


Slide 1



Slide 2

Introduction

Electricity is an essential part of modern life . Without it, we wouldn't have lights, refrigeration, computers, TV's, stereos, etc., etc., etc.



Slide 3

Remember -Electricity can also be very DANGEROUS!

- Every year, more than 1,000 employees are killed, and
- Another 30,000 are injured from electrical shock.
- Most of the injuries could have been prevented.

Slide 4

- Did you know that just 100 mA flowing through the body for only 2 seconds can cause death?
- Why, a portable drill draws about 30 times that amount of current!



Slide 5

- The “Let Go” threshold that prevents you from releasing your grip of an exposed electrical wire is about 10-20 mA.



Slide 6

OSHA Regulations


- 29 CFR 1910, Subpart S - Electrical Standards
- 29 CFR 1910.147 - Lockout/Tagout
- 29 CFR 1910.137 - Personal Protective Equipment




Slide 7

What is Electricity?

"The physical phenomena arising from the behavior of electrons and protons that is caused by the attraction of particles with opposite charges and the repulsion of particles with the same charge."




Slide 8




Huh?

Let's explain that differently.....



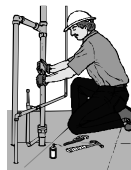
Slide 9



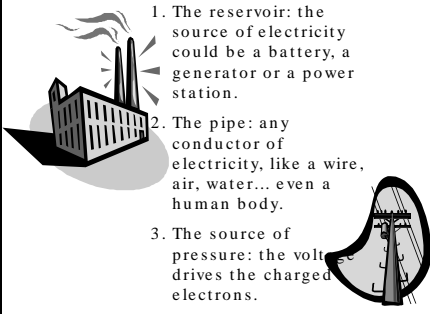
Think of electricity like water flowing through a pipe.

For the water to flow, you must have:

1. A reservoir
2. A pipe
3. A source of pressure



Slide 10




1. The reservoir: the source of electricity could be a battery, a generator or a power station.

2. The pipe: any conductor of electricity, like a wire, air, water... even a human body.

3. The source of pressure: the voltage drives the charged electrons.

Slide 11



➤ What is "Current"? Just like in a stream, current is the flow of electric charge.

➤ What about "Voltage"? Voltage is the pressure, or the push, that drives the electricity forward.

➤ How about "Resistance"? - Think of the resistance as the friction between the walls of a pipe and the water. Any electrical appliance is a resistor.

Slide 12


OHM'S Law

➤ $I = E/R$

➤ I = Intensity, or Current (amps)

➤ E = Electromotive force, or Voltage


➤ R = Resistance, or Ohms



Slide 13

Electrical Hazards


- Shock
- Burns
- Arc-Blast
- Explosions
- Fires



Slide 14

Shocks


- Direct -
Currents of 30 mA or more can cause death.
- Indirect -
Human reactions can result in falls or sudden movement into machinery.



Slide 15

A shock can occur when there is:


- Contact with both wires of an electrical circuit
- Contact with a wire and the ground source
- Contact with a ground source and a metal part that is in contact with the circuit



Slide 16

Burns


- Results when “hot” wires or equipment is touched. Typically, it’s the hands that are burned.



Slide 17

Arc- Blast


- Thermal Radiation
- Pressure Wave
- Projectiles



Slide 18

Explosions


- Occur when electricity provides a source of ignition in a potentially explosive atmosphere.



Slide 19


Fires

➤Electricity is one of the most common causes of fire in homes and workplaces.



Slide 20

The effects of shock depend upon:




- Current and voltage
- Resistance
- Path through the body
- Duration of shock

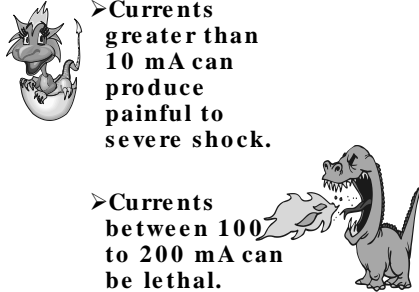
Slide 21

Current and Voltage

➤Although high voltages can produce massive destruction of tissue upon contact, the most harmful effects of electrical shock are due to the current.



Slide 22




➤ Currents greater than 10 mA can produce painful to severe shock.

➤ Currents between 100 to 200 mA can be lethal.

Slide 23

Resistance

Resistance of the human body varies with the amount of moisture on the skin. The drier the skin, the higher the resistance.




Slide 24

Path through the body:


➤ When current flows from hand to feet, the path includes both the heart and the lungs.

➤ This type of shock can be fatal!



Slide 25


Duration of shock:



- If the shock is of short duration, it may only be painful.
- But, a current of 100 mA flowing through your body for just a few seconds can be fatal.

