ELECTRICAL HAZARDS TRAINING

FIU OSHA - SUSAN HARWOOD TRAINING GRANT

DISCLAIMER

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AGENDA

- Welcome
- Introduction to OSHA
- Worker's rights
- Introduction to Electrical Hazards
  - ❑ What is electricity? How it works?
  - ❑ Preventing Electrocution
- Common Electrical Hazards
- Electrical Protective Equipment
- Exercises
- Certificates

INTRODUCTION TO OSHA

Overview of anti-retaliation provisions, employee rights, employer responsibilities, whistleblower laws, and OSHA's complaint investigation procedures

WHY IS OSHA IMPORTANT TO YOU?

- OSHA began because, until 1970, there were no national laws for safety and health hazards.
- On average, 12 workers die every day from job injuries
- Worker deaths in America are down–on average, from about 38 worker deaths a day in 1970 to 12 a day in 2013.
- **WORKER FATALITIES**
- 4,836 workers were killed on the job in 2015
- Falls — 364 out of 937 total deaths in construction in CY 2015 (38.8%)

DISCUSSION QUESTIONS

- When, during your work experience, did you first hear about OSHA?
- What did you think about OSHA then?
- What do you think OSHA's job is?

HISTORY OF OSHA

- OSHA stands for the Occupational Safety and Health Administration, an agency of the U.S. Department of Labor
- OSHA's responsibility is worker safety and health protection
- On December 29, 1970, President Nixon signed the OSH Act
- This Act created OSHA, the agency, which formally came into being on April 28, 1971

OSHA'S MISSION

- To save lives
- To prevent injuries
- To protect America's workers

STRATEGIES TO REDUCE INJURIES AND DEATHS

- Strong, fair, and effective enforcement.
- Outreach, education, and compliance assistance.
- Partnerships and other cooperative programs.

Labels for hazardous substances in your workplace

Labels for a hazardous chemical must contain:

- Name, Address and Telephone Number
- Product Identifier
- Signal Word
- Hazard Statement(s)
- Precautionary Statement(s)
- Pictogram(s)

OSHA INSPECTIONS

- The OSH Act authorizes OSHA compliance safety and health officers (CSHOs) to conduct workplace inspections at reasonable times.
- OSHA conducts inspections without advance notice, except in rare circumstances (e.g. Imminent Danger)
- In fact, anyone who tells an employer about an OSHA inspection in advance can receive fines and a jail term.

INSPECTIONS PROCESS

- A typical OSHA on-site inspection includes four stages:

1. Presentation of inspector credentials.
2. An opening conference.
3. An inspection walk-around.
4. A closing conference.

OSHA'S INSPECTION PRIORITIES

Priority	Category of Inspection
1st	**Imminent Danger:** *Reasonable certainty an immediate danger exists*
2nd	**Fatality/Catastrophe:** *Reported to OSHA; inspected ASAP*
3rd	**Complaints/Referrals:** *Worker or worker representative can file a complaint about a safety or health hazard*
4th	**Programmed Inspections:** *Cover industries and employers with high injury and illness rates, specific hazards, or other exposures.*

OSHA'S COMPLAINT INVESTIGATIONS

- OSHA evaluates each complaint to determine how it can be handled best--an off-site investigation or an on-site inspection
- Before beginning an inspection, OSHA staff must be able to determine from the complaint that there are reasonable grounds to believe that a violation of an OSHA standard or a safety or health hazard exists.
- If OSHA has information indicating the employer is aware of the hazard and is correcting it, the agency may not conduct an inspection after obtaining the necessary documentation from the employer.

RIGHTS AS A WHISTLEBLOWER

- Employee may file a complain with OSHA under Section 11(c) if your employer retaliates against you by taking unfavorable personnel action because you engaged in protected activity relating to workplace safety and health.
- OSHA requires that complaints must be filed within 30 days after the alleged retaliation.

RIGHTS AS A WHISTLEBLOWER

- Your employer may be found to have retaliated against you if your protected activity was a contributing or motivating factor in its decision to take unfavorable personnel action against you. Such actions may include:
  - ✧ Firing or laying off
  - ✧ Blacklisting
  - ✧ Denying overtime or promotion
  - ✧ Disciplining
  - ✧ Denying benefits
  - ✧ Failing to hire or rehire
  - ✧ Intimidation
  - ✧ Reassignment affecting promotion prospects
  - ✧ Reducing pay or hour

OBJECTIVES

- Given current OSHA and industry information regarding construction worksite illnesses, injuries and/or fatalities, the participant will be able to recognize electrocution hazards in construction.
  - – Identify major electrocution hazards
  - – Describe types of electrocution hazards
  - – Protect him/herself from electrocution hazards
  - – Recognize employer requirements to protect workers from electrocution hazards

ELECTRICITY

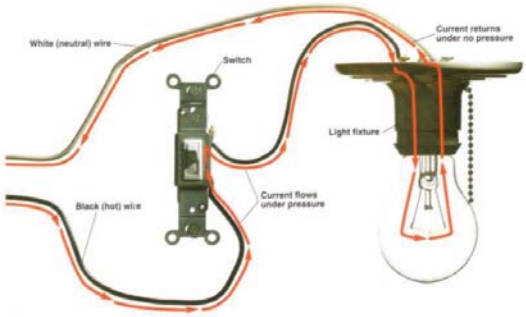
- Electricity is a natural energy force.
- Electricity is also a man made energy force.
- It is essential to modern life and taken for granted everyday.

