Electrical Safety / Lock-out Tag-out

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About Speaker

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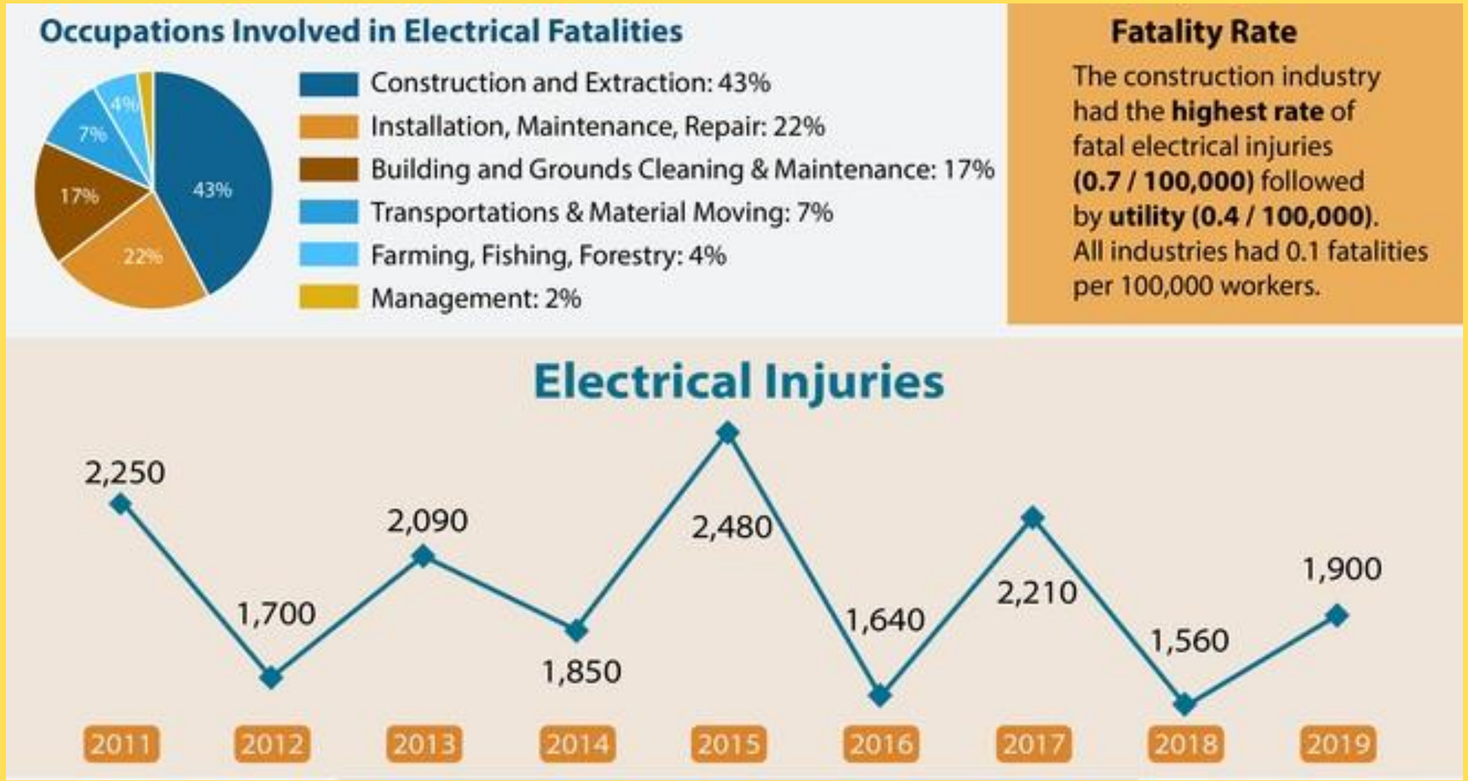
Agenda

- Statistics
- How Electricity Works
- Resistors
- Insulators / Conductors
- How Shock Occurs
- Shock & the Human Body
- Burns & Other Injuries
- Preventing Electrical Hazards
- Insulation
- Guarding
- Grounding
- Circuit Protection devices
- Safe Work Practices
- Overhead Lines
- Lock-out / Tag-out
- Care of Cords and Equipment
- Summary

