed electrical sources exists and/or contact is likely are provided with and use appropriate and certified personal protective equipment or PPE. The following rules apply to the use and care of PPE gear:

* Appropriate PPE must be used where exposed electrical sources are present, and/or contact is likely.
* PPE used must be designed for the work being performed and environment in which it is used.
* PPE must be visually inspected and/or tested before use. Any gear with defects or damage must be replaced, repaired or discarded.
* In cases where the insulating capabilities of the PPE are damaged during the work, a protective outer cover, such as leather, must be used.
* Employees must wear nonconductive head protection wherever there is a danger of injury from electrical burns or shock from contact with exposed energized parts.
* Employees must wear certified protective eye / face equipment whenever there is a danger from electrical arcs or flashes, or from flying objects resulting from an electrical explosion.

**Electrical PPE inspection schedule**

|  |  |
| --- | --- |
| **Type of equipment** | **When to test** |
| Rubber insulating line hose | Upon indication that insulating value is suspect |
| Rubber insulating covers | Upon indication that insulating value is suspect |
| Rubber insulating blankets | Before first issue and every 12 months |
| Rubber insulating gloves | Before first issue and every 6 months |
| Rubber insulating sleeves | Before first issue and every 12 months |

**Electrical Lockout and Tagout Requirements**

**Application of locks and tags**
A lock and a tag must be placed on each disconnecting means used to deenergize circuits and equipment on which work is to be performed, except in certain cases as specified below.

* A lock is attached to prevent persons from operating the disconnecting means unless they resort to undue force or the use of tools.
* Each tag contains a statement prohibiting unauthorized operation of the disconnecting means and removal of the tag.
* If a lock cannot be applied, a tag may be used without a lock. A tag used without a lock must be supplemented by at least one additional safety measure that provides a safety level equivalent to lock use. Examples of additional safety measures include the removal of an isolating circuit element, blocking of a controlling switch, or opening of an extra disconnecting device.
* A lock may be placed without a tag only under all of the following conditions:
	+ Only one circuit or piece of equipment is deenergized.
	+ The lockout period does not extend beyond the work shift.
	+ Employees exposed to the hazards associated with reenergizing the circuit or equipment are familiar with this procedure.

**Working at Elevated Locations**

Any person working on electrical equipment on a crane or other elevated equipment must take necessary precautions to prevent a fall from reaction to electrical shock or other causes. A second person, knowledgeable as a safety watch, must assume the best position possible to help the worker in case of an accident. Portable ladders shall have nonconductive siderails when they are used where the employee or the ladder could contact exposed energized parts. Depending on the specific workspace and height, consider using a fall protection system also.

 **General Protective Equipment and Tools**

General protective equipment and tools shall be used when in the proximity of or working on exposed energized parts. The following rules apply:

* When working on or near exposed energized parts, qualified employees must use insulated tools or handling equipment suitable for the voltage present and the working environment. In cases where the insulation may be damaged, a protective outer layer must be added.
* Fuse handling equipment – insulated for the circuit voltage – must be used to remove or install fuses when the terminal is energized.
* Ropes and other hand lines used near exposed energized equipment must be nonconductive.

**Warnings and barricades**

Warnings and barricades are used to alert unqualified employees of the present danger related to exposed energized parts. The following rules apply:

* Safety signs, warning tags, etc., must be used, warning unqualified employees of the electrical hazards present, even temporarily.
* Nonconductive barricades must be used with safety signs to prevent unqualified employees access to exposed energized parts or areas.
* Where barricades and warning signs do not provide adequate protection from electrical hazards, an employee must be stationed to warn and protect employees.

**Portable electrical equipment**

Electrical equipment is defined as any cord or plug-type electrical device. Flexible or extension cords are considered electrical equipment. Other examples of portable electrical equipment include powered hand tools, powered bench tools, fans, radios, etc. The following safety rules apply to portable electrical equipment:

* Portable equipment must be handled in a manner that does not cause damage. Power cords may not be stapled or otherwise hung in a way that can cause damage to the outer jacket or insulation.
* Portable equipment is visually inspected for damage, wear, cracked or spilt outer jackets or insulation, etc., before use or before each shift. Tools that remain connected once put in place need not be inspected until relocated. Any defects – any tool or equipment with defects or damage such as cracked or split outer jackets or insulation – must be repaired or taken out of service.
* Always check the compatibility of cord sets and receptacles for proper use.
* Ground-type cord sets must be only used with ground-type receptacles when used with equipment requiring a ground-type conductor.
* Attachment plugs and receptacles may not be altered or connected in a way that would prevent the proper continuity of the equipment grounding conductor. Adapters must not be used if they interrupt the continuity of the grounding conductor.
* In wet areas or areas where conductive liquids are used, only portable electrical equipment that is double insulated and/or designed for use in those areas must be used.
* Employees who are wet or have wet hands may not handle portable electrical equipment (plug in, unplug, etc.). Appropriate personal protective equipment must be used when handling any electrical equipment that is wet or covered with a conductive liquid.
* Locking-type connectors must be properly secured after connection to a power source.