ELECTRICITY

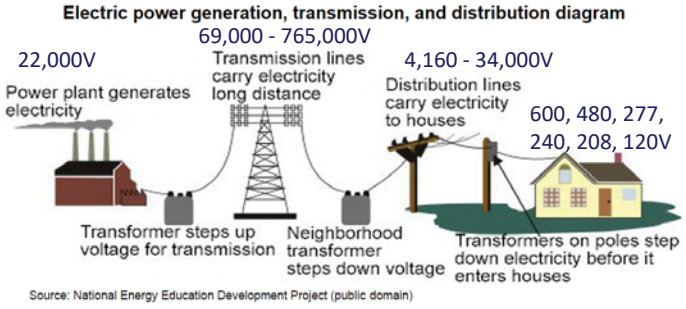
- How many tools, equipment, artifacts work with electricity?
- Some people make a living working with electricity, most people just around electricity
- Out of 3,945 worker fatalities in private industry in calendar year 2012, 775 or 19.6% were in construction. Electrocutions 66 (9%) of all on-the-job fatalities that year, according to the Bureau of Labor Statistics.

UNDERSTANDING ELECTRICITY

UNDERSTANDING ELECTRICITY



ELECTRICITY DISTRIBUTION

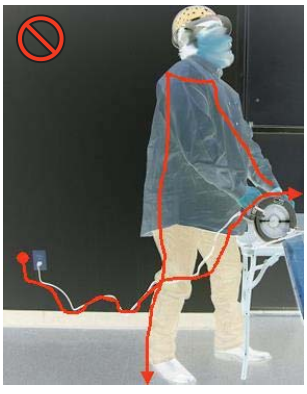


HOW ELECTRICITY WORKS

- When electrical tools are working properly a complete circuit is maintained between the tool and the energy source.

HOW ELECTRICITY WORKS

- However, if the tool is damaged the person may come in contact with the electricity and can become a path for the current.
- The person will be shocked!



DEFINITIONS

CIRCUIT

A continuous loop of electrical current flowing along wires or cables.

CURRENT

The movement of electrons along a conductor.

AMPERE (or amp)

Refers to the rate at which electrical power flows to a light, tool, or appliance.

VOLTAGE (or volts)

A measurement of electricity in terms of Pressure.

DEFINITIONS

WATTAGE (or watt)

A measurement of electrical power in terms of total energy consumed. Watts can be calculated by multiplying the voltage times the amps.

CONDUCTOR

Any material that allows electrical current to flow through it. Copper wire is an especially good conductor.

INSULATOR

Any material, such as plastic or rubber, that resists the flow of electrical current. Insulating material protect wires and cables.

OSHA STANDARDS

- OSHA's general industry electrical safety standards are published in Title 29 Code of Federal Regulations (CFR), Part 1910.302 through 1910.308 —Design Safety Standards for Electrical Systems, and 1910.331 through 1910.335 — Electrical Safety-Related Work Practices Standards.

OSHA STANDARDS

- OSHA's Construction industry electrical safety standards are published in Title 29 Code of Federal Regulations (CFR) 1926 Subpart K. Part 1926.400 through 1926.499

WHAT IS AN ELECTROCUTION HAZARD?

- Electrocution results when a person is exposed to a lethal amount of electrical energy.
- An electrical hazard can be defined as a serious workplace hazard that exposes workers to the following:
  - Burns
  - Electrocution
  - Shock
  - Arc Flash/Arc Blast
  - Fire
  - Explosions

BE SAFE

BE SAFE

•**B** = Burns:

• A burn is the most common shock-related injury. Burns from electricity are one of three types: Electrical, Arc/Flash or Thermal Contact.

•**E** = Electrocution:

• Electrocution is fatal; it means to kill with electricity. Electrocution results when a human is exposed to a lethal amount of electrical energy.

•**S** = Shock:

• Shock results when the body becomes part of the electrical circuit; current enters the body at one point and leaves at another. Electrical shock is defined as a reflex response to the passage of electric current through the body.

BE SAFE

•**A** = Arc Flash/Blast:
• An arc flash is the sudden release of electrical energy through the air when a high-voltage gap exists and there is a breakdown between conductors. An arc flash gives off thermal radiation (heat) and bright, intense light that can cause burns. Temperatures have been recorded as high as 35,000 °F. High-voltage arcs can also produce considerable pressure waves by rapidly heating the air and creating a blast.
•**F** = Fire:
• Most electrical distribution fires result from problems with "fixed wiring" such as faulty electrical outlets and old wiring. Problems with cords (such as extension and appliance cords), plugs, receptacles, and switches also cause electrical fires.
•**E** = Explosions:
• An explosion can occur when electricity ignites an explosive mixture of material in the air.

WHAT ARE THE MAJOR TYPES OF ELECTROCUTION HAZARDS IN CONSTRUCTION?

- contact with power lines,
  – specially with overhead or buried
- contact with energized sources,
  – could cause electrical shock and burns or death
- faulty extension cords,
- improper grounding of equipment
- overloaded circuits
- wrong use of PPE and/or tools
- wet/damp areas in the vicinity of electrical sources

COMMONLY CITED VIOLATIONS

- 1910.305(b)(1): Unused openings
- 1910.303(g)(2): Exposed live parts
- 1910.305(b)(2): Missing covers
- 1910.304(f): Defective Ground
- 1910.305(g)(1)(iii): Prohibited uses of flexible cords.

COMMONLY CITED VIOLATIONS

- 1910.303(f): Unlabeled disconnects
- 1910.305(g)(2)(iii): Strain relief
- 1910.303(b)(2): Listed & labeled
- 1910.303(b)(1): General Duty Clause
- 1910.303(g)(1): Access & working space.

