

Electrical Safety 29 CFR 1910.332



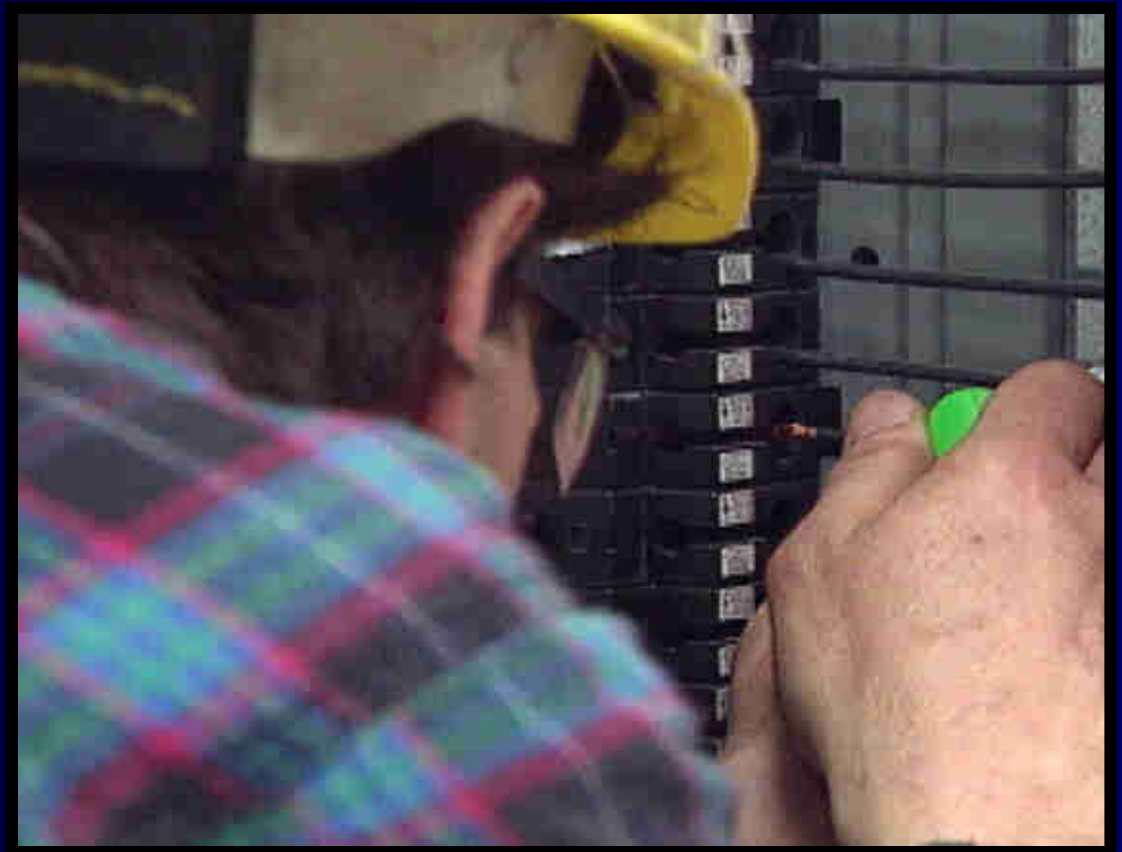
Concerned About Electricity?

- How many sets of Christmas lights do you plug into one extension cord?
- Do you still use your hot and sparking electric drill?
- Is your vacuum cleaner's cord twisted and frayed?
- Have you installed outlet covers to protect your toddler's probing fingers?



Leading causes of injury are:

- Unsafe work practices (cause of 75% of fatalities)
- Working with unsafe equipment
- Working in an unsafe environment



Qualified Worker/ Unqualified Worker

Qualified Worker

- One who is familiar with the construction and operation of the equipment and hazards involved:

Or

- One who is undergoing “on-the-job” training and has demonstrated competency in performing the duties safely.

Unqualified Worker

One who is not capable of determining or distinguishing:

- Exposed line parts from other parts.
- Techniques to determine nominal voltage of live lines.
- Clearance distances required and corresponding voltages.

This training does not make you a qualified worker!

