

Introduction

The purpose of these guidelines is to establish minimum standards to protect cast and crew members against electrical shock, burns, electrocution, and other electrical safety hazards as well as ensure compliance with regulatory requirements applicable to electrical systems. Always adhere to the National Electrical Code (NEC) and all applicable Federal, local and Authority Having Jurisdiction requirements (AHJ).

Definitions

The below terms will be used throughout this document:

Qualified Person

Person(s) who has demonstrated skills and knowledge related to the operation and installation of electrical equipment and has received safety training to identify the hazards and reduce the associated risk.

Hazard Control Methods

The following control methods should be implemented to prevent the occurrence of electricity-related incidents. This is not an all-inclusive list; additional control methods may be identified by a qualified person (e.g., hazard assessment) or required by the Authority Having Jurisdiction (AHJ).

Engineering Controls

- All electrical distribution panels, breakers, disconnects, switches and junction boxes should be completely enclosed.
- Water-tight enclosures should be used if any of these components could be exposed to moisture.
- Structural barriers should be used to prevent accidental damage to electrical components.
- Conduits must be supported for their entire length, and non-electrical attachments to conduits are prohibited.
- Non-rigid electrical cords should have strain relief wherever necessary.
- Proper cable covers and ramps should be used anytime cables and cords are on walking or driving paths.
- Portable ladders shall have non-conductive side rails if they are used where either the ladder or the cast or crew member may contact exposed energized parts.

Administrative Controls

- Only trained and qualified person(s) may install, repair or service electrical equipment (consult your local Authority Having Jurisdiction (AHJ) for mandatory qualifications).
- Only trained and qualified person(s) may connect, disconnect, or operate 480 Volt systems or equipment.
- Only trained and qualified person(s) may work in areas containing unguarded, uninsulated energized lines or parts of equipment operating at 50 volts or more.
- Only trained and qualified person(s) may work on or with unguarded, uninsulated electric circuit parts or equipment that cannot be deenergized.
- Physical barriers and signage must be used to prevent unauthorized persons from entering areas where new installation or repair of permanent electrical components or equipment is being performed.
- Portable cables and conductors should be color coded to ensure that 120-volt equipment is not mistakenly connected to a 480-volt system.

Work Practice Controls

- Appropriate PPE (e.g., insulated safety shoes, non-conductive gloves, Class E hardhat, etc.) for the task should be selected and worn. [Refer to Safety Bulletin 23D- Common Motion-Picture/Television Tasks and Associated PPE.](#)
- Use appropriate tools for the task (e.g., insulated tools, etc.).

General Precautions

Wet Environments

- Portable electric equipment and flexible cords (e.g., stingers, extension cords, power strips, etc.) shall be rated for wet environments.
- If working outside or in a wet environment, use an appropriate Ground Fault Circuit Interrupter (GFCI). GFCI's should not be used when an unexpected shutdown of power might introduce additional or increased hazards (e.g., life-critical stunt equipment, life-critical SPFX equipment, emergency exit signs, emergency lighting, etc.). Use of GFCIs must be evaluated by a qualified person.
 - IF GFCIs cannot be used, other precautions must be taken to eliminate the risk of shock (e.g., moving equipment away from the water hazard, enclosing the equipment in a rated container, or raising the equipment onto dry platforms).
- Do not submerge electrical equipment and cables in water unless they are specifically designed to do so and are placed by appropriately trained and qualified individuals.
- Never put water on an electrical fire and use the proper type of fire extinguisher such as one with an ABC or BC rating.

Hazardous Environments

- Where flammable materials (e.g., combustible dusts, flammable gases, vapors, or liquids) are present, electric equipment capable of igniting them shall not be used, unless measures (e.g., grounding, bonding, ventilation, etc.) are taken to prevent hazardous conditions from developing.
- More rigorous electrical installation requirements are mandated where flammable materials are used on a regular basis. Consult your local AHJ (Authority Having Jurisdiction) for electrical building standards when installing, repairing, or operating electrical equipment in these atmospheres.
- Please contact your Production Safety Representative prior to starting work in hazardous environments.

Clearances

- Minimum clearances must be observed when working near overhead power lines, particularly when using aerial lifts or scaffolds. Always be aware of power lines in your work area, especially overhead lines that can be un-insulated. [Refer to Safety Bulletin 23A – Powerline Distance Requirements.](#)
- All electric panels and electrical disconnects must be unobstructed with a minimum of 36 inches (91 cm) of clearance.

