## Electrical Safety NFPA 70E

1. **Purpose**

This section provides information and requirements for basic electrical safety. Work operations shall be conducted in a manner which, at a minimum, complies with applicable health and safety laws and regulations, including OSHA 29 CFR 1910.301-.399, Subpart S Electrical, and National Fire Protection Agency (NFPA) 70E *“Standard for Electrical Safety in the Workplace*”*.*

1. **Safe Work Practices**

Safety-related work practices will be employed to prevent electric shock or other injuries resulting from either direct or indirect electrical contacts, when work is performed near or on equipment or circuits which are or may be energized. The specific safety-related work practices will be consistent with the nature and extent of the associated electrical hazards and as follows:

* Non-qualified personnel are prohibited from working on or near exposed energized electrical circuits or systems. Non-qualified personnel will be trained in the recognition and avoidance of electrical hazards in the work area.
* Any exposed electrical systems will be de-energized and lockout/tagout procedures adhered to before unqualified personnel are allowed access to the work areas. The circuits energizing the parts shall be locked out, tagged out or both. Conductors and parts of electrical equipment that have been de-energized but not been locked or tagged out shall be treated as live parts.
* Only qualified persons may work on electric circuit parts or equipment that has not been de-energized. Such persons shall be made familiar with the use of special precautionary techniques, PPE, Insulating & shielding materials and insulated tools.
* If work is to be performed near overhead lines, the lines will be de-energized and grounded, or other protective measures such as insulating shielding will be provided before work is started.
* Vehicles or equipment working near overhead lines will be required to maintain a safe working distance of at least 10 feet. If the voltage is higher than 50 kV, the clearance will be increased 4 inches for every 10 kV over that voltage.
* Employees may not enter spaces containing exposed energized parts or work on energized parts unless illumination is provided that enables the employee to perform the work safely. Employees may not reach blindly into areas which may contain energized parts. Where lack of illumination or an obstruction precludes observation of the work to be performed, employees shall not perform any task within the Limited Approach Boundary of energized electrical conductors or circuit parts operating at 50 volts or more or where an electrical hazard exists.
* When an employee works in a confined or enclosed space (such as a manhole or vault) that contains exposed energized parts the employee will use, protective shields, protective barriers, or insulating materials as necessary to avoid inadvertent contact with these parts. Doors, hinged panels, and the like will be secured to prevent their swinging into an employee and causing the employee to contact exposed energized parts.
* Conductive materials and equipment such as long dimensional conductor objects will be handled in a manner to prevent them from contacting exposed energized conductors or circuit parts, or will be shielded to prevent conduction of electrical energy. Conductive articles of jewelry and clothing (such as watch bands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, or metal headgear) may not be worn if they might contact exposed energized parts while performing work.
* Portable ladders will have nonconductive side rails if they are used where the employee or the ladder could contact exposed energized parts. The employee will ensure that the placement of any ladder will allow a safe working distance from any energized parts or equipment.
* Synthetic clothing such as nylon or polyester should not be worn. Clothing worn while working on electrical systems should meet the risk requirements of the system being worked on and at a minimum be flame-resistant (cotton).

1. **Approach Distances**

When an unqualified person is working in an elevated position near overhead lines, the location shall be such that the person and the longest conductive object he or she may contact cannot come closer to any unguarded, energized overhead line than the following distances:

* 10 ft. for voltages to ground 50 kV or below.
* 10 ft. for voltages to ground over 50 kV. Add 4 inches of distance for every 10 kV over 50 kV.

When an unqualified person is working on the ground in the vicinity of overhead lines, the person may not bring any conductive object closer to unguarded, energized overhead lines than:

* 10 ft. for voltages to ground 50 kV or below.
* 10 ft. for voltages to ground over 50 kV. Add 4 inches of distance for every 10 kV over 50 kV.