BODY REACTION TO ELECTRICITY

(1,000 milliamperes = 1 amp; therefore, 15,000 milliamperes = 15 amp circuit)

Current	Reaction
Below 1 milliampere	Generally not perceptible
1 milliampere	Faint tingle
5 milliampere	Slight shock felt; not painful but disturbing. Average individual can let go. Strong involuntary reactions can lead to other injuries.
6-25 milliamperes (women)	Painful shock, loss of muscular control
9-30 milliamperes (men)	The freezing current or "let-go" range. Individual cannot let go, but can be thrown away from the circuit if extensor muscles are stimulated.
50 150 milliamperes	Extreme pain, respiratory arrest, severe muscular contractions. Death is possible.
1,000 - 4,300 milliamperes	Rhythmic pumping action of the heart ceases. Muscular contraction and nerve damage occur; death likely.
10,000 milliamperes	Cardiac arrest, severe burns; death probable

HOW DOES WATER AFFECT THE FLOW OF ELECTRICITY?

- Pure water is a poor conductor. But small amounts of impurities in water like salt, acid, solvents, or other materials can turn water itself and substances that generally act as insulators into conductors or better conductors.
- Dry wood, for example, generally slows or stops the flow of electricity. But when saturated with water, wood turns into a conductor. The same is true of human skin. Dry skin has a fairly high resistance to electric current. But when skin is moist or wet, it acts as a conductor. This means that anyone working with electricity in a damp or wet environment needs to exercise extra caution to prevent electrical hazards.

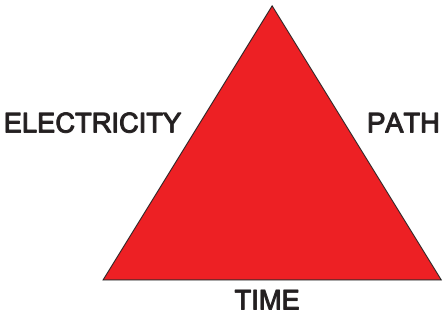
WHAT CAUSES SHOCKS?

- Electricity travels in closed circuits, normally through a conductor. But sometimes a person's body — an efficient conductor of electricity — mistakenly becomes part of the electric circuit. This can cause an electrical shock. Shocks occur when a person's body completes the current path with:
  - both wires of an electric circuit;
  - one wire of an energized circuit and the ground;
  - a metal part that accidentally becomes energized due, for example, to a break in its insulation; or
  - another "conductor" that is carrying a current.
- When a person receives a shock, electricity flows between parts of the body or through the body to a ground or the earth.

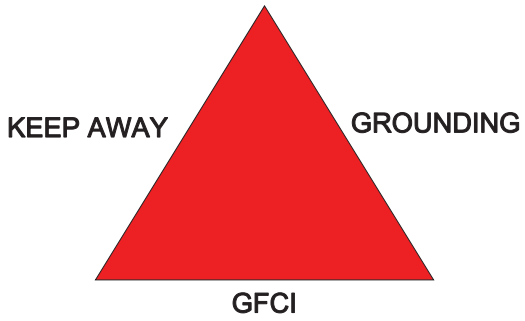
IMPROPER USE OF EXTENSION AND FLEXIBLE CORDS

- Because they are exposed, flexible, and unsecured, they are more susceptible to damage than fixed wiring. Hazards are created when cords, cord connectors, receptacles, and cord- and plug connected equipment are improperly used and maintained.
- To reduce hazards, flexible cords must connect to devices and to fittings in ways that prevent tension at joints and terminal screws.

ELECTROCUTION TRIANGLE



PROTECTIVE TRIANGLE



HOW CAN I PROTECT MYSELF FROM ELECTROCUTION HAZARDS?

A. Maintain a safe distance from overhead power lines

B. Use ground-fault circuit interrupters (GFCI)

C. Inspect portable tools and extension cords

D. Use power tools and equipment as designed

E. Follow lockout/tagout procedures

MINIMUM CLEARANCE DISTANCES

Voltage (nominal, kV, alternating current)	Minimum clearance distance (feet)
Up to 50	10
Over 50 to 200	15
Over 200 to 350	20
Over 350 to 500	25
Over 500 to 750	35
Over 750 to 1000	45
Over 1000	(As established by the power line owner/operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution)

HOW CAN I PROTECT MYSELF FROM ELECTROCUTION HAZARDS?

- Before work begins, be sure that the:
  - Equipment/activity is located within a safe working distance from power lines
  - Utility company has de-energized and visibly grounded the power lines or installed insulated sleeves on power lines
  - Flagged warning lines have been installed to mark horizontal and vertical power line clearance distances
  - Tools and materials used are nonconductive

HOW CAN I PROTECT MYSELF FROM ELECTROCUTION HAZARDS?

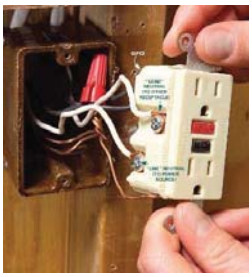
- Verify the height of power lines and their proximity to cranes and lifting equipment
- Use non-conductive ladders and retract them before moving them
- Call utility companies before excavating
- Hand dig within 3 ft of any cable location. More than one underground cable may be buried in area of locator markings

HOW CAN I PROTECT MYSELF FROM ELECTROCUTION HAZARDS?

- Use ground-fault circuit interrupters (GFCI)
- A "GFCI" is a ground fault circuit interrupter that is designed to protect people from severe and sometimes fatal electrical shock. A GFCI detects ground faults and interrupts the flow of electric current, and is designed to protect the worker by limiting the duration of an electrical shock.
- There are three types of GFCI: receptacle, temporary/portable, and circuit breaker

HOW CAN I PROTECT MYSELF FROM ELECTROCUTION HAZARDS?

1) Receptacle GFCI: Often found on construction work sites, outdoor areas and other locations where damp conditions do or could exist. The receptacle GFCI fits into the standard outlet box and protects users against ground faults when an electrical product is connected to the GFCI protected outlet



HOW CAN I PROTECT MYSELF FROM ELECTROCUTION HAZARDS?

2) Temporary/portable GFCI: AP portable GFCI is an extension cord combined with a GFCI. It adds flexibility in using receptacles that are not protected by GFCIs. Extension cords with GFCI protection incorporated should be used when permanent protection is unavailable.

