



## **TOOL BOX SAFETY TOPIC**

### **ELECTRICAL SAFETY**

#### **Introduction:**

OSHA's General Industry Standards for Electrical Safety in the workplace are found in 29 CFR 1910.301-399 (Subpart S). Similarly, OSHA's Construction Industry Standards in 29 CFR 1926.400-449 (Subpart K) address electrical safety requirements that are necessary for the practical safeguarding of employees involved in construction work.

Employees can be exposed to electrical hazards while working on a jobsite. Electricity on a jobsite can come from generators, temporary power sources, and existing power sources. Care must be taken when working on or near energized parts, when using electricity in damp or wet conditions, when using extension cords, and power tools, and during excavation because of unknown underground power sources.

Without exception, the employer is responsible for ensuring the safety of assigned workers.

## **Causal Factors:**

OSHA has found that the most frequent causes of electrical injuries are:

- Contact with power lines
- Failure to de-energize electric circuits and equipment before working on them
- Lack of ground-fault protection
- Path to ground is missing or discontinuous
- Equipment not being used in the manner prescribed
- Improper use of extension and flexible cords

Risk taking is a common thread that is most often a secondary cause of all electrical injuries.

Furthermore, accidents might be the result of potentially hazardous conditions such as inadequate lighting, defective equipment, or poor access. Fatigue and environmental factors like heat and cold can also be contributing factors.

## **Written Program:**

Employers should establish a written electrical safety program to minimize potential employee exposures to serious workplace hazards such as electrocution, shock, arc-blast, fires or explosions from electrical equipment.

## **Training requirements:**

Safety-related work practices for general industry, including training requirements for employees, are covered in 29 CFR 1910.331-360. Safety related work practices for construction are located in 29 CFR 1926.416. 29 CFR 1926.417 covers lockout and tagging of circuits.

Employees should be trained in and familiar with the safety-related work practices that pertain to their respective job assignments. OSHA standards define a qualified person as one familiar with the construction and operation of the equipment and the hazards involved (see 29 CFR 1910.399 and 29 CFR 1926.449).

## **General requirements:**

### **Examination, Installation, and Use of Equipment**

Electrical equipment must be maintained free from recognized hazards that are likely to cause death or serious physical harm to workers. Frequent and periodic inspections of electrical

installations and review of work procedures in use by personnel will allow the employer to establish and maintain safe working conditions.

Items for inspection should include but not be limited to:

- Inspection of work areas for sufficient access and working space about all equipment to permit ready and safe operation and maintenance of electrical equipment.
- Identifying the correct work procedures and the personal protective equipment (PPE) that will be needed.
- All portable electric tools and their cords must be inspected prior to each use.
- All extension cords and cables must be intact with no cuts, breaks, or incorrect splices. Never file or bend the plug blades or cutoff the grounding pin (third prong) of an extension cord or appliance to plug it into an old-style, two-wire outlet, which does not include an equipment grounding conductor.
- Extension cords, portable tools, and trouble lights should be plugged into GFCI protected receptacle outlets.
- Extension cord sets used with portable electric tools and appliances must be of three-wire type and shall be designed for hard or extra-hard usage.
- Any flexible cord or cable passing through doorways or other pinch points must be protected with sufficient padding or other means to avoid damage.
- Lights for general use must be protected from accidental contact or breakage. Protection is to be provided by elevation of 7 feet or by a suitable guard.
- All pull boxes, junction boxes, and fittings must be provided with tight-fitting covers approved for the purpose. Any openings in pull boxes, junction boxes, or panel boxes are to be covered.
- Disconnecting or disengaging means need to be identified, intact, and functioning.

## **Ground-Fault Protection for Personnel:**

An electrical shock and electrocution hazard exists when no third wire, grounding conductor is used. If a fault occurs in a tool a worker is holding, the current will follow the path of resistance, through a worker's hands or feet, or both, and then back to the electric service via ground.

OSHA standards require that employers protect their employees from ground faults on construction sites (and for construction-like activities in general industry) by using ground fault circuit interrupters (GFCIs) for receptacle outlets. Receptacle outlets, which are not a part of the permanent wiring of the building or structure and which are in use by employees, must

have approved GFCIs for personnel protection. Where the GFCI protection is not available the employer must establish and implement an assured equipment grounding conductor program (AEGCP).

A **GFCI** is the only electrical protective device whose sole purpose is to protect people from electrocution. The GFCI is a solid-state, sensitive device designed to open the circuit in case of ground-fault leakage current too small to trip the circuit breaker (but large enough to be dangerous to personnel). The GFCI protects personnel by opening the circuit when current flows through a ground-fault path.