When a qualified person is working in the vicinity of overhead lines, whether in an elevated position or on the ground, the person may not approach or take any conductive object without an approved insulating handle closer to exposed energized parts than shown in the following:

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| **Approach Distances for Qualified Employees – Alternating Current** | |
| **Voltage Range (Phase to Phase)** | **Minimum Approach Distance** |
| 300V and less | Avoid contact |
| Over 300V, not over 750V | 1 ft 0 in (30.5 cm) |
| Over 750V, not over 2 kV | 1 ft 6 in (46 cm) |
| Over 2 kV, not over 15 kV | 2 ft 0 in (61 cm) |
| Over 15 kV, not over 37 kV | 3 ft 0 in (91cm) |
| Over 37 kV, not over 87.5 kV | 3 ft 6 in (107 cm) |
| Over 87.5 kV, not over 121 kV | 4 ft 0 in (122 cm) |
| Over 121 kV, not over 140 kV | 4 ft, 6 in (137 cm) |

* The person is insulated from the energized part (gloves, with sleeves if necessary, rated for the voltage involved are considered to be insulation of the person from the energized part on which work is performed); or
* The energized part is insulated both from all other conductive objects at a different potential and from the person; or
* The person is insulated from all conductive objects at a potential different from that of the energized part.

1. **Limited Approach Boundary**

Live parts to which an employee might be exposed shall be put into an electrically safe work condition before an employee works on or near them, unless the employer can demonstrate that de-energizing introduces additional or increased hazards or is infeasible due to equipment design or operational limitations or if the energized parts operate at less than 50 volts. Only qualified employees are permitted to enter spaces with live parts. Only qualified people are allowed to test, conduct voltage tests or troubleshooting within the Limited Approach Boundary.

Unqualified persons shall not be permitted to enter spaces that are required to be accessible to qualified employees only, unless the electric conductors and equipment involved are in an electrically safe work condition.

A shock hazard analysis shall be conducted to determine the voltage to which personnel will be exposed, boundary requirements, and the personal protective equipment necessary in order to minimize the possibility of electric shock to personnel.

1. **Task Hazard Analysis**

A task hazard analysis shall be conducted to include a review of the task and foreseeable hazards that use event severity, frequency, probability, and avoidance to determine the level of safe practices employed. A task hazard analysis shall include:

* Gathering task information and determining task limits.
* Documenting hazards associated with each task.
* Estimating the risk factors for each hazard/task pair.
* Assigning a safety measure for each hazard to attain an acceptable or tolerable level of risk.

Contributing factors of the probability of electrical hazards to consider are hazard exposure, human factors, task history, workplace culture, safeguard reliability, ability to maintain or defeat protective measures, and preventative maintenance history.

1. **Arc Flash Risk Assessment**

* An arc flash risk assessment shall be conducted before beginning energized work to determine if an arc flash hazard exists.
* If an arc flash hazard exists, the assessment must determine the appropriate safety-related work practices, the arc flash boundary, and the PPE required to minimize the risk of electric shock.
* Assessments must be documented and equipment field marked with a label.
* The arc flash hazard assessment shall be reviewed prior to beginning work with exposure to electrical hazards.

1. **Alerting Techniques**

* Alerting techniques shall be used to warn and protect employees from hazards which could cause injury due to electric shock, burns, or failure of electric equipment parts.
* The alerting technique used must not increase the potential for employee injury.
* Safety signs, safety symbols, or accident prevention tags shall be used where necessary to warn employees about electrical hazards which may endanger them. Safety signs must meet the requirements of ANSI Z535 Table 130.7(F).
* Barricades shall be used in conjunction with safety signs where it is necessary to prevent or limit employee access to work areas with exposure to uninsulated energized conductors or circuit parts. Conductive barricades may not be used where they might cause an electrical contact hazard.
* If signs and barricades do not provide sufficient warning and protection from electrical hazards, an attendant shall be stationed to warn and protect employees.

