

Electrical Safety Awareness - Qualified/Non-Qualified

Policy:

All electrical work will be conducted in a manner consistent with existing regulations and with good standard practices. This section establishes standards for electrical operations.

Because electrical work has the potential for personnel electrocution and the potential hazard of catastrophic property damage, extreme caution must be exercised when working with electricity and electrical equipment. Electrical equipment can also cause fire because of its potential as an ignition source for causing fire or explosion. Fire is frequently caused by short circuits, overheating equipment and failure of current limiters, thermal sensors, and other safety devices. Explosions may occur when flammable liquids, gases, and dusts are exposed to ignition sources generated by electrical equipment.

Requirements:

1. Electrical installations and utilization equipment will be in accordance with the current edition of the National Electrical Code, National Fire Protection Association (NFPA 70); American National Standards Institute (ANSI) Standard C1. This code will also apply to every replacement, installation, or utilization equipment.
2. Equipment or facilities designed, fabricated for, and intended for use by Pagoda Electrical, Inc. personnel will be procured to meet the requirements of the National Electric Code.
3. Frames of all electrical equipment, regardless of voltage shall be grounded.
4. Exposed non-current carrying metal parts of electrical equipment that may be come energized under abnormal conditions shall be grounded in accordance with the National Electrical Code.
5. Wires shall be covered wherever they are joined, such as: outlets, switches, junction boxes, etc.
6. Parts of electrical equipment which in ordinary operation produce arcs, sparks, etc., shall not be operated or used in explosive atmospheres or in close proximity to combustible materials.
7. Equipment connected by flexible extension cords shall be grounded either by a 3-wire cord or by a separate ground wire (except double insulated equipment).
8. Ground fault circuit interrupters (GFCI) shall be used on all 120-volt, single-phase, 15- and 20-ampere receptacle outlets at job sites when the receptacles are not a part of the permanent wiring of the building or structure. Receptacles on a two wire, single-phase portable or vehicle-mounted generator rated not more than 5 kilowatt, where the circuit conductors of the generator are insulated from the generator frame and all or the grounded surfaces, need not be protected with GFCI's.

Inspections:

Supervisors will insure that work areas are inspected for possible electrical hazards.

Sufficient workspace shall be provided and maintained around electric equipment to permit safe operations and maintenance of such equipment.

Responsibilities:

a. Supervisors

1. All work hazards must be anticipated and all safeguards utilized.
2. Ensures that all employees are properly trained and instructed in the safe operation of electrical equipment and aware of all hazards associated with the use of these electrical devices.
3. Initiates any necessary administrative action required to enforce safety practices.
4. Requests assistance from Pagoda Electrical, Inc. Management regarding equipment operation which require unique safety practice instructions.

b. Employees

1. Follows Pagoda Electrical, Inc.'s electrical safety policies and procedures and instructions of responsible Supervisors and the Safety and Health Manager.
2. Brings to the attention of the supervisor and/or Health and Safety Branch potential hazardous situations such as discrepancies between instruction, procedures, policies and manual, faulty equipment, misapplication of device, etc.
3. Electrical equipment known to be malfunctioning must be repaired or replaced before use. The repair must be initiated as soon as possible after the malfunction is noted.

c. Safety and Health Manager

1. Assists supervisors in defining hazardous operations, designating safe practices and selecting proper application of devices.
2. When necessary, obtains from the principle supervisor, standard operating procedure for electrical equipment and devices in use.
3. In coordination with Pagoda Electrical, Inc. Management and other supervisors, reviews and approves standard operating procedures.
4. Evaluates potential electrical hazards during facility inspections to insure compliance with existing Pagoda Electrical, Inc. policy and other safety guidelines.
5. Requests support from Pagoda Electrical, Inc. Management on hardware and equipment testing, tagging out of unserviceable equipment, and taking corrective action where necessary.