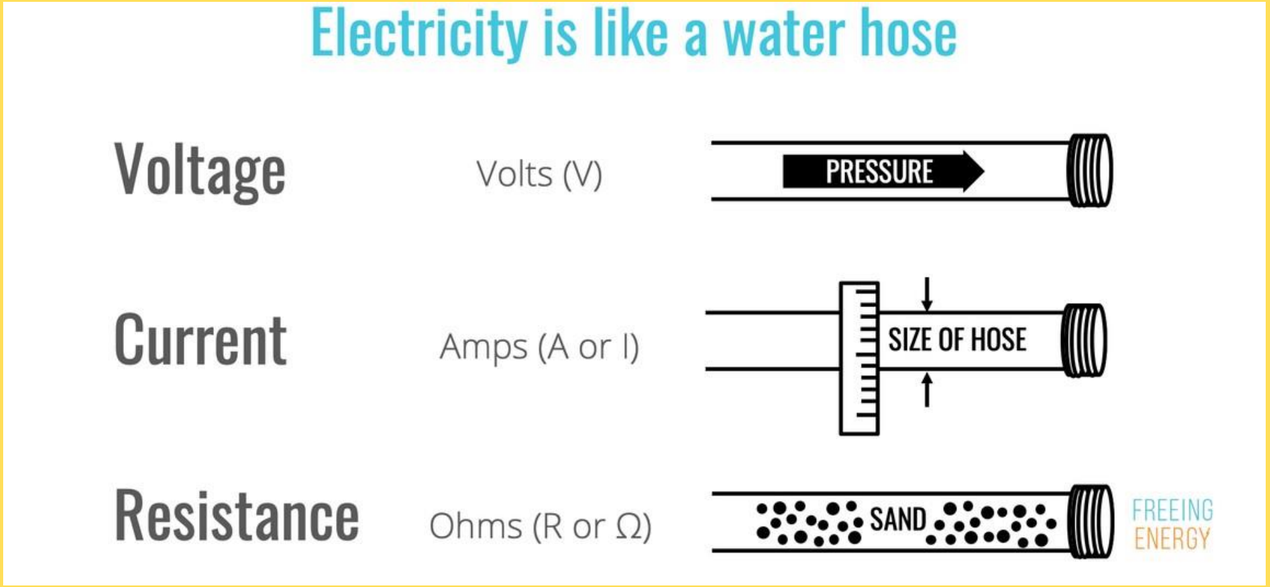
Statistics

- The construction industry had the highest rate of fatal electrical injuries
- some of the different occuations invoved in electrical fatalities



How Electricity works

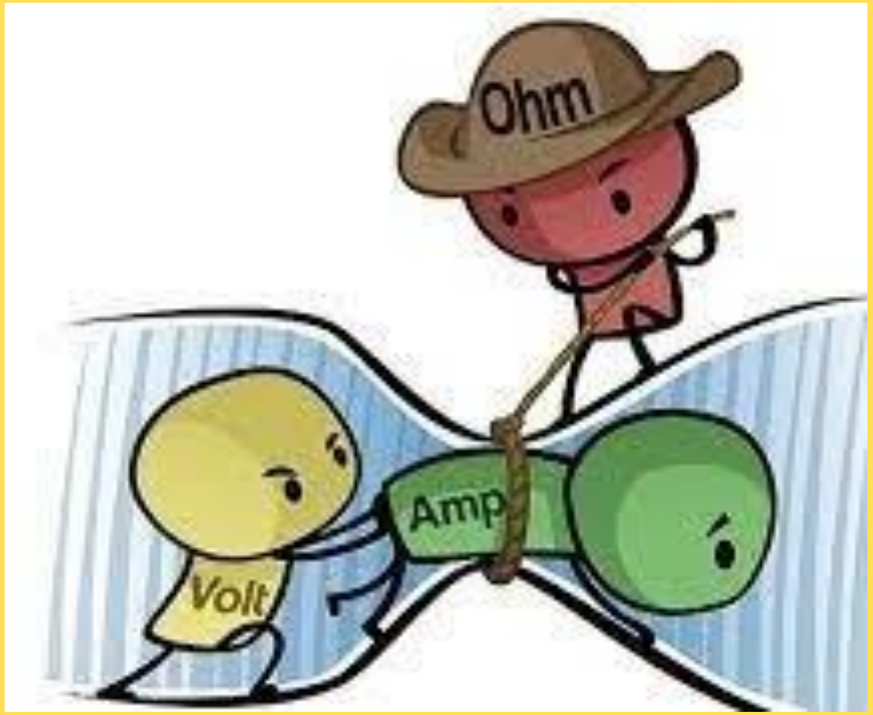
- Operating an electric switch may be considered analogous to turning on a water faucet.
- In the case of water, the source is a reservoir or pumping station
- For electricity, the source is the power generating station; current travels through electric conductors in the form of wires; and pressure, measured in volts, is provided by a generator.