Maintenance

- Ensuring that electrical equipment is in good working condition is essential to your safety and those working nearby.
- Inspect equipment and cables prior to use. Equipment that is malfunctioning or showing defects/damage should be removed from service, tagged, and locked out until repairs can be completed.
- Fuses and circuit breakers should only be replaced by trained and qualified person(s).
- Only trained and qualified person(s) may repair or service electrical equipment (consult your local Authority Having Jurisdiction (AHJ) for mandatory qualifications).

Rigging & De-Rigging Electrical Systems

- Flexible electrical cords (e.g., stingers, extension cords, etc.) may not be used for raising or lowering equipment.
- Do not pull on the cord when unplugging equipment, grasp the plug to firmly unplug.
- Ensure hands are not wet when rigging and de-rigging electrical systems.
- Portable cables and conductors should be color coded in accordance with the National Electrical Code (NEC).
- Where more than one voltage system exists within the same premises, each system conductor shall be identified by the system to which it is connected. This can be done by separate color coding, marking tape, tagging or other equally effective means.
- Always treat any exposed or non-insulated part of a distribution system as energized.
- The electrical system should be de-energized while it is being rigged.
- Connections should be made from the farthest load first, then progressively towards the power source. Disconnections should be made in the reverse order.

Energizing an Electrical System

Before energizing a system:

- Ensure equipment, cables, plugs, and connectors are free from exposed current-carrying parts, damage, and excessive wear. Damaged equipment should not be used.
- Ensure grounded equipment has been tested for continuity between the ground pin on the plug and the non-current-carrying metal parts of the equipment.
- Ensure all connections are properly mated.
- Ensure the system is free from short circuits and crossed wires.
- If applicable, follow all required [lockout tagout protocols](#).

Vehicle and Trailer-Mounted Generators

Safe work practices must be observed while using vehicle and trailer-mounted generators.

Generator Operator Responsibilities

Generator operators must be trained and qualified. They have the following responsibilities:

- Comply with appropriate standards and regulatory requirements for operating generators.
- Ensure appropriate fire extinguishers are available and serviceable.
- Ensure exposure to cast, crew, and the public is minimized.

Generator Placement

When planning placement for a generator:

- Ensure sufficient ventilation.
- Direct exhaust away from people, air intakes and enclosed areas.
- Restrict the ability of public, cast, and crew to access exposed connections by using appropriate barriers.
- Do not position under trees or near dry brush.
- Do not block fire lanes, hydrants, or emergency exits or doorways.
- Do not park where the generator may be exposed to fire effects, pyrotechnics, or other hazardous materials.

Fueling a Generator

When fueling a generator:

- Turn off the power.
- Ensure the frame of the fuel vehicle is bonded to the frame of the generator.
- Bond fuel containers to the frame of the generator.
- Wear appropriate PPE.
- Do not smoke or expose flammable liquids to open flame or ignition sources.
- Ensure fueling components (e.g., nozzles, hoses, gas cans, etc.) are listed by a Nationally Recognized Testing Laboratory (NRTL).
- Avoid over-filling and spilling fuel.
- Report any spills or leaks to your supervisor as soon as possible.

Grounding or Bonding Generators

Properly grounded and bonded electrical generators offer protection for you and those working with you in multiple situations. When needed, proper grounding and bonding gives electricity a safe path to follow, preventing serious injury. Contact your authority having jurisdiction (AHJ) for proper grounding requirements at your location.

Earth Grounding Generators

When grounding and bonding conditions cannot be met, the generator may need to be grounded to the earth. Requirements include:

- When the generator is an exclusive source of power for a location and earth grounding is required, avoid using interior water pipes, metal fixtures, metal frames of buildings, fire hydrants or standpipes.
- When a building has live electrical service, but a generator is being used in combination with the building's power, the generator's grounding connection must be bonded to the main building grounding electrode system and the service.

Multiple Generators

Unless otherwise required by the Authority Having Jurisdiction (AHJ), multiple generators should have their grounding connections bonded together if:

- Generators are located within 20' of one another.
- On an exterior set, one generator supplies equipment that could come within 20' of equipment supplied by another generator.
- On an interior set, one generator supplies equipment that could come within 12' of equipment supplied by another generator.