3. General Electrical Safety Practices

Safety-related work practices shall be employed to prevent electric shock or other injuries resulting from either direct or indirect electrical contacts, when work is performed near or on equipment or circuits which are or may be energized. The specific safety-related work practices shall be consistent with the nature and extent of the associated electrical hazards. The following practices are to be followed by all employees:

a. Individual

1. The user is responsible for obtaining necessary tools and safety equipment from the designated storage area, checking it for discrepancies, returning it to storage in good condition and identifying any faulty equipment to his/her supervisor. It shall be the Supervisor's immediate responsibility to replace any faulty safety equipment and notify the Safety and Health Manager.
2. Eye protection is required during any electronic or electrical hardware repair, installation and/or open front operation.
3. When working on or near conductors and parts of electric equipment that have been deenergized but have not been locked out or tagged in, shall treat the conductor and /or equipment as live and be treated as energized.



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4. Electrical safety shoes, long sleeve non-polyester, low flammability shirts and insulating gloves will be worn when operating or testing 600 volt or higher equipment.
5. Regarding Lockout and Tagging. While any employee is exposed to contact with parts of fixed electric equipment or circuits which have been deenergized, the circuits energizing the parts shall be locked out or tagged or both.
6. Protective apron will be worn over polyester or other highly flammable clothing during soldering operations.
7. When "Working on or near exposed energized parts."
 - a) This paragraph applies to work performed on exposed live parts (involving either direct contact or by means of tools or materials) or near enough to them for employees to be exposed to any hazard they present.
 - b) "Work on energized equipment." Only qualified persons may work on electric circuit parts or equipment that have not been deenergized. Such persons shall be capable of working safely on energized circuits and shall be familiar with the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools.
 - c) "Overhead lines." if work is to be performed near overhead lines, the lines shall be deenergized and grounded, or other protective measures shall be provided before work is started. If the lines are to be deenergized, arrangements shall be made with the person or organization that operates or controls the electric circuits involved to deenergize and ground them. If protective measures, such as guarding, isolating, or insulating, are provided, these precautions shall prevent employees from contacting such lines directly with any part of their body or indirectly through conductive materials, tools, or equipment.
 - (i) "Unqualified persons."
 - (A) When an unqualified person is working in an elevated position near overhead lines, the location shall be such that the person and the longest conductive object he or she may contact cannot come

closer to any unguarded, energized overhead line than the following distances:

For voltages to ground 50kV or below - 10 feet (305 cm);

For voltages to ground over 50kV - 10 feet (305 cm) plus 4 inches (10 cm) for every 10kV over 50kV.

(B) When an unqualified person is working on the ground in the vicinity of overhead lines, the person may not bring any conductive object closer to unguarded, energized overhead lines than the distances per below:

For voltages to ground 50kV or below - 10 feet (305 cm);

For voltages to ground over 50kV - 10 feet (305 cm) plus 4 inches (10 cm) for every 10kV over 50kV.

Note: For voltages normally encountered with overhead power line, objects which do not have an insulating rating for the voltage involved are considered to be conductive.

(ii) "Qualified persons."

(A) Qualified employees must adhere to the approach distances in Table S5 of OSHA regulations 29 CFR 1910.33, which is copied and included below as our Table A

**TABLE A - APPROACH DISTANCES FOR QUALIFIED
EMPLOYEES - ALTERNATING CURRENT**

Voltage range (phase to phase)	Minimum approach distance
300V and less	Avoid Contact
Over 300V, not over 750V	1 ft. 0 in. (30.5 cm).
Over 750V, not over 2kV	1 ft. 6 in. (46 cm).
Over 2kV, not over 15kV	2 ft. 0 in. (61 cm).
Over 15kV, not over 37kV	3 ft. 0 in. (91 cm).
Over 37kV, not over 87.5kV	3 ft. 6 in. (107 cm).
Over 87.5kV, not over 121kV	4 ft. 0 in. (122 cm).
Over 121kV, not over 140kV	4 ft. 6 in. (137 cm).

(iii) "Vehicular and mechanical equipment."