Resistance

Resistance to the flow of electricity is measured in ohms and varies widely. It is determined by three factors:

- The nature of the substance itself
- The length and cross-sectional area (size) of the substance
- The temperature of the substance.



$$I = \frac{V}{R}$$

Insualtors / Conductors

- Substances, such as porcelain, wood, pottery, and dry wood, offer such a high resistance that they can be used to prevent the flow of electric current and are called insulators.
- When it is dry, the skin has a fairly high resistance to an electric current; but when it is moist, there is a radical drop in resistance.
- When water is present either in the environment or on the skin, anyone working with electricity should exercise even more caution than they normally would.

How Shock Occurs

- The severity of the shock received when a person becomes a part of an electric circuit is affected by three primary factors:

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  - The amount of current flowing through the body (measured in amperes
  - The path of the current through the body
  - The length of time the body is in the circuit

- Other factors that may affect the severity of shock are the:

  - Frequency of the current;
  - The phase of the heart cycle when shock occurs
  - The general health of the person

Shock & Human Body

- The effects of electric shock depend upon the type of circuit, its voltage, resistance, current, a pathway through the body, and duration of the contact.
- Effects can range from a barely perceptible tingle to immediate cardiac arrest.
- A difference of fewer than 100 milliamperes exists between a current that is barely perceptible and one that can kill.
- Muscular contraction caused by stimulation may not allow the victim to free himself or herself from the circuit, and the increased duration of exposure increases the dangers to the shock victim.

Shock & Human Body

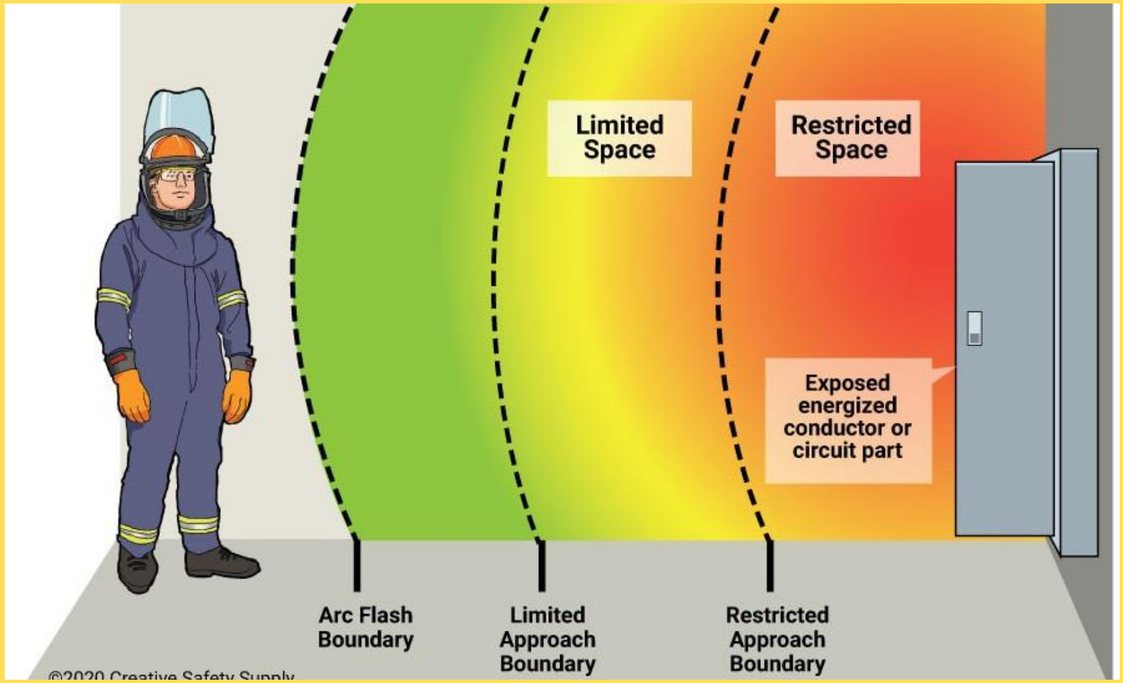
- A severe shock can cause considerably more damage to the body than is visible.
- For example, a person may suffer internal hemorrhages and the destruction of tissues, nerves, and muscles.
- In addition, shock is often only the beginning of a chain of events.
- The final injury may well be from a fall, cuts, burns, or broken bones
- The so-called low voltages can be extremely dangerous because, all other factors being equal, the degree of injury is proportional to the length of time the body is in the circuit.

