Electrical Safety Program

Wetherbee
electric inc.

Purpose

To establish the minimum standards required to prevent hazardous electrical exposure to personnel, as well as to impart knowledge of requirements needed to work energized electrical jobs while giving information about proper safe work procedures.

Scope

This electrical safety program applies to all work performed by Wetherbee Electric, Inc. employees, regardless of the specific job site location.

General Safety

Electric Hazards

- Electrical shocks and burns can occur as electricity passes through your body upon touching an energized source; high voltages passing through the head or chest can result in death and severe burns.
- An electrical arc flash can occur if a conductive object gets too close to a high-amp current source, resulting in air temperatures as high as 35,000 degrees Fahrenheit, and can ignite clothes or cause severe skin burns.
- Similar to an arc flash, arc blasts can occur when air that has been heated up mixes with the vaporization of metal, which can result in a pressure wave that can damage hearing and cause memory loss.
- Falls may occur if a worker is taken by surprise from an electrical shock or arc blast.

Electrical Safety Principles (for Energized Conditions)

- De-energize whenever possible.
- Thoroughly plan each and every job using a step-by-step procedure that is agreed upon by everyone involved; include a list of potential hazards.
- Identify and minimize electrical hazards.
- Ensure all workers receive proper training.

Responsibilities

Safety Director

- Evaluate work being performed and determine compliance with the details of this program.
- Provide and assist in the training for electrical work and general training.
- Review and update this program periodically.
- Evaluate the overall effectiveness of this program.

Responsibilities

Supervisors

- Promote electrical safety awareness to all employees and ensure compliance with all parts of this safety program.
- Ensure employees receive proper training for the electrical tasks they are assigned.
- Maintain a list of qualified employees and ensure they are provided with all the necessary protective equipment.

Employees

- Follow all the work practices as outlined in this program and attend all required training.
- Immediately report any concerns you may have related to electrical safety.

Training

Requirements: Any worker near an energized source or a potentially energized current of fifty volts or greater must be trained in energized electrical safety practices and retrained as needed.

Qualified Persons: Training must be given to workers in how to avoid electrical hazards associated with working on or near exposed energized parts before performing their first electrical task. Training needs to be provided when an employee is initially assigned to the job and refresher training shall be provided every three years. The following items should be included in the training process:

Training

- Working knowledge of the National Electric Code (NEC)
- The Lockout/Tagout Training Program
- Universal electrical safety procedures
- Knowledge of how to distinguish live electrical equipment from non-live equipment, as well as nominal voltage
- Distance to electrical equipment that is allowed depending on experience level
- The selection and use of proper work practices, equipment, tools, and other materials
- An understanding of the signs and symptoms of electric shock, burns, and other potential electrical health problems

Training

Documentation of Training and Experience: Documentation of training will be kept by the safety coordinator. Proper experience and training must be maintained for all personnel covered by the program, and proper documentation is necessary as proof of adequate training.

Program

Portable Electrical Equipment and Extension Cords

- Extension cords may only be used to provide temporary power and any cords must be visually inspected prior to any use, with any defective cords being removed from service right away.
- Extension cords must be of the three-wire type and designed for hard usage.
- Job-made extension cords are forbidden under the electrical code.
- A ground-fault circuit interrupter must be used for extension cords on construction sites or anywhere wet.
- Extension cords must be protected from damage and not placed anywhere hazardous.

Program

Portable Electrical Equipment and Extension Cords

- Cords must be covered by a cord protector or tape and when used with a grounding-type equipment, the cords must contain an equipment grounding connector.
- Attachment plugs and receptacles may not be connected in a way that compromises the system.
- Flexible cords may only be plugged into ground receptacles.
- All portable equipment and flexible cords that are used in highly conductive work locations must be approved for those locations.
- An employee's hands must be dry when plugging and unplugging flexible cords and energized components.

Program

Portable Electrical Equipment and Extension Cords

- If a current could provide a conductive path to an employee's hand, protective equipment must be worn when handling said equipment.
- Locking-type connectors must be properly locked into the connector.
- Illumination lamps must be protected from breakage and all metal sockets must be grounded.
- Temporary lights must not be suspended by their cords unless they are designed that way.

Program

Requirements for Temporary Wiring

Temporary electrical power and lighting installations of 600 volts or less may only be used during and for renovation, maintenance, repair, or experimental work. The following requirements also apply:

- Ground-fault protection (e.g. ground-fault circuit interrupters or GFCI) must be provided on all temporary-wiring circuits, including extension cords, used on construction sites.
- In general, all equipment and tools connected by cord and plug must be grounded.
- Feeders must originate in an approved distribution center that is rated for the voltages and currents the system is expected to carry.

Program

Requirements for Temporary Wiring

- Branch circuits must originate in an approved power outlet or panel board.
- Neither bare conductors nor earth returns may be used for the wiring of any temporary circuit.
- Receptacles must be of the grounding type unless they are installed in a complete metallic raceway, each branch circuit must contain a separate equipment-grounding conductor, and all receptacles must be electrically connected to the grounding conductor.
- Flexible cords and cables must be approved and suitable for the location and intended use.
- Suitable disconnecting switches or plug connects must be installed to permit the disconnection of all ungrounded conductors of each temporary circuit.