**Electrical Circuit Safety Procedures**

Electrical power and lighting circuits are defined as devices specifically designed to connect, disconnect or reverse circuits under a power load condition. When these circuits are employed, the following rules apply:

* Cable connectors (not load-break connectors) and fuses, terminal plugs and/or cable splice connectors may *not* be used, unless an emergency, to connect, disconnect or reverse a circuit. Use proper electrical circuits.
* After a protective circuit is disconnected or opened, it is not connected or closed until it has been determined that the equipment and circuit can be safely energized.
* Overcurrent protectors of circuits or connected circuits are not modified, even on a temporary basis, beyond the installation safety requirements.
* Only qualified employees may perform tests on electrical circuits or equipment.
* Test equipment and all associated test leads, cables, power cords, probes and connectors are visually inspected for external damage before use. Any damage or defects shall be repaired before use or the item is placed out of service.
* Test equipment is rated to meet or exceed the voltage being tested and rated fit for the environment in which it is being used.
* Where flammable or ignitable materials are stored, even occasionally, electrical equipment capable of igniting them is not used – unless proper measures are taken to prevent hazardous conditions from developing.

**Standard Operating Procedures**

**SOP: Electrical pre-work procedure**

Except in extreme cases, work on electrical equipment is only done with all electrical circuits in the work area deenergized by following the lockout / tagout procedure. When working on or near energized electrical circuits with less than 30 volts to ground, the equipment need not be deenergized if there will be *no* increased exposure to electrical burns or to explosion from electric arcs.

To prepare for work on electrical systems or components, the following procedure applies:

*Caution: Treat all electrical circuits as "live" until they have been tagged and locked out and tested by the following procedure.*

1. Obtain permission from supervisor to conduct work.
2. Lockout and tagout all sources of electrical power.
3. Verify deenergized condition before any circuits or equipment are considered and worked on.
4. A qualified person must operate the equipment controls or otherwise verify that the equipment cannot be restarted.
5. Verify proper operation of a voltmeter at a live electrical source of the same rated voltage as the circuit to be worked.
6. Use the voltmeter to check all exposed circuits phase to phase and phase to ground for evidence of voltage / current in the circuit.
7. Conduct work on the circuit only after determining that there is no voltage in any of the exposed circuits.
8. If voltage is detected in any exposed circuit, STOP, inform supervisor and determine source and procedure to eliminate voltage.
9. Conduct work.
10. Close all exposed circuits, boxes, controls, equipment.
11. Remove lockout / tagout.
12. Obtain supervisor permission to energize circuits.

**SOP: Working on or near exposed energized circuits**

In the rare situation when energized equipment (or working in near proximity to energized equipment) cannot be deenergized, the following work practices must be used to provide protection:

*Caution: Unqualified employees are prohibited from working on or near exposed energized circuits.*

1. Obtain permission from manager to work on or near energized electrical circuits.
2. Lockout and tagout all circuits possible.
3. Treat all circuits as energized.
4. Remove *all* conductive clothing and jewelry (rings, watches, wrist/neck chains, metal buttons, metal writing instruments, etc.).
5. Use proper personal protective equipment, shields and/or barriers to provide effective electrical insulation from energized circuits. This may include electrical-rated insulated gloves, aprons, rubber-soled shoes, insulated shields, insulated tools, etc.
6. Provide adequate lighting. Do not enter areas with exposed energized parts unless illumination (lighting) is provided so that employee can see clearly and work safely. Do not reach unless you can see clearly what you are reaching to or for – do not reach around obstructions of view or without lighting into areas where exposed energized parts are located.
7. Employees entering a confined space with exposed energized parts must use protective barriers, shields, and/or equipment / insulated materials rated at or above the present voltage to avoid contact.
8. Doors or other hinged panels must be constructed and secured to prevent them from swinging into an employee and causing contact with exposed energized parts.
9. Housekeeping in areas of exposed energized parts may not be completed in areas with close contact unless adequate safeguards (insulation equipment or barriers) are present. Conductive cleaning material (steel wool, silicon carbide, etc.) or liquids may not be used unless procedures (lockout and tagout, etc.) are in place and followed.
10. Station a safety observer outside the work area. The sole function of this person is to quickly deenergize all sources of power and pull worker free from electrical work area with a non-conductive safety rope if contact is made with an energized electrical circuit.
11. A person qualified in CPR must be readily available to the scene.

**SOP: Re-energizing electrical circuits after work completed**

These requirements must all be met, in the order given, *before* circuits or equipment are reenergized, even temporarily.

1. A qualified person shall conduct tests and visual inspections, as necessary, to verify that all tools, electrical jumpers, shorts, grounds and other such devices have been removed, so that the circuits and equipment can be safely energized.
2. Warn employees exposed to the hazards associated with reenergizing the circuit or equipment to stay clear of the circuits / equipment.
3. Remove each lock and tag. They are to be removed only by the employee who applied it or under his or her direct supervision. However, if this employee is absent from the workplace, then the lock or tag may be removed by a qualified supervisor designated to perform this task provided that:
4. The supervisor ensures that the employee who applied the lock or tag is not available at the workplace.
5. The supervisor ensures that the employee is aware that the lock or tag has been removed before he or she resumes work at that workplace.
6. Conduct a visual determination that all employees are clear of the circuits and equipment.

**Acknowledgement Form**

I have received and reviewed the Company Name Electrical Safety Program, and I agree to comply with it as it pertains to my position.

Employee name

Date

Manager Name