HOW CAN I PROTECT MYSELF FROM ELECTROCUTION HAZARDS?

3) Circuit Breaker GFCI: The GFCI circuit breaker controls an entire circuit, and is installed as a replacement for a circuit breaker on the main circuit board. Rather than install multiple GFCI outlets, one GFCI circuit breaker can protect the entire circuit. At sites equipped with circuit breakers, this type of GFCI might be installed in a panel box to give protection to selected circuits.

HOW CAN I PROTECT MYSELF FROM ELECTROCUTION HAZARDS?

- Inspect portable tools and extension cords Workers need to inspect extension cords prior to their use for any cuts or abrasion. Extension cords may have damaged insulation. Sometimes the insulation inside an electrical tool or appliance is damaged.
- When the insulation is damaged, exposed metal parts may become energized if a live wire inside touches them. Electric hand tools that are old, damaged, or misused may have damaged insulation inside.

HOW CAN I PROTECT MYSELF FROM ELECTROCUTION HAZARDS?

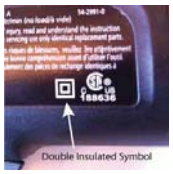
- Use power tools and equipment as designed
- Workers using power tools and equipment should follow tool safety tips to avoid misusing equipment.

HOW CAN I PROTECT MYSELF FROM ELECTROCUTION HAZARDS?

- Tool safety tips
  - Never carry a tool by the cord
  - Never yank the cord to disconnect it
  - Keep cords away from heat, oil, and sharp edges
  - Disconnect when not in use and when changing accessories such as blades and bits
  - Avoid accidental starting. Do not hold fingers on the switch button while carrying a plugged-in tool
  - Use gloves and appropriate footwear
  - Store in a dry place when not using
  - Don't use in wet/damp environments
  - Keep working areas well lit
  - Ensure that cords do not cause a tripping hazard
  - Remove damaged tools from use
  - Use double-insulated tools

DOUBLE-INSULATED TOOLS

- Hand-held tools manufactured with non-metallic cases are called double-insulated. If approved, they do not require grounding under the National Electrical Code. Although this design method reduces the risk of grounding deficiencies, a shock hazard can still exist.



HOW CAN I PROTECT MYSELF FROM ELECTROCUTION HAZARDS?

- Follow lockout/tagout procedures
- Lockout/tagout is an essential safety procedure that protects workers from injury while working on or near electrical circuits and equipment. In addition, lockout/tagout prevents contact with operating equipment parts such as, blades, gears, shafts, etc.
- Also, lockout/tagout prevents the unexpected release of hazardous gases, fluids, or solid matter in areas where workers are present.

PERFORMING LOCKOUT/TAGOUT ON CIRCUITS

- Identify all sources of electrical energy for the equipment or circuits in question
  - Disable backup energy sources such as generators and batteries
  - Identify all shut-offs for each energy source
  - Notify all personnel that equipment and circuitry must be shut off, locked out, and tagged out (Simply turning a switch off is not enough)
  - Shut off energy sources and lock switch gear in the OFF position. Each worker should apply his/her individual lock and keys kept with the worker
  - Test equipment and circuitry to ensure they are de-energized. This must be done by a qualified person
  - Deplete stored energy (for example, in capacitors) by bleeding, blocking, grounding, etc.
  - Apply a lock or tag to alert other workers that an energy source or piece of equipment has been locked or tagged out
  - Make sure all workers are safe and accounted for before equipment and circuits are unlocked and turned back on. Only a qualified person may determine when it is safe to re-energize circuits.

WHAT IS AN EMPLOYER REQUIRED TO DO TO PROTECT WORKERS FROM ELECTROCUTION?

A. Ensure overhead power line safety
B. Isolate electrical parts
C. Supply ground-fault circuit Interrupters (GFCI)
D. Ensure proper grounding
E. Ensure power tools are maintained in a safe condition
F. Ensure proper guarding
G. Provide training
H. Enforce a LOTO (locked out, tagged out) safety-related work practices
I. Ensure Proper Use of Flexible Cords

GUARDING (ISOLATE ELECTRICAL PARTS)

- Guarding involves locating or enclosing electric equipment to make sure people don't accidentally come into contact with its live parts.
- Effective guarding requires equipment with exposed parts operating at 50 volts or more to be placed where it is accessible only to authorized people qualified to work with it.
- Recommended locations are a room, vault, or similar enclosure; a balcony, gallery, or elevated platform; or a site elevated 8 feet (2.44 meters) or more above the floor. Sturdy, permanent screens also can serve as effective guards.

GUARDING (ISOLATE ELECTRICAL PARTS)

- Conspicuous signs must be posted at the entrances to electrical rooms and similarly guarded locations to alert people to the electrical hazard and to forbid entry to unauthorized people. Signs may contain the word "Danger," "Warning," or "Caution," and beneath that, appropriate concise wording that alerts people to the hazard or gives an instruction, such as "Danger/High Voltage/Keep Out."

WHAT IS AN EMPLOYER REQUIRED TO DO TO PROTECT WORKERS FROM ELECTROCUTION?

OSHA ground-fault protection rules and regulations have been determined necessary and appropriate for worker safety and health. Therefore, it is the employer's responsibility to provide either:

(a) ground-fault circuit interrupters on construction sites for receptacle outlets in use and not part of the permanent wiring of the building or structure; or

(b) a scheduled and recorded assured equipment grounding conductor program on construction sites, covering all cord sets, receptacles which are not part of the permanent wiring of the building or structure, and equipment connected by cord and plug which are available for use or used by workers.

WHAT IS AN EMPLOYER REQUIRED TO DO TO PROTECT WORKERS FROM ELECTROCUTION?

