
Training Curriculum

Electrical

Safety

Training

TABLE OF CONTENTS

Training Goal.....	2
Module A: Energized exposed electrical parts.....	2
Module B: Working on or near exposed electrical parts	2
Module C: Distinguishing exposed live parts	3
Module D: Determining the nominal voltage	4
Module E: Clearance distances: energized overhead lines	5
Module F: Illuminating your work areas	5
Module G: Working in confined spaces.....	6
Module H: Proper handling methods of conductive materials.....	6
Module I: Using nonconductive ladders.....	6
Module J: Hazards of wearing conductive apparel.....	6
Module K: Portable electrical equipment	7
Module L: Protective equipment.	8
Module M: Alerting techniques	8

Training

Electrical Safety Training

Training Goal

To provide safe work practices to be used while working on or near energized exposed electrical parts.

Safety Director's Responsibility

To ensure that workers who work on or near energized and de-energized electrical parts are trained on what safeguards to use when working in the proximity of these potential hazards.

Module A: Energized exposed electrical parts

Define an energized exposed electrical part.

Contents: Lecture on the definitions of: exposed parts, live or energized parts, de-energized exposed parts and exposed parts that are de-energized but are not locked/tagged out (considered energized exposed parts). Point out situations that could occur where employees may come into contact with energized or deenergized parts.

Trainer's Notes: The employee must know the difference between an "Authorized Employee" (29 CFR 1910.147) and a "Qualified Employee"(29 CFR 1910.333)

Module B: Working on or near exposed electrical parts

Explain procedures for working on or near exposed electrical parts.

Contents: Lecture employees on the duties of qualified workers. Include that live parts operating at less than 50 volts to ground do not need to be de-energized when the worker experiences no increased exposure to electrical burns or explosions due to electric arcs.

Explain that lockout/tagout procedures must be done by a qualified person where electricity is involved. Reference the Lockout/Tagout procedures that have been written for Institution.

Discuss the use of circuit breakers and similar devices for opening and closing electric power and lighting circuits.

- Explain that fuses, terminal lugs, cable connectors, and cable splice connections may not be used for the opening and closing of electric power and lighting circuits.
- Inform workers that a circuit can not be manually reenergized after the circuit protective device deenergized the circuit without first determining if the equipment and circuit can be safely energized.
- The repeated closing of circuit breakers and replacement of fuses is not allowed.
- Instruct qualified workers that over-current protection devices are not to be modified even on a temporary basis.

Trainer's Notes: Use specific location examples.

Module C: Distinguishing exposed live parts

Discuss the methods used to distinguish exposed live parts from other parts of electrical equipment.

Contents: Lecture and give a hands-on exercise of electrical detection tools.

Discuss the testing of electric circuits or equipment.

- This testing can only be performed by qualified persons.
- The testing equipment and instruments and their associated devices should be checked for defects and damage before use.
- All defective or damaged equipment or instruments and associated devices must be removed from service until repairs are made and it is safe for use.
- Instruct the qualified workers that these instruments and equipment must be rated for the circuits and equipment to which they will be connected.

Trainer's Notes: Equipment should include a volt/OHM meter and a polarity tester.

Module D: Determining the nominal voltage

Explain how to determine the nominal voltage of exposed live parts.

Contents: Lecture on OHMS law and how it differs when dealing with alternating and direct current. In order to understand what Ohms Law is all about you need to understand electricity and what makes Voltage, Current and Resistance in a circuit.

Include the following:

What is Current?- Current is the movement of electrons in a circuit. Electric current is the movement of electrons from one atom to another in a conductor. If you can visualize a piece of copper wire with billions of atoms and each one of them losing an electron and all the electrons jumping to other atoms, you will begin to see what current is. Current is the movement of electrons in a conductor. The name we give to current so we can talk about it is AMPERE and the symbol is I.

What is Resistance?- Resistance is the opposition of electron flow in a circuit and is based on the physical size of the conductors. Since current is the movement of free electrons in a circuit then the number of atoms in a wire make a big difference as to how many electrons can flow at any given time. The bigger the diameter a wire is, the more atoms there are in the wire, so the more free electrons. If we want to control the amount of current flowing in a circuit we can use smaller wire to allow less current and larger wire to allow more current. The name we give to this opposition is called RESISTANCE and the symbol is R. The amount of resistance is called OHMS.

What is voltage?- Voltage is the potential difference in a circuit and it is caused by the unbalanced state of atoms. When an electron leaves the orbit of an atom it leaves a hole or a positive charge. This hole or positive charge will attract any electron that comes close to it so that it can go back to a normal state. In order to have current flow you must have a source of atoms with missing electrons and you must have a source of negative electrons. If these sources of charges have a current path to flow through then the electrons will be attracted to the positive atoms to fill the holes. You need a complete circuit made of conductive material in order to have current flow and the current will flow from the negative source to the positive source.

AC current is a specific type of electric current in which the direction of the current's flow is reversed, or alternated, on a regular basis. Direct current is no different electrically from alternating current except for the fact that it flows in the same direction at all times.

Ohm's Law states that if you have **one volt** applied to a **one ohm** resistance the current will be **one amp**. Knowing that, it is possible to calculate the voltage,

resistance and current in a circuit if you know 2 of the values using the equations $V=I \times R$, $R=V/I$ and $I=V/R$

Trainer's Notes: Use both equipment and math exercises

Module E: Clearance distances: energized overhead lines

Inform the workers of clearance distances when working below unguarded, energized overhead lines.