Program

Wet or Damp Locations

Work in wet or damp locations should not be performed unless it is absolutely critical. Electrical work should be postponed until the area is dry. The following special precautions must be incorporated while performing work in damp locations:

- Only use electrical cords that have Ground Fault Circuit Interrupters (GFCI).
- Place a dry barrier over any wet or damp work surface.
- Work is prohibited in areas with standing water.
- Don't use electrical extension cords in wet or damp locations.
- Keep electrical cords away from standing water.

Program

Working on De-Energized Equipment

Electrically Safe Condition: Assume all electronic objects are energized until every individual member agrees it isn't. Every circuit and conductor must be tested every time work is done on them. Proper equipment must be worn until the equipment is proven to be de-energized, including:

- Voltage rated gloves and leather protectors
- Electrically insulated shoes
- Approved insulating mats
- Safety glasses
- Any required Arc Flash PPE

Program

Working on De-Energized Equipment

Additionally, the National Fire Protection Association (NFPA) lists six steps to ensure conditions for electrically safe work:

1. Identify all sources of power to the equipment.
2. Check applicable up-to-date drawings, diagrams, and identification tags.
3. Remove the load current, and then open the disconnecting devices for each power source.
4. Where possible, visually verify that blades of disconnecting devices are fully open or that draw out-type circuit breakers are fully withdrawn.

Program

Working on De-Energized Equipment

5. Test each phase conductor or circuit part with an adequately rated voltage detector to verify that the equipment is de-energized.
6. Properly ground all possible sources of induced voltage and stored electric energy (such as, capacitors) before touching.

Program

Working on De-Energized Equipment

De-energizing is live work that may result in an arc-flash due to equipment failure. When de-energizing, follow the procedures described in "Working on or Near Live Equipment":

- **Lockout/Tagout Program**: Each facility shall establish a written lockout/tagout program and train employees in the program.
- **Lockout/tagout application**: Each person who could be exposed to electric energy must be involved in the lockout/tagout process.

Program

Working on De-Energized Equipment

- After de-energizing, each employee at risk should apply an individual lockout/tagout device to each source of electric energy.
- The tag used in conjunction with a lockout or tagout device must have a label prohibiting unauthorized operation of the disconnecting means or unauthorized removal of the device.
- Before beginning work, each involved employee must verify through testing that all energy sources have been de-energized.

Program

Working on De-Energized Equipment

Individual qualified-employee control procedure: For minor servicing, maintenance, inspection, and more, work may be done without attaching lockout/tagout devices if the plug is next to where the employee is working, is always easy to see, and the equipment is never left alone while being serviced.

Program

Working on De-Energized Equipment

Complex lockout/tagout procedures: Special procedures are needed when there is more than one energy source, crew, craft, location, employer, way to disconnect, or lockout/tagout procedure. In any of these cases, one qualified person should be in charge of the lockout/tagout procedure with full responsibility for ensuring all energy sources are under lockout/tagout and to account for all people on the job (including a written detail of the job).

Program

Working on De-Energized Equipment

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Program

Working on De-Energized Equipment

Removal of lockout/tagout devices: Lockout and tagout devices should be removed only by the person installing them. If work is not completed when the shift changes, workers arriving on shift should apply their locks before departing workers remove their locks.

Program

Working on De-Energized Equipment

Return to service: Once work is completed and lockout/tagout devices removed, tests and visual inspection must confirm that all tools, mechanical restraints, electric jumpers, shorts, and grounds have been removed. Only then is it safe to re-energize and return to service.

Program

Vehicular and Mechanical Equipment

When work must be performed near overhead lines, the lines shall be de-energized and grounded, or other protective measures shall be provided before work is started, and arrangements will be made with the owners of the lines to de-energize and ground them.

Elevated Equipment: Where any vehicle or mechanical equipment structure will be elevated near energized overhead lines, they shall be operated so that the Limited Approach Boundary is maintained. However, under any of the following conditions, the clearances shall be permitted to be reduced:

Program

Vehicular and Mechanical Equipment

- If the vehicle is in transit with its structure lowered, the Limited Approach Boundary distance to the overhead lines shall be permitted to be reduced by 6 ft. If insulated barriers are installed and they are not part of an attachment to the vehicle, the clearance shall be permitted to be reduced to the design working dimensions of the insulating barrier.
- 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 un-insulated portion of the aerial lift and the power line) shall be permitted to be reduced to the Restricted Approach Boundary

Program

Vehicular and Mechanical Equipment

- 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.

Program

Vehicular and Mechanical Equipment

Equipment Contact: Employees standing on the ground shall not contact the vehicle or mechanical equipment or any of its attachments, unless either of the following conditions applies:

- The employee is using protective equipment rated for the voltage.
- The equipment is located so that no un-insulated part of the structure (that portion of the structure that provides a conductive path to employees on the ground) can come within a hazard zone.