LOW VOLTAGE DOES NOT IMPLY LOW HAZARD

Burns & Other injuries

The most common shock-related injury is a burn. Burns suffered in electrical accidents may be of three types:

- Electrical
- Arc
- Thermal contact



Burns & Other injuries

- Electrical burns are the result of the electric current flowing through tissues or bones.
- Tissue damage is caused by the heat generated by the current flow through the body.
- Arc or flash burns, on the other hand, are the result of high temperatures near the body and are produced by an electric arc or explosion.
- Finally, thermal contact burns are those normally experienced when the skin comes in contact with hot surfaces of overheated electric conductors, conduits, or other energized equipment.

Burns & Other injuries

- Electric shock can also cause injuries of an indirect or secondary nature in which involuntary muscle reaction from the electric shock can cause bruises, bone fractures, and even death resulting from collisions or falls.
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Preventing Electrical Hazards

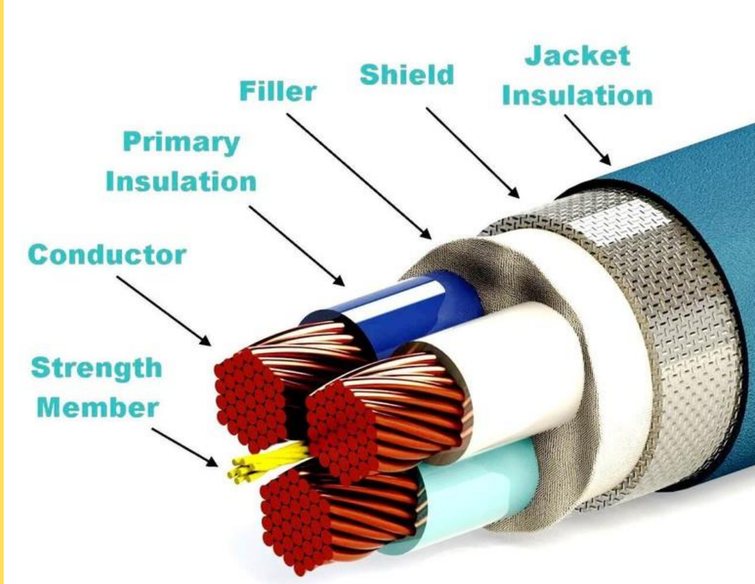
- Electrical accidents appear to be caused by a combination of three possible factors: unsafe equipment and/or installation; workplaces made unsafe by the environment; and unsafe work practices.
- There are various ways of protecting people from the hazards caused by electricity.
- These include: insulation; guarding; grounding; electrical protective devices; and safeworkpractices.