What you should know:

- What to do if a fellow employee is shocked by electricity
- How to lockout/tagout electrical energy
- Safe distances to maintain from high power
- Safe use of portable electrical devices

Electrical Circuits

- Electrical source
- Electrical user
- Wires



Electrical Hazards

Primary hazards

- Shock
- Arc
- Blast

Shock

Electricity that flows through a closed circuit system via conductors. A closed loop.



Rules of Electricity

- Electricity travels in a completed circuit
- Electricity always travels in the path of least resistance
- Electricity tries to travel to ground



Electricity and People

- A person usually offers a lessor resistance for the electricity
- The person forms a completed circuit when touching the ground
- Electricity always tries to travel to ground

Voltages and Amperes

- Voltage = Amps X Ohms (resistance)
- Converting voltage to amps
- Typical Industrial Voltages
 - 110/120 Volts = 60 milliAmps (mA)
 - 220/240 Volts = 120 mA
 - 440/480 Volts = 240 mA



Effects On The Body

- Minor tingling to cardiac arrest
- Both low & high voltages can be deadly
- Can cause more damage than is readily visible



Effects on the Human Body

- 1 mA: Can be felt by the body
- 2-10 mA: Minor shock, might result in a fall
- 10-25 mA: Loss of muscle control, may not be able to let go of the current
- 25-75 mA: Painful, may lead to collapse or death
- 75-300 mA: Last for 1/4 second, almost always immediately fatal

Severity Of Shock Depends On :

- Amount of current flowing through body
- The path it takes through the body
- Elapsed time during shock

Conductor vs. Insulator

■ Conductor

- Transfers electricity



■ Insulator

- Stops electricity





Body's Resistance

- Skin offers most of the body's electrical resistance
- Increased resistance
 - Thick and callused skin (foot or hand)
 - Dry skin
- Decreased resistance
 - Thin skin (inner forearm)
 - Wet or sweaty skin
 - Broken or abraded skin (scratches)

The body is a great conductor

Possible injuries include:

External & Internal burns,

heart fibrillation,

cardiac arrest,

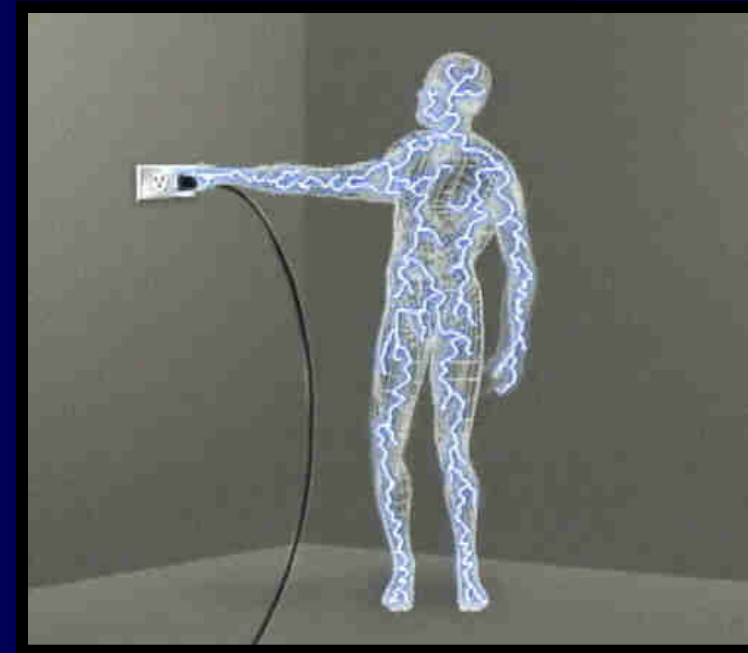
instant paralysis of respiratory system

**Never touch anyone who may be in contact
with electricity!**

What to do in emergencies:

- 1. Shut off power**
- 2. Call for emergency help**
- 3. Administer CPR**

If unable to shut off power,
use a wooden chair, pole, or
PVC to free the person .





Resistance Varies

- Different levels of electrical resistance for each person
- Ranges from 500 ohms to many thousands of ohms
- The greater the body's resistance, the less chance of harm
- A similar voltage shock can be minor to one person and deadly to another.