•1926.404(b)(1)(i)

•General. The employer shall use either ground fault circuit interrupters as specified in paragraph (b)(1)(ii) of this section or an assured equipment grounding conductor program as specified in paragraph (b)(1)(iii) of this section to protect employees on construction sites. These requirements are in addition to any other requirements for equipment grounding conductors.

WHAT IS AN EMPLOYER REQUIRED TO DO TO PROTECT WORKERS FROM ELECTROCUTION?

- 1926.404(b)(1)(ii)
- Ground-fault circuit interrupters. All 120-volt, single-phase 15- and 20-ampere receptacle outlets on construction sites, which are not a part of the permanent wiring of the building or structure and which are in use by employees, shall have approved ground-fault circuit interrupters for personnel protection. Receptacles on a two-wire, single-phase portable or vehicle-mounted generator rated not more than 5kW, where the circuit conductors of the generator are insulated from the generator frame and all other grounded surfaces, need not be protected with ground-fault circuit interrupters.
- 1926.404(b)(1)(iii)
- Assured equipment grounding conductor program. The employer shall establish and implement an assured equipment grounding conductor program on construction sites covering all cord sets, receptacles which are not a part of the building or structure, and equipment connected by cord and plug which are available for use or used by employees. This program shall comply with the following minimum requirements:
- **1926.404(b)(1)(iii)(A)**
- A written description of the program, including the specific procedures adopted by the employer, shall be available at the jobsite for inspection and copying by the Assistant Secretary and any affected employee.
- **1926.404(b)(1)(iii)(B)**
- The employer shall designate one or more competent persons (as defined in 1926.32(f)) to implement the program.

WHAT IS AN EMPLOYER REQUIRED TO DO TO PROTECT WORKERS FROM ELECTROCUTION?

- The employer needs to ensure that all power tools and equipment are maintained in a safe condition to:
  - Ground power supply systems, electrical circuits, and electrical equipment
  - Frequently inspect electrical systems to insure path to ground is continuous
  - Ensure workers understand to inspect electrical equipment prior to use
  - Ensure ground prongs are not removed from tools or extension cords
  - Ground exposed metal parts of equipment

WHAT IS AN EMPLOYER REQUIRED TO DO TO PROTECT WORKERS FROM ELECTROCUTION?

- Provide training
- Workers need be trained in and familiar with the safety-related work practices that pertain to their respective job assignments. Train workers working with electric equipment in safe work practices to:
  - De-energize electric equipment before inspecting or repairing
  - Use cords, cables, and electric tools that are in good repair
  - Lockout/Tagout recognition and procedures
  - Use appropriate protective equipment

WIRE INSULATION

- Before connecting electrical equipment to a power source, it's a good idea to check the insulation for any exposed wires for possible defects. Insulation covering flexible cords such as extension cords is particularly vulnerable to damage.
- The insulation that covers conductors in non-construction applications is regulated by Subpart S of 29 CFR 1910.302 through 1910.308, Wiring Design and Protection.
- Subpart S generally requires insulation on circuit conductors. It also specifies that the insulation used should be suitable for the voltage and conditions. Conductors used in construction applications are regulated by Subpart K of 29 CFR 1926.402 through 1926.408

LADDERS AND ELECTROCUTION

- 1926.1053(b)(12)
- Ladders shall have nonconductive side rails if they are used where the employee or the ladder could contact exposed energized electrical equipment, except as provided in § 1926.955(b) and (c)
- Conductive ladders. Portable metal ladders and other portable conductive ladders may not be used near exposed energized lines or equipment. However, in specialized high-voltage work, conductive ladders shall be used when the employer demonstrates that nonconductive ladders would present a greater hazard to employees than conductive ladders. part.

TOOLS

- Hand tools are tools that are powered manually. Hand tools include anything from axes to wrenches. The greatest hazards posed by hand tools result from misuse and improper maintenance.
- Some examples include the following:
  - If a chisel is used as a screwdriver, the tip of the chisel may break and fly off, hitting the user or other employees.
  - If a wooden handle on a tool, such as a hammer or an axe, is loose, splintered, or cracked, the head of the tool may fly off and strike the user or other employees.
  - If the jaws of a wrench are sprung, the wrench might slip.
  - If impact tools such as chisels, wedges, or drift pins have mushroomed heads, the heads might shatter on impact, sending sharp fragments flying toward the user or other employees.
- The employer is responsible for the safe condition of tools and equipment used by employees. Employers shall not issue or permit the use of unsafe hand tools. Employees should be trained in the proper use and handling of tools and equipment.

PREVENT HAZARDS ASSOCIATED WITH THE USE OF POWER TOOLS

- Workers should observe the following general precautions:
  - Never carry a tool by the cord or hose.
  - Never yank the cord or the hose to disconnect it from the receptacle.
  - Keep cords and hoses away from heat, oil, and sharp edges.
  - Disconnect tools when not using them, before servicing and cleaning them, and when changing accessories such as blades, bits, and cutters.
  - Keep all people not involved with the work at a safe distance from the work area.
  - Secure work with clamps or a vise, freeing both hands to operate the tool.
  - Avoid accidental starting. Do not hold fingers on the switch button while carrying a plugged-in tool.
  - Maintain tools with care; keep them sharp and clean for best performance.
  - Follow instructions in the user's manual for lubricating and changing accessories.
  - Be sure to keep good footing and maintain good balance when operating power tools.
  - Wear proper apparel for the task. Loose clothing, ties, or jewelry can become caught in moving parts.
  - Remove all damaged portable electric tools from use and tag them: "Do Not Use."

ELECTRICAL HAZARDS

The following is a list of a common electrical hazards found on construction sites:

- Improper grounding
- Exposed electrical parts
- Inadequate wiring
- Overhead power lines
- Damaged insulation
- Overloaded circuits
- Wet conditions
- Damaged tools and equipment

IMPROPER GROUNDING

- Grounding is the process used to eliminate unwanted voltage.