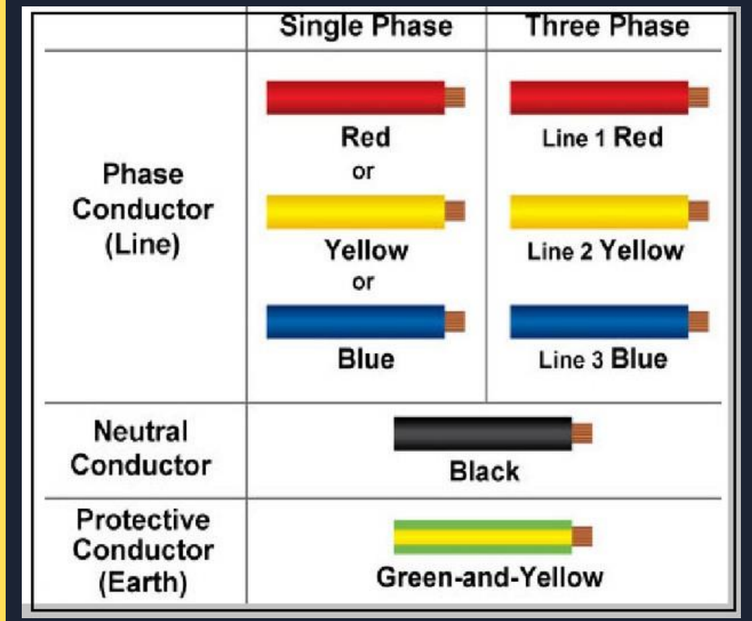
These include:

- Insulation
- Guarding
- Grounding
- Electrical protective devices
- Safe work practices.

Insulation

- One way to safeguard individuals from electrically energized wires and parts is through insulation.
- An insulator is any material with high resistance to electric current.
- Insulators such as glass, mica, rubber, and plastic, are put on conductors prevent shock, fires, and short circuits.
- Before you prepare to work with electric equipment, it is imperative to check the insulation before making a connection to a power source to be sure there are no exposed wires.
- The insulation of flexible cords, such as extension cords, is particularly vulnerable to damage.
- Conductors and cables are marked by the manufacturer to show the maximum voltage and American Wire Gage size, the type letter of the insulation, and the manufacturer's name or trademark.
- Insulation is often color coded. In general, insulated wires used as equipment grounding conductors are either continuous green or green with yellow stripes.
- Hot wires are often colored black or red