Hazard Assessments

- **Workplace audits**
- J.S.A.
- Accident/incident investigations

Personal Protective Equipment

- Rubber gloves
- Sleeves
- Dielectric boots
- Hard hats
- Eye & face protection
- Flame resistant clothing

Additional Equipment

- Insulated mats/blankets
- Protective barriers
- Hot sticks
- Insulated tools



Training

■ Qualified workers

- How to identify exposed energized parts
- How to safeguard or work on energized parts

■ Unqualified workers

- How electricity works
- Risks of working with energized equipment
- Tasks to be performed only by qualified workers



Hazard Control

- Electrical systems are inherently safe
- Injuries typically occur when:
 - Procedures are inappropriate
 - Procedures are not followed or ignored
 - Safety systems are circumvented

General Electrical Hazards

- High-voltage overhead power lines
- Damaged insulation on wires
- Digging or trenching near buried lines
- Broken switches or plugs
- Overloaded circuits
- Overheated appliances or tools
- Static electricity
- Flammable materials





Portable Power Tools

- Inspect portable power tools
- Never use damaged equipment
 - Tag it out of service
 - Have it repaired or replaced
- Never use portable power equipment in wet or damp areas
- Stop using power tools if they become hot or start sparking

Portable electric equipment

- UL approved equipment and cords
- Graded for hazardous locations
- Extension cords must have a ground wire polarity plug.
- Inspect for frays, breaks or other damage to the cord insulation
- Inspect for grease, oil or chemicals on cords
- Do not unplug or raise equipment by cord
- Do not use around combustible atmospheres
- Work in dry area - avoid water

Extension Cords

- Inspect and check for capacity
- For temporary work only
- Do not use as a rope to pull or lift objects
- Should not be fastened with staples or hung over hooks





Electrical Cord Inspection

- Deformed or missing pins
- Damaged outer jacket or insulation
- Evidence of internal damage
- If damaged, take out of service until repaired



Circuit Protection

- Energize or de-energize with appropriate switches, breakers, etc.
- Do not energize or de-energize with fuses, terminal lugs, or cable splice connections
- If circuit protection device is tripped—inspect



Grounding Equipment

- Most electrical equipment is designed with a grounding system
- Do not use equipment with damaged grounding connectors
- Do not use adapters that interrupt the grounding connection



Ground Fault Circuit Interrupters

- GFCIs reduce the likelihood of fatal shocks
- Detect small amount of earth current and automatically switch off the power
- Used with extension cords and portable tools
- Fuses and circuit breakers protect equipment, not people



Static Electricity

- Created when materials rub together
- Can cause shocks or even minor skin burns
- Reduced or prevented by:
 - Proper grounding
 - Rubber matting
 - Grounding wires, gloves, or shoes



Flammable/Ignitable Materials

- Flammable gases, vapors, or liquids
- Combustible dust
- Can be ignited by static electricity
- Require specially designed electrical equipment



Machine Operators

- Never tamper with electrical interlocks
- Do not repair electrical components of your machine
- Properly shut off machinery before working in the point of operation
- Obey warning signs and follow safe procedures

Lockout/Tagout

- Lockout/Tagout prevents uncontrolled energization of equipment.
- Types of energy controlled by lockout/tagout:

- **Electrical**
- **Chemical**
- **Gravitational**
- **Hydraulic**
- **Mechanical**
- **Pneumatic**
- **Radiation**
- **Stored**
- **Thermal**



The basics

- Lockout prevents unexpected release of energy or the start up of equipment
- Energy sources must be identified and de-energized **BEFORE** beginning work
- Release stored energy
- Check to ensure no energy is present before working
- **When finished with task, make sure that no one else is in harms way before startup**