(A) Any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines shall be operated so that a clearance of 10 ft. (305 cm) is maintained. If the voltage is higher than 50kV, the clearance shall be increased 4 in. (10 cm) for every 10kV over that voltage. However, under any of the following conditions, the clearance may be reduced:

- (1) If the vehicle is in transit with its structure lowered, the clearance may be reduced to 4 ft. (122 cm). If the voltage is higher than 50kV, the clearance shall be increased 4 in. (10 cm) for every 10 kV over that voltage.
- (2) If insulating barriers are installed to prevent contact with the lines, and if the barriers are rated for the voltage of the line being guarded and are not a part of or an attachment to the the vehicle or its raised structure, the clearance may

be reduced to a distance within the designed working dimensions of the insulating barrier.

- (3) If the equipment is an aerial lift insulated for the voltage involved, and if the work is performed by a qualified person, the clearance (between the uninsulated portion of the aerial lift and the power line) may be reduced to the distance given in Table A.

(B) Employees standing on the ground may not contact the vehicle or mechanical equipment or any of its attachments, unless:

- (1) The employee is using protective equipment rated for the voltage; or
- (2) The equipment is located so that no uninsulated part of its structure (that portion of the structure that provides a conductive path to employees on the ground) can come closer to the line than permitted in this section.

(C) If any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines is intentionally grounded, employees working on the ground near the point of grounding may not stand at the grounding location whenever there is a possibility of overhead line contact. Additional precautions, such as the use of barricades or insulation, shall be taken to protect employees from hazardous ground potentials, depending on earth resistivity and fault currents, which can develop within the first few feet or more outward from the grounding point.

d. "Illumination."

Employees may not enter spaces containing exposed energized parts, unless illumination is provided that enables the employees to perform the work safely.

Where lack of illumination or an obstruction precludes observation of the work to be performed, employees may not perform tasks near exposed energized parts. Employees may not reach blindly into areas which may contain energized parts.

e. "Confined or enclosed work spaces."

When an employee works in a confined or enclosed space (such as a manhole or vault) that contains exposed energized parts, Pagoda Electrical, Inc. shall provide, and the employee shall use, protective shields, protective barriers, or insulating materials as necessary to avoid inadvertent contact with these parts. Doors, hinged panels, and the like shall be secured to prevent their swinging into an employee and causing the employee to contact exposed energized parts.

f. "Conductive materials and equipment."

Conductive materials and equipment that are in contact with any part of an employee's body shall be handled in a manner that will prevent them from contacting exposed energized conductors or circuit parts. If an employee must handle long dimensional conductive objects (such as ducts and pipes) in areas with exposed live parts, Pagoda Electrical, Inc. shall institute work practices (such as the use of insulation, guarding, and material handling techniques) which will minimize the hazard.

g. "Portable ladders."

Portable ladders shall have nonconductive siderails if they are used where the employee or the ladder could contact exposed energized parts.

h. "Conductive apparel."

Conductive articles of jewelry and clothing (such a watch bands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, or metal headgear) may not be worn if they might contact exposed energized parts. However, such articles may be worn if they are rendered nonconductive by covering, wrapping, or other insulating means.

b. Pagoda Electrical, Inc. Requirements

1. All electrical and electronic equipment must be inspected for electrical hazards before using.
2. All electrical equipment must be grounded through power cords, frame grounding and/or grounding through wiring in conduit system. NOTE: Some power tools and instruments are now double insulated and do not require or need three pronged plugs. Contact the Safety and Health Manager where the discrepancy or hazard exists.
3. Pagoda Electrical, Inc. equipment will be kept clear of electrical panelboards with the following clearances: 36 inches for 120/208 volts and 42 inches for 277/480 volts and up to 600 volt equipment.
4. Operation of panelboard circuit breakers by laboratory personnel is prohibited except in case of personal emergency, contact the Safety and Health Manager for operation.
5. Switching devices which are tagged or locked shall not be operated until tag is removed by issuer.
6. When work is to be performed on electrical equipment, care must be taken to make sure the electrical source is turned off, rendered inoperative, tagged and locked. (Re: Lock out/Tag out). Working on live parts of 50 volts or more shall not be done except in an emergency and with proper procedure and/or qualified "Buddy" with appropriate safety equipment.