Program

Vehicular and Mechanical Equipment

Equipment Grounding: If any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines is intentionally grounded, employees working will not stand near the grounding zone or in the hazard zone.

Working on or Near Energized Equipment

Working on live circuits means actually touching energized parts. Working near live circuits means working close enough to energized parts to pose a risk even though work is on de- energized parts. Common tasks where there may be a need to work on or near live circuits include:

- Taking voltage measurements
- Opening and closing disconnects and breakers
- Racking breakers on and off the bus
- Removing panels and dead fronts
- Opening electric equipment doors for inspection

Important Boundaries

- The **Limited Approach Boundary** is the distance from an exposed live part within which a shock hazard exists.
- The **Restricted Approach Boundary** is the closest distance to exposed live parts a qualified person can approach with without proper PPE and tools. Inside this boundary, accidental movement can put a part of the body or conductive tools in contact with live parts or inside the prohibited approach boundary.
- The **Prohibited Approach Boundary** is the minimum approach distance to exposed live parts to prevent flashover or arcing. Approaching any closer is comparable to making direct contact with a live part
- The **Flash Protection Boundary** is the approach limit at a distance from exposed live parts within which a person could receive a second degree burn if an electrical arc flash were to occur.

Other Precautions

- If the parts cannot be de-energized, barriers such as insulated blankets must be used to protect against accidental contact or protective equipment must be worn.
- Employees shall not reach blindly into areas that might contain exposed live parts.
- Employees shall not enter spaces containing live parts unless illumination is provided that allows the work to be performed safely.
- Conductive articles of jewelry and clothing shall not be worn
- Conductive materials, tools, and equipment that are in contact with any part of an employee's body shall be handled in a manner that prevents accidental contact with live parts.
- When an employee works in a confined space or enclosed spaces (such as a manhole or vault) that contains exposed live parts, the employee shall use any protective equipment needed to avoid touching parts.

Energized Electrical Equipment Program Implementation

Implementation Procedures

1. Immediately place danger labels on equipment required to be labeled by NEC 110.16.
2. Until an arc flash hazard analysis can be made, a qualified person should determine the normal voltage of exposed energized electrical conducts and circuit
3. Determine the use of V-rated gloves
4. The Safety Manager/Officer shall complete an arc flash hazard analysis Collect data on the facility's power distribution system.

Energized Electrical Equipment Program Implementation

Arc Flash Hazard Analysis

- Arrangement of components on a one-line drawing with nameplate specifications of every device
- Contact the electric utility for information including the minimum and maximum fault currents that can be expected at the entrance to the facility
- Conduct a short circuit analysis followed by a coordination study
- These equations produce the necessary flash protection boundary distances and incident energy to determine the minimum PPE requirement.

Energized Electrical Equipment Program Implementation

Arc Flash Hazard Analysis

- The arc flash hazard analysis is a responsibility of the Safety Manager/Officer.
- The arc flash hazard analysis shall be done for all new electrical system installations.

Site Managers should evaluate the condition of their electrical equipment and petition the Safety Manager/Officer to conduct the arc flash hazard analysis when considered immediately necessary. Reasons for conducting the analysis include the following:

Energized Electrical Equipment Program Implementation

Arc Flash Hazard Analysis

Site Managers should evaluate the condition of their electrical equipment and petition the Safety Manager/Officer to conduct the arc flash hazard analysis when considered immediately necessary. Reasons for conducting the analysis include the following:

- Some equipment may be old, possibly in poor condition creating a greater potential for flashover.
- Equipment is requiring greater than average maintenance.
- Frequent use of high hazard/risk category personal protective equipment during the conduct of maintenance.

Personal Protective Equipment

Employees working in areas where potential electrical hazards can occur must be provided with personal protective equipment that is proper for the type of work to be performed. Examples of PPE include:

- Flame retardant shirt and pants
- Cotton underwear
- Flame retardant coveralls

Nonconductive head protection should be worn whenever there is a danger of head injury or electric burns.

Personal Protective Equipment

Flame-Resistant Apparel & Underlayers: Inspect flame-resistant apparel before each use and, if damaged, throw out the protective coverings right away. When worn, this should cover all ignitable clothing and be easily removable.

Rubber Insulating Equipment: Inspect this equipment before potential use and test the equipment at the standard time.

Personal Protective Equipment

Insulated Tools and Materials: These tools must be rated for the exact voltages on which they are used.

Access Limiting Equipment: Barriers shall be used to block off areas that cannot be entered by unqualified personnel. Attendants should always be present to ensure no one crosses where they shouldn't.

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We are your single source integrator for parking access, security, and electrical projects.

Wetherbee Electric, Inc. was established in Oklahoma in 1899. For over 120 years, our company has been shaped by a tradition of excellence. Wetherbee Electric has cultivated strong relationships inside Oklahoma and out.

Our construction projects have ranged from Montana to Texas, and California to Maine. We even have offshore experience in Puerto Rico and the Isle of Trinidad.

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