Fact File

OSHA Safety – Electrical Safety

NEC provisions directly related to employee safety:

- Installation Safety Requirements
  [29 CFR 1926.402 - 1926.415]
- Safety-Related Work Practices
  [29 CFR 1926.416 - 1926.430]
- Safety-Related Maintenance and Environmental Considerations
  [29 CFR 1926.431 - 1926.440]
- Safety Requirements for Special Equipment
  [29 CFR 1926.441 - 1926.448]
- Definitions
  [29 CFR 1926.449]

Electrical Terms

Volts – electrical pressure (measure of electrical force)
Amps – the volume or intensity of the electrical flow
Watts – the power consumed
Current – electrical movement (measured in amps)
Circuit – the complete path of the current. Includes the electricity source, the conductor, and the output device (such as a tool, light, etc.)
Resistance – measured in ohms; the resistance of a material to the flow of electricity
Conductors – materials with little resistance
Grounding – a conductive connection to the earth that acts as a protective measure
Insulators – materials with high resistance to electricity; often used to prevent electricity from getting to unwanted places

Four main types of electrical injuries:

- Electrocution
- Electrical shock
- Burns
- Indirect – i.e., a fall from a ladder caused by a shock

A shock occurs when your body offers the path of least resistance for completing a circuit.

Shocks can occur when your body completes the path with:

- Both wires of an electric circuit
- One wire of an energized circuit and the ground
- A metal part that accidentally becomes energized
- Another “conductor” that is carrying a current

A shock’s severity depends on:

- The amount of current
- The current’s path
- The length of time (duration)
- The current’s frequency

General Information

- When electrical shock is sufficient to cause muscle contraction, the “freezing” effect makes it impossible for the person to pull free from the energy source. The current must be shut off immediately to release them!
- Static electricity can also cause a shock, and while the kind you get after shuffling across a carpet is generally mild, static electricity can build up and discharge to an object with very serious consequences. Grounding or other measures are often necessary to prevent static electricity buildup.
- The longer the exposure to the current, the greater the danger.
- Low voltage does not mean low hazard!
- A severe shock often causes more damage than that initially visible: There may be internal hemorrhaging and tissue and nerve damage.

"Clues" that an electrical hazard exists:

- A ground fault circuit interrupter keeps tripping
- Circuit breakers trip and fuses blow, which show that too much current is flowing. This could be due to a number of factors, such as malfunctioning equipment or a short between conductors.
- An electrical tool, wire, or connection that feels warm may indicate too much current in the circuit or equipment.
- An extension cord that feels warm may indicate too much current for the wire size of the cord.
- A cable, fuse box or junction box that feels warm may indicate too much current in the circuits
- A burning odor, which may indicate overheated insulation
- Worn, frayed or damaged insulation around wires or conductors is an electrical hazard because the conductors could be exposed. Contact with an exposed wire could cause a shock, and damaged insulation could cause a short, leading to arcing or a fire.

Besides PPE, other vital methods of protection when working around power lines include:

- Post warning signs near overhead power lines and buried power line indicators
- Contact utilities for buried power line locations
- Stay at least 10 feet away from overhead lines
- Assume that lines are energized unless you've established otherwise
- Have the lines' owner or operator deenergize them before work begins on them
- Use wood or fiberglass ladders in lieu of metal

The safety of equipment must be determined by the following:

- Suitability for installation and use in conformity with the provisions of the standard – that is, suitability of equipment for an identified purpose evidenced by a listing, by labeling, or by certification for that identified purpose.
- Mechanical strength and durability. For parts designed to enclose and protect other equipment, this includes the adequacy of the protection thus provided.
- Electrical insulation
- Heating effects under conditions of use – if it starts to overheat disconnect it!
- Arcing effects
- Classification by type, size, voltage, current capacity, and specific use

To protect you from harm due to the poor condition of cords and wires:

- Insulate live wires
- Check before use
- Use only 3-wire-type cords
- Use only cords marked for hard or extra-hard usage
- Make sure your cords are equipped with strain-relief
- Unplug cords by grasping the plug, not pulling the cord
- Take unmarked or modified cords out of service

Four components comprise a typical extension cord grounding system:

- A third wire in the plug, called a ground wire;
- A three-pronged plug with a grounding prong on one end of the cord;
- A three-wire, grounding-type receptacle at the other end of the cord;
- A properly grounded outlet

The National Electrical Code (NEC) requires that GFCIs be used when:

- Electricity is used near water (a common example is a hair dryer, which are now required to have GFCIs lest they fall [or be “accidentally” dropped] into a bathtub or sink…)
- Temporary wiring or extension cords are being used
- Circuits are providing power to outdoor receptacles or portable tools

Common misuses of electrical equipment to avoid:

- Using multi-receptacle boxes that are designed to be securely mounted as “portable” stations by fitting them with a power cord and putting them on the floor
- Using equipment that is specifically labeled for use in dry, indoor locations only outside.
- Attaching ungrounded two-prong adapter plugs to three-prong cords and tools
- Using circuit breakers of fuses with the wrong rating for overcurrent protection
- Using cord or tools that have been modified from the way they were manufactured and/or meant to be used – for example, removing a face plate, insulation, or ground prongs
- Using cords or tools with exposed wires, and fraying, cut or worn insulation

Use the three-stage safety model to stay safe: **recognize, evaluate, and control** hazards. To be safe, you must think about your job and plan for hazards. To avoid injury or death, you must understand and recognize hazards. You need to evaluate the situation you are in and assess your risks. You need to control hazards by creating a safe work environment, by using safe work practices, and by reporting hazards to a supervisor.

If you do not recognize, evaluate, and control hazards, you may be injured or killed by the electricity itself, electrical fires, or falls. If you use the safety model to recognize, evaluate, and control hazards, you are much safer.