7. Extension cords are intended only for temporary use with portable appliances, tools, and similar equipment that are not normally used at one specific location. Extension cords are not to be used as a substitute for fixed wiring. FEB will install receptacles when needed for new equipment.

c. Emergency Procedures

In the event of a medical emergency (shock etc.) contact a member of Management, contact local Emergency Rescue Units (911), and direct Emergency Rescue Units to the scene. If there is a person nearby who has received First Aid/CPR training, he/she should be contacted immediately to give assistance.

d. Emergency Removal or Tag and Lock

In the event of an emergency in which the person responsible for removing the tag and lock cannot be located, the General Foreman may remove the device in the presence of a member of the Health and Safety Branch. Details for removal are given in the Lock out/Tag out Policy

e. Hazards

The extreme hazard of electrical equipment is the potential for personnel electrocution from contacting energized systems. Electrical equipment can also cause catastrophic property damage because of its potential as an ignition source for causing fire or explosion.

Control of Hazardous Energy (Lock-Out/Tag-Out)

The procedures specified in this section comply with the requirements for the isolation or control of hazardous energy sources set forth in the OSHA standard (29 CFR 1910.147 – proposed). The accidental release of energy during maintenance work can and frequently does cause severe injuries, amputations, and death. Energy can be present in the form of electricity, potential energy (due to gravity) stored in elevated masses, chemical corrosivity, chemical toxicity, or pressure.

The only exceptions (allowed by OSHA to these requirements) are those situations involving “hot tap” operations. For this exception to be valid, Pagoda Electrical, Inc. personnel involved must demonstrate that the continuity of services is essential, that shutdown of the energy source is impractical, and that documented (written) procedures and special equipment have been implemented that will provide proven effective protection. These procedures apply to all maintenance or installation operations conducted on Pagoda Electrical, Inc. premises.

1.Tag-out Devices

Tags affixed to energy isolating devices are warning devices that do not provide the physical restraint on those devices that a lock would provide. Any tag so attached to an energy isolating device must not be removed without authorization of the person attaching it, and it must never be bypassed, ignored, or otherwise defeated. Tags must be legible and understandable in order to be effective. Tags must be made of materials which will withstand environmental conditions encountered in the workplace. When utilized, tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use. Tag-out devices must be substantial enough to prevent inadvertent or accidental removal.

Tag-out devices must warn against hazardous conditions if the machine or equipment is energized and must include appropriate warnings such as:

•DO NOT START •DO NOT ENERGIZE

•DO NOT OPEN •DO NOT OPERATE •DO NOT CLOSE

2. Lock-out Devices

Lockout devices and practices vary by nature and function. Several effective lockout devices and practices are listed as follows:

- a. Padlocks. Key operated padlocks are recommended and should be assigned individually.

2. Lock-out Devices

Several effective lockout devices and practices are listed as follows:
(continued)

- b. Multiple lock adapters will enable more than one worker to place their own padlock on the isolating device to guarantee that the machine or equipment will remain deactivated until each and every employee completes their own task, and only then will the last padlock be removed.
- c. Chains or other commercially available devices should be used to prevent valves from being opened or, in some cases, closed. The principle of multiple lock adapters still applies even when chains or other devices are used on operations requiring more than one employee.

3. Procedures

- a. General

If energy-isolating devices are not capable of being locked out, they must be modified so that they are capable of being locked out whenever major replacement, repair, renovation, or modification of the machine or equipment takes place. Whenever new machines or equipment are installed, energy-isolating devices for such machines or equipment must be designed to accept a lockout device.

If an isolating device cannot be locked out for any reason, then additional steps must be taken to assure full employee protection such as removing fuses, blocking switches, blanking off lines, etc.