- A ground is a physical electrical connection to the earth.

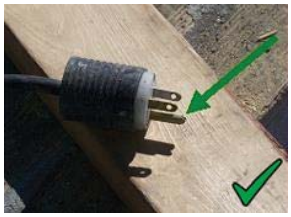
IMPROPER GROUNDING

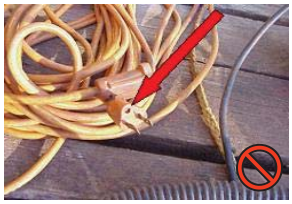
- Electrical equipment must be properly grounded.

- Grounding reduces the risk of being shocked or electrocuted.

IMPROPER GROUNDING

- The ground pin safely returns leakage current to ground.





- NEVER remove the ground pin.

IMPROPER GROUNDING

- Removing the ground pin removes an important safety feature.

- You can get shocked!

EXPOSED ELECTRICAL PARTS

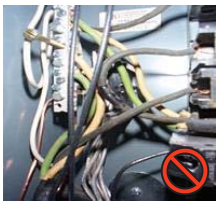
- Exposed wires or terminals are hazardous.

- Report these conditions to your supervisor.

EXPOSED ELECTRICAL PARTS

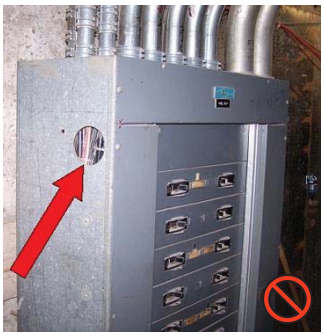
- This electrical panel has missing circuit breakers.

- Never use a panel that has exposed wires.



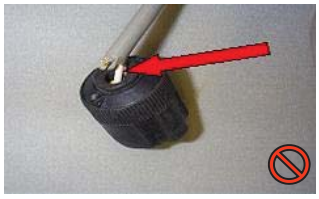
EXPOSED ELECTRICAL PARTS

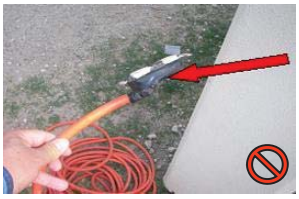
- All openings must be closed.



EXPOSED ELECTRICAL PARTS

- Outer insulation on electrical cords must be intact.



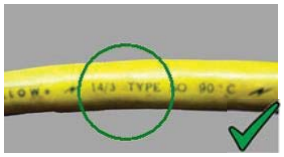


EXPOSED ELECTRICAL PARTS

- On construction sites, temporary lighting must be properly guarded and protected to avoid contact with broken bulbs and avoid potential shocks.

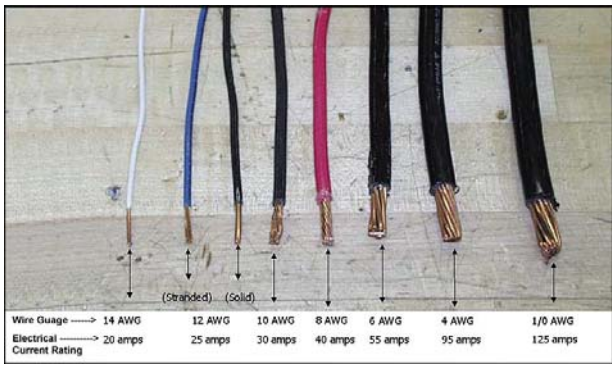
INADEQUATE WIRING

- Use properly rated extension cords.



- Make sure your power tools are being used with a properly rated extension cord.

INADEQUATE WIRING



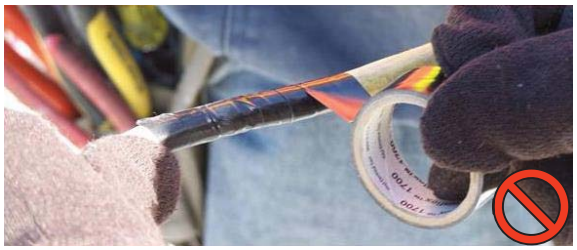
DAMAGED INSULATION

- Defective or inadequate insulation is a hazard.

- Insulation prevents conductors from contacting each other or you.

DAMAGED INSULATION

- Never attempt to repair a damaged cord with tape.



DAMAGED INSULATION

- Never use tools or extension cords with damaged insulation.

DAMAGED INSULATION

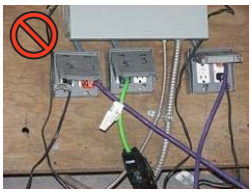
- Never hang extension cords from nails or sharp objects.

DAMAGED INSULATION

Do not run extension cords through doors or windows.

OVERLOADED CIRCUITS

- Overloaded circuits can cause fires.



- Use proper circuit breakers.

OVERLOADED CIRCUITS

- Never overload an outlet.

OVERLOADED CIRCUITS

- Do not use power strips or surge protectors on construction sites.

- Use a 3-way extension with a GFCI instead.

DAMAGED TOOLS AND EQUIPMENT

- Do not use electric tools that are damaged.
- You may receive a shock or be electrocuted.

DAMAGED TOOLS AND EQUIPMENT

- Double insulated tools are labeled.
- It will be marked “Double Insulated”.
- It will have the following symbol:

WET CONDITIONS

- Wet conditions are hazardous.

- Damaged insulation increases the hazard.

WET CONDITIONS

- Always avoid using tools in wet locations.

- Water increases the risk of electric shock.

OVERHEAD POWER LINES

- Survey the site for overhead power lines.

- Never store materials or equipment under overhead power lines.

OVERHEAD POWER LINES

- Maintain a distance of at least 10’ between tools and equipment and overhead power lines.