1. **Work Permit**

When working on energized electrical conductors or circuit parts that are not placed in an electrically safe condition, work to be performed shall be considered energized electrical work and shall be performed by written permit only. The work permit shall consist of:

* A description of the circuit and equipment to be worked on and their location.
* Justification for why the work must be performed in an energized condition.
* A description of the safe work practices to be employed.
* Results of the shock hazards analysis.
* Determination of shock protection boundaries.
* Results of the flash hazard analysis.
* The Flash Protection Boundary
* The necessary personal protective equipment to safely perform the assigned task.
* Means employed to restrict the access of unqualified persons from the work area.
* Evidence of completion of a job briefing, including a discussion of any job-specific hazards.
* Energized work approval (authorizing or responsible management, safety officer, or owner, etc.) signature(s).

A job briefing shall be held before starting each job and include all employees involved. The briefing shall cover hazards associated with the job, work procedures involved, special precautions, energy source controls, and PPE requirements.

1. **Personal Protective Equipment (PPE)**

Employees working in areas where electrical hazards are present shall be provided with, and shall use, protective equipment that is designed and constructed for the specific part of the body to be protected and for the work to be performed.

All PPE used must meet the NFPA 70e requirements in Table 130.7(C)(14) of.

All insulating PPE must be inspected before each day's use and immediately following any incident that can reasonably be suspected of having caused damage. Insulating gloves shall be given an air test, along with the inspection. Such tests include:

* Blankets-before first issue/every 12 months thereafter
* Gloves-before first issue and every 6 months
* Sleeves before first issue and every 12 months
* Covers and Line hose shall be testing if insulating value is suspect.

1. **Test Instruments**

Test instruments, equipment, and their accessories shall meet the requirements of ANSI/ISA-61010-1-Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use -Part 1 General Requirements, for rating and design requirements for voltage measurement and test instruments intended for use on electrical systems 1000 Volts and below.

When test instruments are used for the testing for the absence of voltage on conductors or circuit parts operating at 50 volts or more, the operation of the test instrument shall be verified before and after an absence of voltage test is performed.

Only qualified persons shall perform testing work on or near live parts operating at 50 volts or more.

1. **Ground-fault circuit interrupters (GFCI)**

* Ground-fault protection will be provided for personnel on construction sites on all 120-volt single phase, 15 and 20 ampere receptacle outlets, which are not a part of the permanent wiring and which are in use by employees.
* Ground fault circuit interrupters will be used when an outlet is near a water source, or when damp or wet conditions exist and portable electrical equipment is being used.
* GFCIs shall be tested periodically to ensure their operability.

1. **Multi-Employer Worksite**

The contract employer shall advise the host employer of:

* Any unique hazards presented by the contract employer’s work.
* Any unanticipated hazards found during the contract employer’s work that the host employer did not mention.
* The measures the contractor took to correct any hazards reported by the host employer to prevent such hazards from recurring in the future.

1. **Audit**

* An audit of the electrical safety program shall be performed every three years to verify the principles and procedures are in compliance with the latest version on NFPA 70E.
* A field audit shall be performed annually to verify the procedures and practices of this standard are being followed.
* The audits shall be documented.

1. **Training**

The degree of training provided will be determined by the employee's respective job assignments.

Qualified employees who are allowed to work within the Limited Approach Boundary shall, at a minimum, be trained in and familiar with the skills and techniques necessary to:

* Distinguish exposed energized electrical conductors and circuit parts from other parts of electric equipment.
* To determine the nominal voltage of exposed energized electrical conductors and circuit parts.
* The approach distances and the corresponding voltages to which they will be exposed.
* The decision making process necessary to determine the degree and extent of the hazard and the personal protective equipment and job planning necessary to perform the task safely.

All other employees who may face a risk of injury due to electric shock or other electrical hazards will also be trained in and familiar with the safety related work practices and approach distances that pertain to their respective job assignments. Employees shall be trained to identify and understand the relationship between electrical hazards and possible injury. All employees will be retrained every three years.

An employee will be retrained under any of the following conditions.

* It is determined that an employee is not following safe work practices.
* If we add new equipment, that is different than the equipment in use, new technology is introduced or new work procedures are being introduced in an employees work area.
* If an employee must use safe work practices that are different than they currently use.

Documentation shall be made when the employee demonstrates proficiency, be maintained for the duration of the employee's employment, and contain each employee's name and date of training.