If the machine or equipment is not capable of being locked out, a tag-out procedure must be documented and utilized. The tag-out procedure must provide full employee protection equivalent to a lockout system. For full employee protection, when a tag-out device is used on an energy-isolating device, the device must be attached at the same location that the lockout device would have been attached, and must demonstrate that the tag-out device will provide a level of safety that is equivalent to that of a lockout system.

b. Plug/Cord and Hose-Connected Type Equipment

When servicing or installing plug/cord or hose connected electrical, pneumatic, or hydraulically powered equipment, the cord or hose shall be disconnected from the equipment to be worked on, prior to starting the work. A tag warning against reconnecting the plug or hose shall be affixed to the plug or hose end.

Any stored energy (e.g., capacitor voltage, hydraulic pressure) shall be safely released prior to the start of maintenance or installation work.

c. Electrically Powered Equipment

Electrically powered equipment shall be de-energized and their source of electricity manually disconnected from them prior to the removal of protective covers or the start of other maintenance or installation work. It is important to recognize that locking and tagging on/off switches is often not sufficient to prevent accidental start up or prevent voltage from being present in the equipment. If the equipment is not wired properly (i.e., the polarity is reversed) or the switch is of the single pole type, voltage can be present even if the operating switch is in the off position. For these reasons, manual disconnects must be placed in the off position and/or the equipment's power fuses removed from the motor control center.

The lock-out/tag-out procedure is as follows:

- a. Each person working on the circuit or piece of equipment shall place a padlock and warning tag on the electrical isolation device (e.g., disconnect switch).
- b. Each person working on the circuit or piece of equipment shall attempt to energize or start the piece of equipment prior to starting work. Each on/off switch capable of energizing the equipment must be “tried.”
- c. If the try step reveals that the equipment is capable of being energized, the proper disconnects must be located and locked out and the try step repeated.
- d. As each person completes his or her task, they shall remove their padlock and tag from the energy isolating device.
- e. All protective covers or panels shall be securely re-attached prior to energizing the equipment after work is completed. In the event that protective covers must be removed to make adjustments on energized equipment, appropriate guards must be constructed and attached in such a manner as to prevent employee contact with live circuitry capable of causing human injury. Such guards must be of durable construction, adequate to prevent injurious contact, and remain in place at all times that the equipment is energized.

- Chemical and/or Pressurized Lines

Prior to working on any pressurized line or a line containing a toxic, flammable, reactive, or corrosive material, the following procedure must be implemented:

- a. The line to be serviced must have two block valves upstream of the work area or device to be serviced or installed, placed in the closed position and tagged. The bleed valve (between the two block valves) shall be opened and tagged so that leakage of the valve upstream would be readily obvious. The line shall be depressurized or drained in a safe manner. Lines shall be broken in such a manner as to release pressure away from the employee. All solids or liquids drained shall be safely collected. This procedure is called “double block and bleed.”

- b. If it is possible for pressure or line material to enter the work area from more than one direction, the line in each direction of travel shall be “double blocked and bled” as described above.
- c. In the event that “double block and bleed” procedures are infeasible (i.e., the line is not provided with adequate valving), alternative measures shall be implemented. One alternate measure is to place a solid “blind” in a flange located between the available upstream valve and the work area. If blinds are used they shall be sufficiently corrosion and pressure-resistant to ensure that if the valve leaks, the blind will stop the material or pressure from reaching the work area.

- **Stored Mechanical Energy**

In situations where equipment to be worked on has stored mechanical energy (e.g., in a flywheel or drop hammer), the stored energy must be released or blocked in a safe manner before starting maintenance or installation work. Effective blocking practices may include the installation of safety blocks or adequate supports. Under no circumstances will “bumper jacks” or “scissor jacks” be considered to be adequate blocks.

E. Training

Additional requirements for unqualified persons. Employees who are not qualified persons shall also be trained in and be familiar with any electrically related safety practices not specifically addressed by 1910.331 through 1910.335 but which are necessary for their safety.

Employees shall be trained in and be familiar with the safety-related work practices required by 1910.331 through 1910.335 that pertain to their respective job assignments, and:

1. Personnel who work around electrical equipment who face a risk of electric shock but who are not qualified and do not perform a primary duty of electrical system installation or maintenance will be trained and be familiar with electrically related safety practices and on the hazards of electricity and the proper precautions to observe.