- Shocks and electrocutions occur where physical barriers are not in place to prevent contact with the wires.

OVERHEAD POWER LINES

- Maintain safe distances between scaffolding and overhead power lines.

OVERHEAD POWER LINES

- Overhead power lines are very dangerous.

- Never attempt to contact an overhead power line.

ACCIDENT PREVENTION

- A willing, positive attitude towards safety will help make a safer work environment.

ACCIDENT PREVENTION

- Always consider these safety precautions:
  - Personal protective equipment (PPE),
  - Inspect tools,
  - Ground fault circuit interrupters (GFCIs),
  - Lock-out/tag-out.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

- PPE for electrical hazards include:
  - hardhats
  - rubber or insulating gloves
  - insulating clothing
- NEVER use damaged PPE!

PERSONAL PROTECTIVE EQUIPMENT (PPE)

- Use appropriate rubber insulating gloves.
- Make sure the gloves fit properly.
- Make sure the glove rating matches with the work to be performed.
- Not all gloves can be used to prevent electric shock.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

- Hard hats offer protection.
- Hard hats are rated for certain uses.
- Metal hard hats SHOULD NOT be used when working close to electrical lines.

INSPECT TOOLS AND CHORDS

- Inspect tools and cords completely before using for:
  - cracks
  - damaged insulation
  - broken ground pins
  - frayed line cord
  - loose parts
  - any other damage

GFCI

- OSHA requires the use of GFCIs on all construction sites.

GFCI

- A GFCI is a fast-acting circuit breaker.
- It senses small imbalances in the circuit caused by current leakage to ground.

GFCI

- It continually matches the amount of current coming and going to an electrical device.
- The GFCI looks for a difference of approximately 5 milliamps.

LOCK-OUT/TAG-OUT

- Workers must ensure electricity is off and "locked-out" before work is performed.

LOCK-OUT/TAG-OUT

- The switch must be tagged.
- The tag lets others know why the switch is off.

LOCK-OUT/TAG-OUT

- Locks and tags are warning signs.
- You must be trained in lock-out/tag-out procedures.

MAJOR HAZARDS SUMMARY

BLOCKED ELECTRICAL PANELS

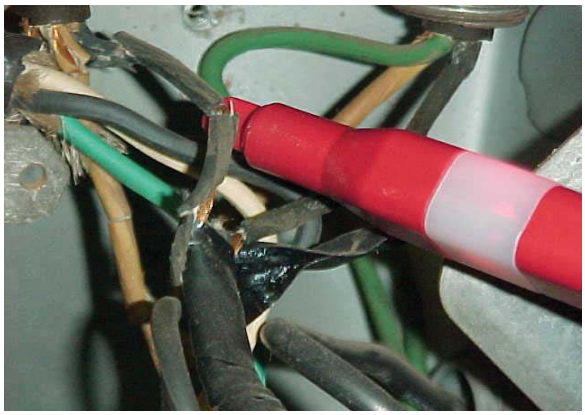
STRAIN ON CONDUCTORS

INADEQUATE STRAIN RELIEF ON CORD

EXPOSED LIVE PARTS

Employee's cap is hung on power strip energized to 120VAC

EXPOSED LIVE PARTS



EXPOSED LIVE PARTS

Missing breakers inside of circuit breaker panel

UNGROUNDED CORDS

Ground pin missing on extension cord

DAMAGED FACEPLATE

UTILITY BOXES

Utility boxes are not approved for usage as extension cords.

RECEPTACLES IN WET LOCATIONS

Receptacles in wet or damp locations need covers.

RECEPTACLES IN WET LOCATIONS

Receptacles in wet or damp locations need covers.

DAMAGED FACEPLATE

PORTABLE ELECTRIC TOOLS

- Inspect before usage.
- Remove from service tools with damaged cords.
- Use grounded or double insulated tools.
- Check continuity of tool.

HAZARD ASSESSMENT

Employers are required to assess the workplace to determine if hazards that require the use of personal protective equipment are present or are likely to be present.

PERSONAL PROTECTIVE EQUIPMENT

- Head protection - overhead hazards
- Eye protection - grinding, chipping, or sawing operations.
- Hearing protection - noisy environments
- Respiratory protection - exposure levels exceed permissible exposure limits.
- Foot protection - falling, rolling, or sharp object.

RUBBER GLOVES

- Must be air tested daily before usage.
- Must be electrically tested every 6 months or replaced.
- Before issuance gloves may be stored for up to 1 year without being tested.

ELECTRICAL PROTECTIVE EQUIPMENT

DESIGN REQUIREMENTS 1910.137(A)

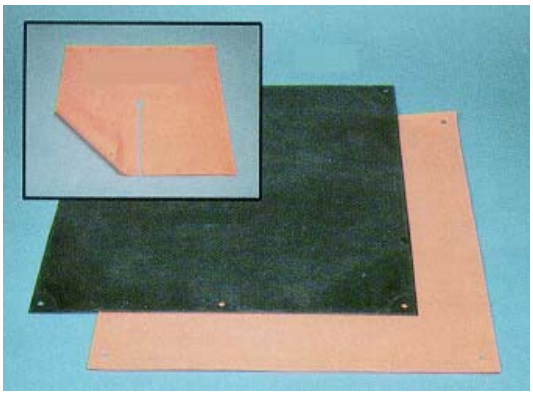
- Manufacture and Marking
  - Class of equipment (0, 1, 2, 3, or 4)
  - Type of equipment (I or II)

CLASS LABEL

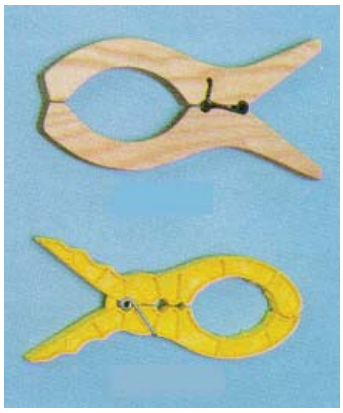
- Class 4 - Designed to insulate up to 40,000 volts.
- Type II - Is molded from man-made materials.