Slide 26


Minimize the Hazards



- Lockout/Tagout
- Guarding
- Grounding
- Mechanical Devices
- Assured Equipment Grounding Program

Slide 27

Minimize the Hazards (contd.)




- Personal Protective Equipment
- Safe Work Practices
- Working at Heights


Slide 28

Lockout/Tagout

- Lock out energy in the off position.
- Attach tags prohibiting their removal.
- Take some additional safety measures if a lock cannot attached.



Slide 29




- Verify absence of power.
- Discharge any stored energy.
- Locks and tags can only be removed by the person who locked/tagged out the equipment, or by a supervisor.

Slide 30

Guarding


- Electrical equipment of 50 volts or more must be guarded by:
 - Location in a locked room
- Screens or partitions
- Elevation of 8 feet or more above the floor or platform
- Entrances to locations with live parts must be marked with warning signs.



Slide 31


Grounding

- All metal parts of equipment must be grounded if the equipment is:
 - Near any other grounded equipment
 - Located in a wet location
 - Connected by a cord or a plug



Slide 32


Mechanical Protection Devices




- Fuses and circuit breakers protect equipment and wiring.
- Fuses melt when too much current flows through them.
- Circuit breakers trip open the circuit.

Slide 33

- An aisle at least 3 feet wide must be maintained in front of circuit breaker panels.
- Circuit breaker panel covers should remain closed.
- Circuit breaker panels should have a directory index.




Slide 34



- There should be no missing breakers or any other open spaces in breaker panels.
- Never secure a breaker in the “closed”, or ON position.
- Never tape a breaker in the “open” or OFF position.

Slide 35


Ground Fault Circuit Interrupter GFCI



- GFCIs protect people.
- GFCIs will shut off electrical power within 1/40th of a second when it detects a difference of 5 mA or more.
- GFCIs must be used when tools and extension cords are used on construction sites and near water.

Slide 36

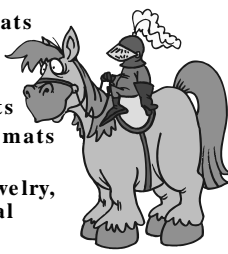
Assured Equipment Grounding Program



- A scheduled system for testing electrical tools and extension cords.
- Written description of specific procedures.
- Helps assure that risks of electrical hazards are prevented/eliminated.
- Competent person must be designated.

Slide 37

- Rubber gloves
- Class B hard hats
- Safety glasses
- Face shields
- Insulated boots
- Insulated arm mats or sleeving
- Take off all jewelry, rings and metal wristwatches.




Slide 38

Portable Equipment

Hand tools:

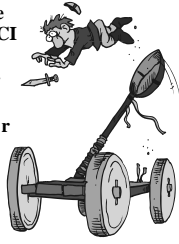
- Must have insulated grips
- Should not have cracks, tears or gaps in the insulation




Slide 39

Power tools:

- Must be double-insulated or third-wire cord grounded, or GFCI installed.
- Inspect tools for wear or defects.
- Check safety guards or shields.
- Inspect power cords and switches for cuts, frayed insulation and loose connections.



Slide 40




Meters and Test Equipment:

- Choose test equipment right for the job.
- Never exceed limitations of test equipment.
- Inspect meters and testers for safe operation.
- Check probes and probe leads for defects.
- De-energize circuit before re-connecting.

Slide 41

Electrical Plugs and Extension Cords


- Make sure extension cords are the right size for the tools being used.
- Always use grounded electrical outlets and don't overload.
- Never remove the grounding post from a 3-prong plug.
- Use a standard plug adapter and attach the ground properly.



Slide 42

Electrical Cords


- Inspect cords regularly for wear or cracks in insulation.
- Keep cords and cables clean and free from kinks.
- Never carry a tool by its cord.
- Never cut off the grounding plug from a cord!



Slide 43

Working at Heights


- Always use non-conductive wooden or fiberglass ladders.
- Never use aluminum ladders.
- Use rubber caps to give protection from shocks and skids.
- Stay at least 10 feet away when voltages are 50 kV or less; further away if voltages are greater.



Slide 44


Safe Work Practices

- Never work around electricity when you, your tools or clothes are wet.
- Don't work on electricity in the rain.
- Make sure there are no atmospheric hazards such as dust particles, flammable vapors or excess oxygen.
- Always work with adequate lighting.



Slide 45

- Don't assume hazard is low when voltage is low.
- Bond and ground all work benches.
- Wear lineman's rubber gloves on both hands.
- Never lean on a metal rail or stand in a puddle of water.
- Never work alone on a live circuit. Always have a partner who is CPR trained.



Slide 46