2. Employees shall be trained in safety related work practices that pertain to their respective job assignment.
3. Employees shall be trained regarding clearance distances around electrical equipment.
4. Each authorized employee who will use a lock-out/tag-out procedure must receive training in the recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, and the methods and means necessary for isolation and control.
5. Employees must be retrained whenever there is a change in their job assignment; a change in machines, equipment, or processes that present a new hazard; or when there is a change in the lock-out/tag-out procedures.

Additional requirements for qualified persons.

Qualified persons (i.e. those permitted to work on or near exposed energized parts) shall, at a minimum, be trained in and familiar with the following:

- The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment.
- The skills and techniques necessary to determine the nominal voltage of exposed live parts, and
- The clearance distances specified in OSHA Regs. 29 CFR 1910.333(c) and the corresponding voltages to which the qualified person will be exposed.

Note 1: For the purposes of OSHA Regs. 29 CFR 1910.331 through 1910.335, a person must have the training required by paragraph (b)(3) of this section in order to be considered a qualified person.

Note 2: Qualified persons whose work on energized equipment involves either direct contact or contact by means of tools or materials must also have the training needed to meet OSHA Regs. 29 CFR 1910.333(C)(2).

Type of training. The training required by this section shall be of the classroom or on-the-job type. The degree of training provided shall be determined by the risk to the employee.

TABLE B. -- Typical Occupational Categories of Employees
Facing a Higher Than Normal Risk of Electrical Accident

<u>Occupation</u>
Blue collar supervisors(1)
Electrical and electronic engineers(1)
Electrical and electronic equipment assemblers(1)
Electrical and electronic technicians(1)
Electricians
Industrial machine operators(1)
Material handling equipment operators(1)
Mechanics and repairers(1)
Painters(1)
Riggers and roustabouts(1)
Stationary engineers(1)
Welders

Footnote(1) Workers in these groups do not need to be trained if their work or the work of those they supervise does not bring them or the employees they supervise close enough to exposed parts of electric circuits operating at 50 volts or more to ground for a hazard to exist.

ALL EMPLOYEES

Housekeeping

1. Use caution signs/cones to barricade slippery areas.
2. Do not store or leave items on stairways.
3. Return tools to their storage places after using them.
4. Do not block or obstruct stairwells, exits or accesses to safety and emergency equipment such as fire extinguishers or fire alarms.
5. Do not place materials such as boxes or trash in walkways and passageways.
6. Do not use gasoline for cleaning purposes.
7. Mop up water around drinking fountains, drink dispensing machines and ice machines.

Lifting Procedures

General

1. Test the weight of the load before lifting by pushing the load along its resting surface.
2. If the load is too heavy or bulky, use lifting and carrying aids such as hand trucks, dollies, pallet jacks and carts, or get assistance from a co-worker.
3. Never lift anything if your hands are greasy or wet.
4. Wear protective gloves when lifting objects with sharp corners or jagged edges.

When lifting

1. Face the load.
2. Position your feet 6"-12" apart with one foot slightly in front of the other.
3. Bend at the knees, not at the back.
4. Keep your back straight.
5. Get a firm grip on the object using your hands and fingers. Use handles when they are present.
6. Hold the object as close to your body as possible.
7. Perform lifting movements smoothly and gradually; do not jerk the load.
8. If you must change direction while lifting or carrying the load, pivot your feet and turn your entire body. Do not twist at the waist.
9. Set down objects in the same manner as you picked them up, except in reverse.
10. Do not lift an object from the floor to a level above your waist in one motion. Set the load down on a table or bench and then adjust your grip before lifting it higher.

Ladders and Step Ladders

1. Read and follow the manufacturer's instructions label affixed to the ladder if you are unsure how to use the ladder.
2. Do not use ladders that have loose rungs, cracked or split side rails, missing rubber foot pads, or are otherwise visibly damaged.