# Best Practices for Electrical Safety for Non-Qualified Employees

Scope

The scope of this best practice consists of guidelines that a facility could use to develop their own detailed and specific procedures for electrical safety for non-qualified employees. OSHA requires that most electrical servicing and repair tasks should be limited to workers who have been fully trained on electrical hazards and procedures. This best practice describes what non-qualified employees need to know about electrical safety. See 29 CFR 1910 Subpart S for requirements for qualified employees. Note that OSHA looks to the prescriptive based requirements of NFPA 70E to fulfill the performance-based requirements included in its standards. NFPA 70E fleshes out how the requirements in the OSHA standards should be met by providing and defining the minimum standard industry practices necessary for electrical safety. OSHA is the law, but NFPA 70E outlines how to comply with OSHA's electrical safety requirements.

Key Points

- Ensure non-qualified persons/employees have basic electrical safety training for working around (not on) electrical equipment. Best practice is annual training and more often if job duties change, internal procedures change, or if not proficient.
- Ensure that only qualified electrical workers perform electrical work.
- Use ground fault circuit interrupters (GFCIs) on extension cords and for temporary electrical supplies.
- Do not use devices with frayed or taped cords.
- Ensure employees know how to report and respond to electrical emergencies.
- Train employees to inspect their work area for unsafe electrical conditions.
- Use equipment that's in good condition per its listing and labeling instructions, i.e. no daisy chaining, no overloading of circuits, etc.

Definitions

Qualified Person and Unqualified Person (in the context of electrical safety) - Because of the potential for fatal accidents when electricity is concerned, OSHA says that only "qualified" persons can perform electrical maintenance and repairs. OSHA defines qualified workers as those who have been fully trained to identify exposed live electrical parts and their voltage, and who have learned exactly what procedures to follow when they work on exposed live parts or are close enough to be at risk. Everybody else is "unqualified," and are prohibited from working on electrical wiring or attempting to repair electrical equipment. In spite of the term "unqualified," there are training requirements for these employees if working around electrical equipment.

Why this Best Practice is Important

- Electrocution is a leading cause of death in the workplace. It only takes one or two-tenths of an ampere (amp) passing through a person to cause death, regardless of the voltage.
- Most 120 volt circuit breakers are set at 15 or 20 amps, about 100 times the amount of current that can cause death. Circuit breakers protect equipment, not you.
- More than half of deaths involving electricity are caused by two things—defective electrical equipment and failure to follow safe procedures.
- Accidents involving electricity can cause fires that can damage your facility in addition to causing injuries or fatalities.
- Because almost every job, even an office job, involves some contact with electricity, all employees should recognize electrical hazards and know how to prevent electrical accidents.

What do Unqualified Persons Need to Know?

Although unqualified persons are not allowed to perform electrical work, those unqualified persons who have a job that might expose them to the risk of electrical shock need some basic electrical safety training. Far too many incidents are caused by unqualified persons making unauthorized electrical repairs. They have to know:

- Tasks/repairs can only be performed by qualified persons (e.g., maintenance and repairs).
- Electrical hazards in the workplace.
- Procedures to follow to protect themselves when they work around electricity.
- How to report electrical problems.
- What to do in the event of an emergency involving electricity.

This best practice details what an unqualified person needs to know.

General Requirements

- ONLY qualified persons may work on electric circuit parts or equipment.
- All electrical equipment shall be properly grounded. See “Grounding Safety” in Appendix A.
- The placement of electrical connections should be such that there is no danger of chemical or water spillage on wires or equipment.
- Don’t touch anything electrical with wet hands or while standing in a wet area.
- There should be no overloaded circuits or daisy chaining of cords or power strips,.
- If a circuit breaker trips, see “Circuit Breaker Resetting” for when and how to reset a breaker.
- Temporary wiring must be managed and controlled. Best practice is for facilities to use a temporary MOC (Management of Change) protocol or have a temporary wiring policy that documents and authorizes the use of temporary wiring and places a time limit on its use.
- Use of extension cords only if necessary and on a temporary basis only. See “Extension Cord and Cable Safety.”