The GFCI will open the circuit if 5 mA or more of current returns to the electric service by any path other than the intended white (neutral) wire. If the equipment grounding conductor is properly installed and maintained the branch circuit breaker will trip (open) the circuit as soon as the faulty tool is plugged in. If by chance this grounding conductor is not intact as a low-impedance path, the GFCI might not trip until a person provides the path. In this case, the person will receive a shock, but the GFCI should trip out so quickly that the person will not be electrocuted. GFCIs are also effective in protecting workers using double-insulated tools.

GFCI receptacles which are fixed and not exposed to damage must be tested at intervals not exceeding 6 months; otherwise, GFCIs must be tested before each use and at intervals not to exceed 3 months. Follow manufacturer's recommended testing procedure to insure the GFCI is working correctly.



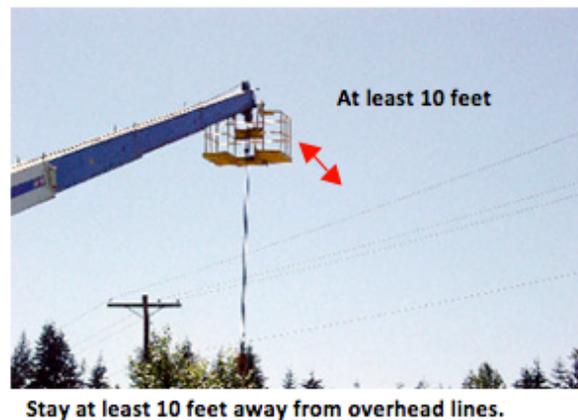
Two types of ground fault circuit-interrupter protective devices.

Where workers are protected by GFCI devices, it is also acceptable and recommended to implement the AEGC program. Should one method of protection – GFCIs or the AEGC program fail, the worker is still protected.

## **Electrical Safety- Related Work Practices:**

OSHA standards require that the employer must NOT permit an employee to work in such proximity to energized electrical conductors or circuit parts operating at 50 volts or more. Further, the employer must NOT permit an employee to work in situations where electrical hazards might exist. In general, live parts to which an employee may be exposed shall be de-energized before the employee works on or near them.

Authorized personnel when installing electrical equipment must use safe work practices and prescribed distances must be maintained. Equipment or circuits that are de-energized must be rendered inoperative (locked out) and must have tags attached at all points where such equipment or circuits can be energized. Employees should avoid the use of electrical equipment if working in wet conditions.



Employees must always regard all wires as live and dangerous, even if de-energized, when their source has NOT been locked out, tagged, and grounded or guarded effectively by insulation or other means.

## Working Around Overhead Lines:

Never go near a downed or fallen electric power line. Do NOT assume that a downed conductor is safe simply because it is on the ground or it is not sparking or humming. Always assume that it is energized. Touching it could be fatal. Do NOT assume that all coated, weatherproof, or insulated wire is just telephone, television, or fiber-optic cable.

If work is to be performed near overhead lines, the lines must be de-energized and grounded, or other protective measures must be provided before work is started. Lines may have insulators put on them by power companies.

When operating equipment or working near overhead lines, whether in an elevated position or on the ground, the person or a conductive object must not approach (an unguarded, energized line) closer than the following distances:

- For voltages to ground 50kV or less = 10 feet
- For voltages to ground over 50kV = 10 feet plus 4 inches for every 10kV over 50 kV

Any portable ladder used by an employee that could contact exposed energized parts must have non-conductive side-rails (wood or fiberglass).



Employees must not wear conductive articles of jewelry or clothing (**watch bands, bracelets, rings, key chains, necklaces, or metal hardhats**) if they might contact exposed energized parts, **unless** they are made non-conductive by means of covering, wrapping, or insulation.

Employees must not perform housekeeping duties at close proximity to exposed energized parts unless adequate safeguards (insulating equipment or barriers) are provided. Electrically conductive cleaning materials must not be used in proximity to energized parts unless procedures are followed which will prevent electrical contact.

### **Electrical Safety Test Questions**

1. Unqualified personnel can work on energized electrical equipment.

True

False

2. GFCI's are used to protect personnel from electrocution.

True

False

3. Extension cords must be visually inspected prior to each use.

True

False

4. Portable electric tools must be inspected before each use

True

False

5. Extension cords and their attachment plugs must have three conductors

True

False

6. Metal hard hats and jewelry can be worn on all jobsites even though they might contact exposed energized parts.

True

False

7. Wet locations do not increase the risk of electric shock or electrocution.

True

False

8. Workers should stay back at least 10 feet from overhead power lines.

True

False

9. Unqualified personnel can work on equipment that is:

- a. De-energized and grounded
- b. Rendered inoperable by lockout
- c. Tagged to indicate that some is working on it and that it must not be turned on
- d. All of the above

## Answers:

1-F, 2-T, 3-T, 4-T, 5-T, 6-F, 7-F, 8-T, 9-d

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