Contents: Discuss the distances between the workers and the longest conductive object they may contact.

Explain the exceptions to the required distances when:

- the worker is wearing insulating protective equipment, such as but not limited to gloves and sleeves,
- the energized part is insulated from the worker and all conductive parts are at a different potential levels and
- the worker is insulated from all conductive objects at a different potential than the energized part.

Trainer's Notes: Clearance distances between energized equipment and self typically is 3 feet.

Module F: Illuminating your work areas

Inform workers that their work area must be properly illuminated so that they can clearly see what they are working on.

Contents: Lecture employees on not entering an area containing exposed energized parts unless the area is properly illuminated.

They should not work near exposed energized parts when it is poor illuminated or when an obstruction prevents one from seeing the work they are doing.

Trainer's Notes: Do not reach into blind areas.

Module G: Working in confined spaces

Contents: Describe procedures for working safely in enclosed or confined spaces.

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- Lecture on the barriers, shields, and insulation to be used for protection against coming in contact with exposed, energized parts.
 - Inform workers that doors, hinged panels, and other similar devices must be secured to prevent contact with exposed energized parts.

Trainer's Notes: Cover Confined Space Training

Module H: Proper handling methods of conductive materials

Contents: Discuss the proper handling methods of conductive materials and equipment.

- Explain that conductive materials or equipment that comes in contact with any part of their body must be carefully handled so that they do not come in contact with exposed, energized parts.
- Discuss the practices in place that protect employees while they are handling long dimensional conductive objects in areas with exposed energized parts.
- Provide information on insulation, guarding, and materials handling.

Trainer's Notes: Make sure employees understand the protective equipment available.

Module I: Using nonconductive ladders

Discuss the use of nonconductive ladders when working near or on electrical parts.

Contents: Lecture on the use of aluminum ladders.

Trainer's Notes: Train the employees on how to inspect ladders.

Module J: Hazards of wearing conductive apparel

Explain the hazards of wearing conductive apparel such as jewelry, metalized aprons, metal headgear, and cloth with conductive threads.

Contents: Lecture on company policy associated with working around exposed parts wearing conductive material.

Trainer's Notes: Discuss the "Path of Least Resistance" associated with electricity.

Module K: Portable electrical equipment

Inform the workers of the proper procedures for using portable electrical equipment.

Contents: Discuss equipment use including the proper handling of cords.

Explain inspections of portable cord- and plug-connected equipment and flexible cord sets.

- Check visually for external defectives such as loose parts, deformed and missing pins, damaged jacket or insulation.
- Inspect for internal defectives such as pinched or crushed outer jacket.
- Conduct inspections before use on every shift.
- Cord- and plug-connected equipment and flexible cord sets which remain connected and are not exposed to damage do not need to be visually inspected until they are relocated.
- Remove from service any defective equipment and do not use it until repairs have been made.
- Check the plug and receptacle-mating configuration before connection to ensure proper mating.
- Inform employees that flexible cords used with grounding-type of equipment must have an equipment grounding conductor.
 - Explain the proper way to use flexible cords with the equipment grounding connector.
 - Connecting or altering these devices is not allowed in order that the grounding pole can be inserted into slots intended for current carrying conductors.
 - Discuss the use of adaptors with equipment grounding connections.
 - Explain that adaptors with the ground missing or where the adaptor is not connected properly cannot be used.
- Discuss the types of portable electrical equipment and flexible cords that can be used in area where contact with water and conductive liquids is possible.
- Discuss the proper methods for plugging and unplugging cord- and plug-connected equipment and flexible cords: make sure hands are dry; do not pull plug out by the cord; handle with insulating protective equipment when the cord connector is wet; and secure locking-type connectors after connections.
- Discuss the use of flammable and combustible materials around electrical equipment.
 - Include information to control hazards of electrical equipment which could ignite flammable materials.

Trainer's Notes: Employees do not need to be electricians, but do need to know how to perform their job safely.

Module L: Protective equipment

Describe the protective equipment.

Contents: Lecture employees on protective equipment to be used. Be sure to include the limitations of the protective equipment.

- PPE used for electrical applications includes, but is not limited to headgear, eye or face protection, rubber insulating gloves, rubber insulating sleeves.
- Discuss inspecting protective equipment to ensure its reliability and safety.
- Instruct workers on the use of insulated tools or handling equipment around exposed energize parts. Protect the insulating material if it could be damaged.
- Protective shields, protective barriers, or insulating materials should be used to protect employees from electrical related injuries when: accidental contact, dangerous electrical heating, or arcing could occur.
- Explain that normally enclosed live parts must be guarded during maintenance.

Trainer's Notes: For electrical applications, review sections 1910.137 and 1910.335, Electrical protective equipment (See PPE Policy).

Module M: Alerting techniques

Describe the alerting techniques.

Contents: Explain and show the signs and markings employees will encounter while working on or near electrical equipment.

- Discuss the use of barricades to prevent or limit entry into an area containing exposed energize parts. Include that the barricades must be nonconductive.
- Discuss using attendants when barricades and signs do not provide sufficient warning.

Trainer's Notes: Discuss signs and the proper color codes and letter styles to be used.