- Use ground fault circuit interrupters (GFCI's) when using extension cords and when using cords outdoors or in wet areas. See "GFCI's Explained" in Appendix A.
- Inspect electrical tools and equipment before use to make sure insulation and wiring are in good condition. Otherwise, do not use. See "Portable Electrical Equipment Safety."
- Proper Lockout/Tagout procedures shall be followed. See the best practice, "Control of Hazardous Energy."
- If a piece of electrical equipment shocks, smokes, smells, or sparks, turn it off, tag it out, and report it to your supervisor.
- Don't contact anything electrical with anything metal.
- In areas with flammable liquids, vapors, or combustible dust, use only electrical cords and equipment identified as safe for that use and that meet the area's electrical classification.
- Make sure equipment doesn't spark or get hot enough to ignite flammable or combustible materials in the area.
- Don't let grease, dust, or dirt build up on electrical equipment.
- Keep electrical equipment well-lubricated to prevent overheating.
- Don't reach blindly into a space that may contain energized parts.
- Electrical service panels and disconnects shall be marked to indicate the voltage and to identify the equipment it controls.
- Junction boxes, electrical service panels, and disconnects shall be kept closed with no openings which would allow contact with energized parts.
- Be aware of other hazards, such as broken conduits, missing outlet and conduit covers, overhead lines, and underground cables.

<u>Electrical Emergencies</u>

- Ensure employees know who to call for emergency assistance.
- Visually examine victims to determine if they are in contact with energized conductors, metal surfaces, and other objects near the victim. The earth itself may be energized.
- Do not touch the victim or conductive surfaces while they are energized.
- De-energize electrical circuits if at all possible.
- Provide medical assistance, if qualified and scene is safe. CPR / AED may be needed.

<u>Electrical Fires</u>

- Use Fire Extinguishers rated for Electrical Fires. These extinguishers will be Class "C" rated.
- Fight the fire only if you can do so safely and are fire extinguisher trained.

<u>Circuit Breaker Resetting</u>

- Best practice is for a facility to have a procedure nor non-qualified employees to operate/reset breakers. It should include instructions to stand to the side of the breaker panel with one's head turned away when operating the breaker.

- Note the OSHA requirements on this subject per §1910.334(b)(2): *"Reclosing circuits after protective device operation*. After a circuit is deenergized by a circuit protective device, the circuit may not be manually reenergized until it has been determined that the equipment and circuit can be safely energized. The repetitive manual reclosing of circuit breakers or reenergizing circuits through replaced fuses is prohibited. Note: When it can be determined from the design of the circuit and the overcurrent devices involved that the automatic operation of a device was caused by an overload rather than a fault condition, no examination of the circuit or connected equipment is needed before the circuit is reenergized."
- The breaker tripped for a reason. Investigate and rectify the reason for the overload.
- After it's determined that circuit and equipment can be safely energized, trained non-qualified employees can make one attempt can be made to reset breakers 220 V or less. One attempt can also be made to reset breakers 480 V or less that feeds a single load. Note that this is one attempt of the circuit breaker, not one attempt per employee.
- The repetitive manual re-closing of circuit breakers or reenergizing circuits through replacing fuses is prohibited.
- Obtain assistance if the circuit breaker trips again.

Appliance Safety

- Use GFCI. If the power outlet isn't a GFCI outlet, plug a portable GFCI directly into the outlet. Then plug the device into the portable GFCI.
- Must be listed by a product safety testing and certification organization.
- Must have a manufacturer's nameplate.
- Must have a power supply cord in good condition.

Extension Cord and Cable Safety

- Use GFCI. If the power outlet isn't a GFCI outlet, plug a portable GFCI directly into the outlet. Then plug the device into the portable GFCI.
- Cords and cables must be suitable for the intended use and voltage.
- Place electrical extension cords so that they do not cause slip, trip, or fall hazards.
- Protect extension cords from damage.
- Secure or suspend extension cords with a non-conductive means.
- Don't drive over cords.
- Don't connect two or more extension cords together.
- Don't use the cord for a rope.
- Don't remove the grounding prong.
- Don't unplug by pulling the cord.
- If cord has frayed or damaged insulation, or insulation repaired with electrical tape, do not use.
- Ensure the plug is fully seated.
- Protect cords that are run through doors and other pinch points.