Lockout/tagout

OSHA - six step procedure

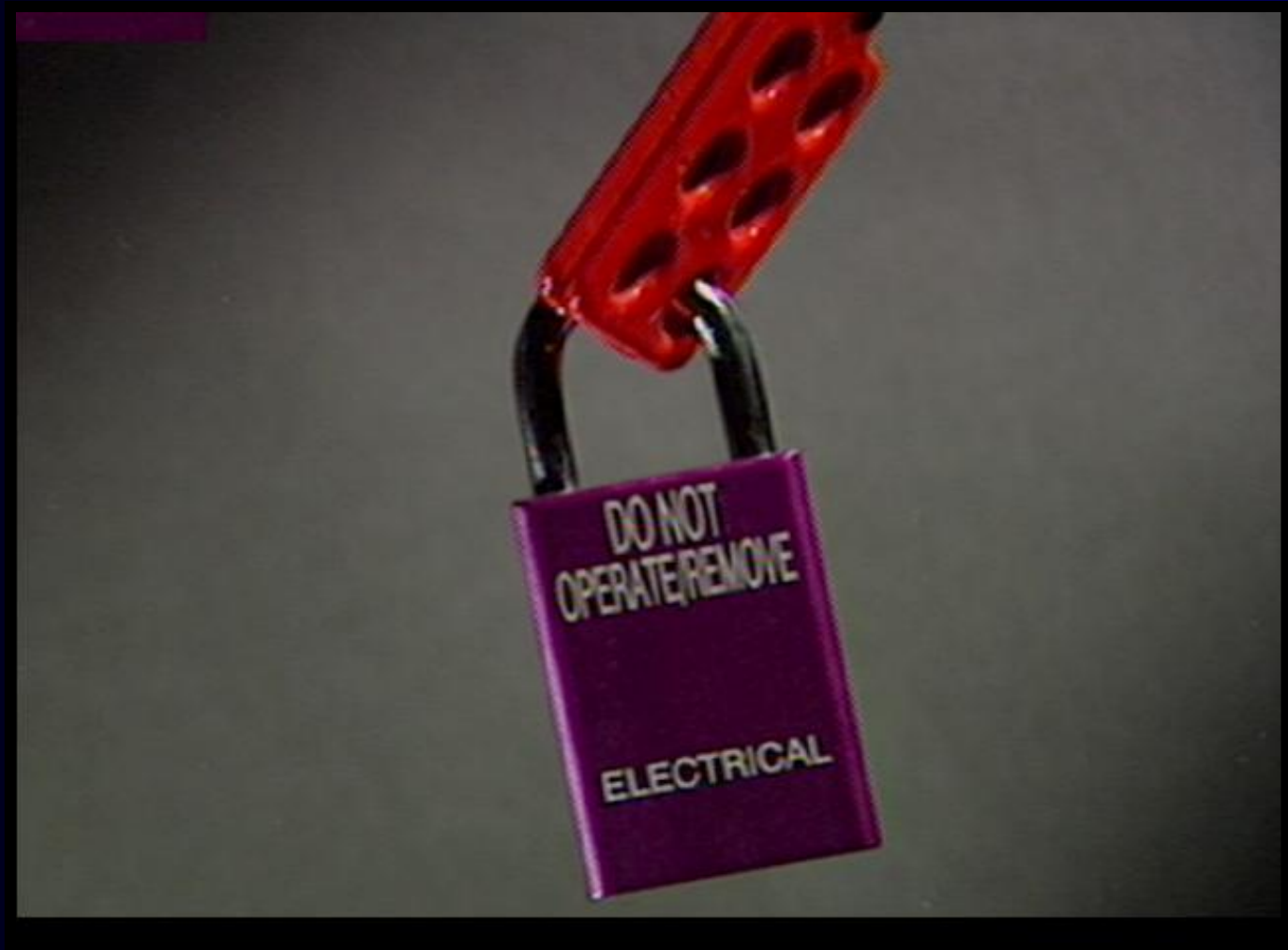
Caution:

Only qualified personnel can work on energized parts.

Authorized persons are qualified to lockout equipment

“The Golden Rule”

Never remove a lock unless it is yours



Safe Work Practices

- Stay away from buried lines when digging
- Identify all potential hazards - zero energy
- When using equipment watch for overhead lines
- Report all potential problems to get corrected immediately



Safe Work Practices

- Maintain safe working position
- Do not reach into hazardous areas
- **Stay at least 10 feet away from lines of 50,000 volts or less**



Safe Work Practices

- Maintain more than 10 feet distance for lines over 50,000 volts



Working With Contractors

- **Written safety policy**
- Meeting with contractor
- Safe work practices
- Periodic evaluation
- Contractor responsibilities



Summary

- Electricity will try to reach ground even if it means going through a person
- Even the “small” voltage from your home can cause serious injury
- Always inspect power tools and cords and do not use them if damaged
- Do not attempt to repair electrical equipment unless trained and qualified