Generator Insulation

While rubber tires on vehicles or trailer-mounted generators will help insulate the frame from the earth, there are other potential paths for electricity that need to be assessed.

- Metal parts attached to these vehicles or trailers such as metal stairways or lift gates should be insulated with rubber mats.
- Metal supports of trailer-mounted generators should be insulated using wooden blocks or other non-conductive material.
- Safety tow chains should be secured to prevent contact with the earth.

Lockout / Tagout (LOTO)

Lockout/tagout (LO/TO) is meant to prevent unexpected energizing of a system or release of stored energy that could cause injury during service and maintenance operations.

Tagging out may only be used when the energy isolating devices are not lockable. Additional training and more rigorous periodic inspections will be required to perform Lockout/Tagout. Refer to the [Lockout Tagout Program](#).

Electrical Test Equipment Requirements

Select electrical test and metering equipment that provides the highest level of safety.

- Test instruments, equipment and their accessories shall be rated for the circuits and equipment to which they will be connected and shall be designed for the environment in which they will be used.
- Clamp-on meters should be used when possible, to minimize the potential for contact with energized conductors.
- Proximity voltage testers, available to persons performing de-energized electrical work, will allow the worker to verify a de-energized condition without contacting an electrical conductor.
- Multimeters should be certified by a Nationally Recognized Testing Laboratory (NRTL) and be designed for the voltage being tested.
- Electrical test equipment should be inspected for soundness and integrity before each use.
- The equipment should not be used if it is damaged, or its functionality is questionable.
- Electrical test equipment should be calibrated based on manufacturer recommendations or whenever the meter is suspected of improper readings. If there is any doubt of the equipment's calibration, it should be recalibrated. Calibration records must be maintained by the equipment owning department.

Electrical Equipment Inspections

Qualified person(s) should inspect all electrical equipment for hazards that could cause cast and crew members injury or death. The following factors will be considered in determining the safety of the equipment:

- Suitability for the intended use
- Proper insulation
- Heating effects under conditions of use
- Arcing effects
- Classification by type, size, voltage, current capacity, and intended use.
- Condition of equipment

Electrical Incidents

- If an electrical accident occurs, notify emergency responders immediately.
- Do not approach any electrical incident until you have been notified by a qualified person, that it is safe to approach.
- Do not touch a victim of electrical shock while they are connected to the circuit. If safe to do so, turn off the power.
- Victims of an electrical shock incident must be evaluated by a qualified medical professional.

Training

A qualified person is one who has training in avoiding the electrical hazards of working on or near exposed energized parts. An unqualified person is one with little or no such training working on or near exposed energized parts.

Unqualified persons are not permitted to work directly on, with, or in the vicinity of exposed energized parts unless under direct supervision of a qualified person and must be trained in how to recognize and avoid energized parts.

Training is required for all cast and crew who may have to work on or in the vicinity of or have to de-energize equipment prior to working on exposed energized parts of circuits operating at 50 volts or more relative to ground.

Content

Qualified persons shall have the following additional training:

- The skills and techniques necessary to distinguish exposed live parts from other parts of electrical equipment.
- The skills and techniques necessary to determine the nominal voltage of exposed live parts.
- Clearance distances from unguarded overhead lines specified by AHJ.
- Hazards of electricity.
- Applicable codes, regulations, and standards.
- Demonstrations and hands on practice.
- Use and care of personal protective equipment.
- Job-specific safe electrical work practices.
- Electrical requirements of safe operating procedures.

Additional topics may be required by local AHJ.

It is important to note that a person can be qualified for certain tasks and not for others. A qualified person must be qualified for the tasks they are designated and authorized to perform. If you have not been previously trained and/or do not know how to perform a task safely, STOP, and inform your department head immediately.

Training may be either on the job or in a classroom setting. The Production must maintain documentation of training.

Additional Resources

Industry-Wide Labor Management Safety Committee (CSATF) - [Safety Bulletins](#)

[23 – Guidelines for Working with Portable Power Distribution Systems and Other Electrical Equipment](#)

[23A – Power Line Distance Requirements](#)

[23C – Working With 480 Volt Systems](#)

[23D- Common Motion-Picture/Television Tasks and Associated PPE](#)

Please contact your Production Safety Representative for further guidance.