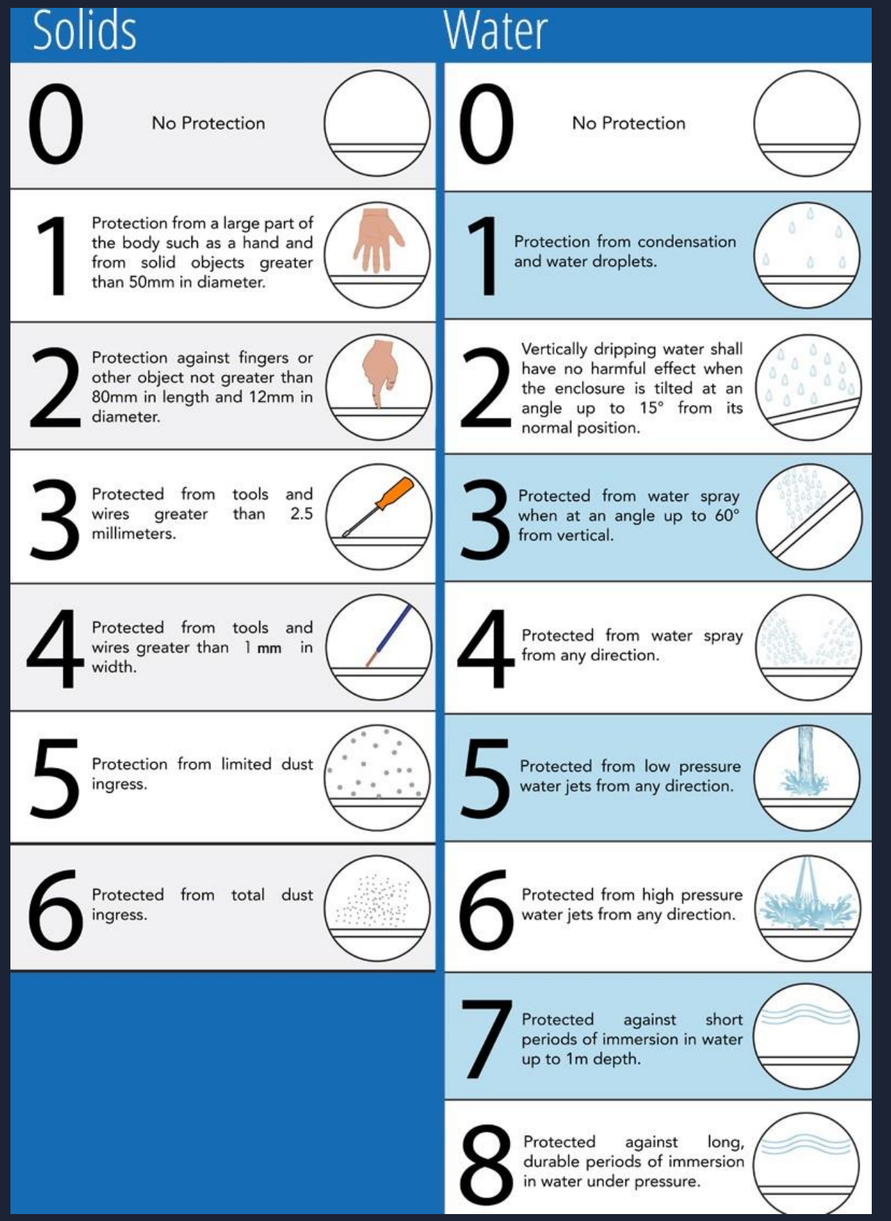


Gaurding

Live parts of electric equipment operating at 50 volts or more must be guarded against accidental contact. This is accomplished by:

- Location in a room, vault, or similar enclosure accessible only to qualified persons
- Use of permanent, substantial partitions or screens to exclude unqualified persons
- Entrances to rooms and other guarded locations containing exposed live parts must be marked with conspicuous warning signs forbidding unqualified persons to enter
- Indoor electric wiring of more than 600 volts, which is open to unqualified persons, must be made with metal-enclosed equipment or enclosed in a vault or area controlled by a lock. In addition, equipment must be marked with appropriate caution signs.

IP Protection



Grounding

- Grounding is another method of protecting you from electric shock.
- The "ground" refers to a conductive body, usually the earth, and means a conductive connection, whether intentional or accidental, by which an electric circuit or equipment is connected to earth or the ground plane.
- By "grounding" a tool or electrical system, a low-resistance path to the earth is intentionally created and this path offers sufficiently low resistance and has sufficient current carrying capacity to prevent the buildup of voltages that may result in a personnel hazard.
- This does not guarantee that no one will receive a shock, be injured, or be killed, but however, substantially reduce the possibility of such accidents, especially when used in combination with other safety measures discussed in this presentation.

Grounding

There are two kinds of required grounds:

- One of these is called the "service or system ground."
- In this instance, one wire-called "the neutral conductor" or "grounded conductor" is grounded. In an ordinary low-voltage circuit, the white (or gray) wire is grounded at the generator or transformer and again at the service entrance of the building.
- This type of ground is primarily designed to protect machines, tools, and insulation against damage.
- To offer enhanced protection, an additional ground, called the "equipment ground," must be
- furnished by providing another path from the tool or machine through which the current can flow to the ground.
- This additional ground safeguards the electric equipment operator in the event that a malfunction causes any metal on the tool to become accidentally energized.
- The resulting heavy surge of current will then activate the circuit protection devices and open the circuit.