Portable Electric Power Strip Safety

- Use GFCI. If the power outlet isn't a GFCI outlet, plug a portable GFCI directly into the outlet. Then plug the device into the portable GFCI.
- Protect from mechanical damage, oil, solvents, abrasion, pinch points and sharp objects.
- Place so not to cause slip, trip, or fall hazards.
- Visually inspect for damage. Any damaged portable electric power strips shall be immediately removed from service.
- Do not connect to another power strip.

Portable Electric Equipment Safety

- Use GFCI. If the power outlet isn't a GFCI outlet, plug a portable GFCI directly into the outlet. Then plug the device into the portable GFCI.
- The user must visually inspect the equipment for defects and damage before the equipment is used on any shift. Tools that have electrical tape repairs on power cords shall be removed from service.
- Remove all damaged portable electric tools from use and tag it out.
- Use double-insulated tools when possible. Otherwise, ensure tools are grounded. For details in double insulated tools, see "Double Insulated Tools Explained" in Appendix A.
- Never carry a tool by the cord.
- Never pull the cord to disconnect it from the receptacle.
- Ensure that cords from electric tools do not present a tripping hazard.
- Keep cords away from heat, oil, and sharp edges, including the cutting surface of a power saw or drill.
- Disconnect tools when not in use, before servicing, and when changing accessories such as blades, bits, etc.
- Avoid accidental starting. Do not hold fingers on the switch button while carrying a plugged-in tool.
- Use gloves and appropriate safety footwear when using electric tools.
- Store electric tools in a dry place when not in use.
- Do not use electric tools in damp or wet locations unless they are approved for that purpose.
- Keep work areas well lighted when operating electric tools.

# Appendix A
# A Few Basic Electrical Safety Principles

Grounding Safety Explained

A ground wire is a safety wire that has intentionally been connected to earth. Grounding adds a third wire that does not carry electricity under normal circuit operations. Its purpose is to provide an alternate return path for any current that is unable to complete its circuit rather than go through anyone touching a dangerous appliance or electrical box.

Double Insulated Tools Explained

Not all electrical tools are made with a grounding pin. A double insulated tool does not have a casing or housing made from a conductive material. Instead it is made of plastic or some other material that is non-conductive. This extra layer of electrical insulation provided by the non-conductive casing or housing negates the need for a grounding wire and prong on the power cord. You can tell if the tool you are using is a double-insulated by looking at the manufacturer's data plate or sticker affixed to the tool, and if it is double insulated and you may see the words "Double Insulated" or the international symbol for a double insulated tool on the label; it is a "square-within-a-square." Remember any breach in the tool's plastic casing or housing creates a potential pathway for electricity to travel through and make contact with your skin. Such conditions can occur if the tool casing or housing is cracked, which can happen if the tool is dropped onto a hard surface. A breach can also occur if any screws or other fasteners that hold the casing or housing parts together become loose and allow the casing to separate.

GFCI's Explained

A ground fault circuit interrupter (GFCI) is a fast acting circuit breaker which shuts off electric power when it senses an imbalance between the outgoing and incoming current. It is designed to break the circuit in as little as 1/40 of a second. The main purpose is to protect people from an electric shock caused when some of the current travels through a person's body due to an electrical fault. Standard circuit breakers shut off power when the current is too high to protect equipment, like 10, 15, or 20 amps, but a mere 0.030 amps through a body can cause paralysis of muscles and stop the human heart. The GFCI breaks the circuit when it detects an imbalance of only 0.005 amps (0.030 amps in Australia and some European / Asian countries.) GFCI's are either built into electrical outlets or are external, portable devices.

- The number of deaths from electrical shock in the work place has been cut in half since GFCI's have been introduced.
- GFCI's are required for all maintenance activities and when extension cords are used.
- GFCI's protect you from electrical shock by tripping on very small amounts of current leakage to ground, which may be through you.

- Plugging one GFCI into another one does not create a hazard. The most sensitive one will trip first.
- GFCI's may be permanently installed in outlets or portable GFCI's may be used. If the power outlet isn't a GFCI outlet, plug a portable GFCI directly into the outlet. Then plug the device into the portable GFCI.
- Test before use. Push the test button and verify the GFCI has shut off by plugging a safe device into it (i.e. portable lamp or tool). If it does not shut off, do not use it. Otherwise, reset it. If the circuit then turns on, it is safe to use.