RUBBER INSULATING MATTING

RUBBER INSULATING BLANKET



BLANKET CLAMPS



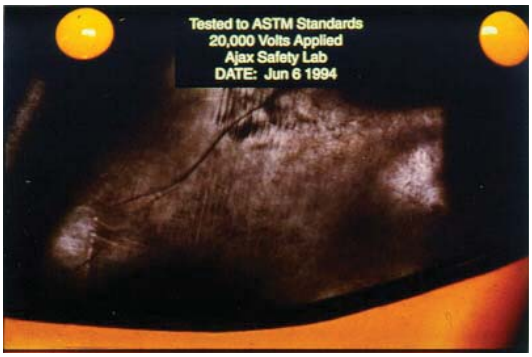
RUBBER INSULATING SLEEVES

RUBBER INSULATING SLEEVES

- Identification markings

RUBBER INSULATING SLEEVES

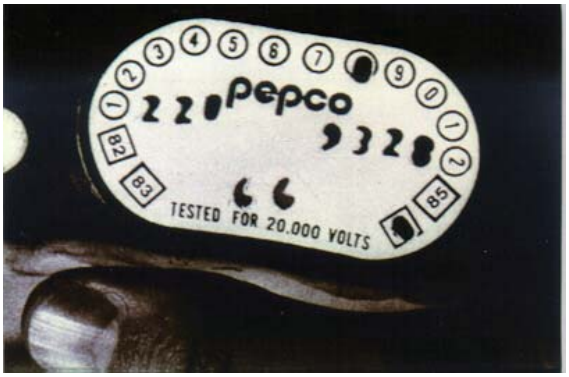
- Test markings



RUBBER INSULATING GLOVES

- Identification markings

RUBBER INSULATING GLOVE TEST STICKER



IN-SERVICE CARE AND USE 1910.137(B)

- Maximum use voltage to conform to Table I-5.
- Equipment damage inspection:
  - No holes, tears, cuts, or punctures; no ozone cutting or checking; no embedded foreign objects; no swelling, softening, hardening, etc.

OZONE DAMAGE

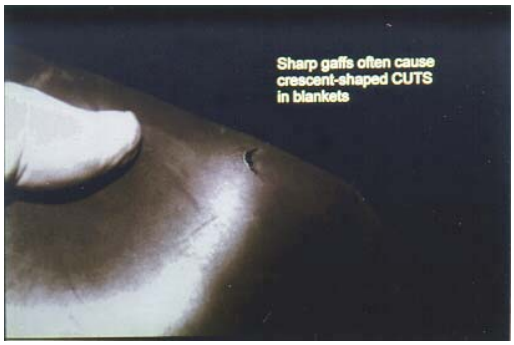
- Severe ozone damage caused by stretching over top of primary

OZONE DAMAGE

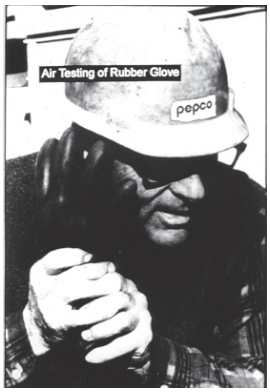
- Damage caused when gloves are kept in an inside-out position for a long period of time

CUT IN BLANKET

- Sharp gaffs often cause crescent-shaped cuts in blankets



AIR TESTING OF RUBBER GLOVES 1910.137(B)(2)(II)



AIR TESTING OF RUBBER GLOVES 1910.137(B)(2)(II)

RUBBER INSUGLATING EQUIPMENT TEST INTERVALS 1910.137(B)(2)(VIII)

Equip.	When to Test
Line hoses	Insulation suspect
Covers	Insulation suspect
* Blankets	Every 12 months
* Gloves	Every 6 months
* Sleeves	Every 12 months

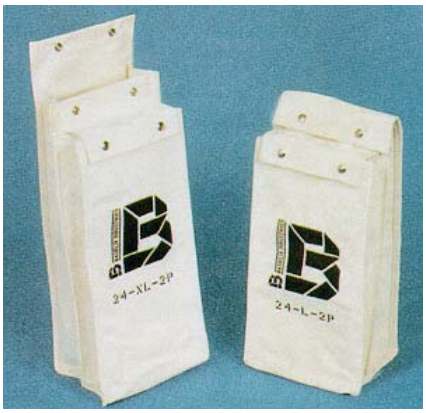
GLOVE PROTECTOR

Class	Gap
0	1”
1	1”
2	2”
3	3”
4	4”

LEATHER PROTECTOR

- Leather Protector glove worn without rubber gloves.

RUBBER GLOVE STORAGE



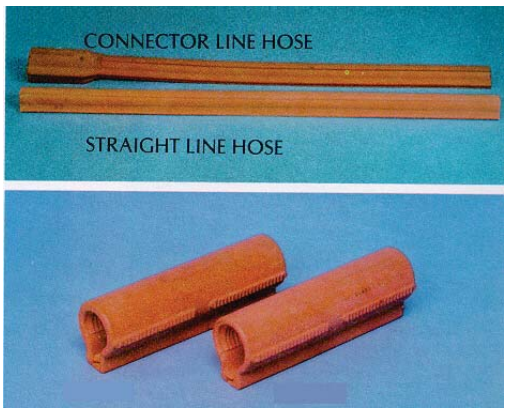
RUBBER GLOVE LINERS

GLOVE DUST

RUBBER BLANKET FIELD TESTING

- Field testing of rubber blanket with cover gear & tools on tarp.

INSULATING LINE HOSES



INSULATOR COVER

NOTES