Circuit Protection Devices

- Circuit protection devices are designed to automatically limit or shut off the flow of electricity in the event of a ground-fault,
- overload, or short circuit in the wiring system.
- Fuses, circuit breakers, and ground-fault circuit interrupters are three well-known examples of such devices
- The ground-fault circuit interrupter, or GFCI, is designed to shutoff electric power within as little as 1/40 of a second.
- It works by comparing the amount of current going to electric equipment against the amount of current returning from the equipment along the circuit conductors.
- If the current difference exceeds 6 milliamperes, the GFCI interrupts the current quickly enough to prevent electrocution

Circuit Protection Devices

EXTREMELY IMPORTANT

- Never remove a grounding device from any electrical source, tool, or equipment.
- Never remove the ground prong from an electrical cord or device of any kind.
- Never by-pass grounding or circuit breaker protection as any time.
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Safe Work Practices

Employees and others working with electric equipment need to use safe work practices. These include:

- Deenergizing electric equipment before inspecting or making repairs
- Using electric tools that are in good repair; using good judgment when working near energized lines
- Using appropriate protective equipment

Over Head Powerlines

- When mechanical equipment is being operated near over-head lines, employees standing on the ground may not contact the□equipment unless it is located so that the required clearance cannot be violated even at the maximum reach of the equipment.
- These employees and their mechanical equipment must stay at least 10 feet (3.05 meters) away from overhead power lines
- Employees, whose occupations require them to work directly with electricity, must use the personal protective equipment required for the jobs they perform.
- This equipment may consist of rubber insulating gloves, hoods, sleeves, matting, blankets, line hose, and industrial protective helmets

Lock Out Tag Out

- When a problem with a breaker occurs in an electrical panel, make sure the breaker is in the off position, place electrical tape (not other tape is allowed), over the breaker in such a manner so-as-to- not allow the breaker to be turned on without removal of the tape.
- Close the panel box, lock the panel cover if that feature is available, place a sign on the panel door noting the problem, the breaker number, and clearly indicate that the panel box is not to be opened by anyone but authorized and qualified repair personnel.
- Be sure the sign is attached to the cover in such a manner that it cannot fall off and must be physically removed. Attach the electrical lock-out tag to the panel cover in addition to the sign.
- Unless you are the qualified district electrician, this lock-out must not be removed or tampered with.

Lock Out Tag Out

- Lock any additional doors to the equipment, i.e. vault room, and place sign on the door indicating “No Admittance –Electrical Work in progress–Danger”
- In any electrical panel or breaker problem, report the problem to the site administrator, the custodial staff on all shifts, and the maintenance department.
- In the case of a non-emergency, a standard on-line work order can be used to notify the maintenance department.
- In the case of an emergency or urgent problem, call the maintenance department director for assistance and notification.
- In all cases, follow-up with an on-line work order and document the problem with dates, times, and names.
- The lock-out tag must include certain information.This includes the name of the person installing the tag.
- This tag can only be removed by the person originally installing it or a qualified electrician.

Lock Out Tag Out

- The removed tag must be returned to the custodial office and saved in a file that contains an explanation of:
- The electrical problem
- How the problem was handled
- Who found the problem
- Who installed the lock-out tag
- Who reported the problem
- Who repaired the problem
- Who removed the lock-out tag
- This is best served in an on-going report on the problem. Documentation is everything.

Care of Cords & Equipments

- Electrical within five (5) feet of any water source must have GFCI protection. Covers must be in place at all times.
- No flammable chemicals or liquids can be stored near electrical or in electrical service rooms.

Care of Cords & Equipments

- Power tools and extension cords must be inspected each time they are used.
- They must be taken out of service immediately upon discovery of worn or broken insulation
- Electrical panel boxes must be secured and problems reported immediately.
- Junction boxes, outlets, receptacles, and switches must be closed and problems reported.

Summary

- Electricity can be helpful and also dangerous, if not respected.
- Safety procedures must be followed in order to protect everyone when dealing with electrical.
- Lock-out / Tag-out procedures for electrical must be followed to help ensure safety and regulatory compliance.
- Lock-out / Tag-out includes other equipment besides electrical and must have the same reporting and documentation.