NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) 70E

Procedure

This electrical safety procedure structures safety procedures to meet the requirements of the NFPA-70E Standard.

The program is designed for qualified employees who occasionally must perform work on or near exposed energized electrical conductors and circuit parts rated greater than 50 volts.

Purpose

This procedure has been established to ensure electrical work on energized parts is performed only when necessary, and after every alternative means to carry out de-energized work has been exhausted. This program establishes safeguards that will identify and control hazards encountered in testing, maintenance, installation, operation, and demolition.

Definitions

Arc Flash Hazard—A dangerous condition associated with the possible release of energy caused by an electric arc.

Arc Flash Hazard Analysis—A study investigating a worker's potential exposure to arc-flash energy. Arc Flash Hazard Analysis is conducted for the purpose of injury prevention and to determine safe work practices, arc flash protection boundary and the appropriate levels of PPE.

Arc Rating—The value attributed to materials that describes their performance when exposed to an electrical arc discharge.

Boundary, Arc Flash Protection—An approach limit at a distance from a prospective arc source within which a person could receive a second degree burn if an electrical arc flash were to occur.

Boundary, Limited Approach—An approach limit at a distance from an exposed energized electrical conductor or circuit part within which a shock hazard exists.

Boundary, Prohibited Approach—An approach limit at a distance from an exposed energized electrical conductor or circuit part within which work is considered the same as making contact with the electrical conductor or circuit part.

Boundary, Restricted Approach—An approach limit at a distance from an exposed energized electrical conductor or circuit part within which there is an increased risk of shock due to electrical arc over combined with inadvertent movement for personnel working in close proximity to the energized electrical conductor or circuit part.

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De-energized—Current carrying parts isolated from any connection to a source of voltage or from electric charge and not having a potential different than that of the earth.

Electrical Hazard—There are three separate electrical hazard categories.

1. Electric Shock (a) by simultaneous contact with both energized ungrounded and grounded conductors, (b) by contact with one of the energized conductors and the ground, and (c) by contact with a metal non-current-carrying part that has become energized by an energized conductor while also in contact with the ground.
2. Electric Arc: Arcing faults or flashes are generated as a result of inadequate electrical contact or poor insulation from phase to ground or phase to phase as short-circuit current surges through vaporized metal and carbon. Arc temperatures can reach 35,000 degrees F and the length and duration of the arc will vary. Burns are severe and often fatal.
3. Arc Blast: Tremendous air pressure is developed as a result of the instantaneous occurrence of an electric arc in the form of a shock wave that may cause property damage, injury or death.

Energized Electrical Work—Any work on electrical equipment, circuits, devices, systems, or any other energized part(s) where an employee is required to deliberately, or could accidentally, place any part of their body, tool or material into or around such electrical devices where the voltage has been deemed to be in excess of 50 volts.

Energized electrical work includes working on or near any energized electrical system, whether alternating or direct current, including, but not limited to, service entrance sections, distribution switchgear, transformers, distribution panels, UPS Systems and branch circuit wiring and may include, but not be limited to:

1. Voltage testing
2. Circuit testing
3. Trouble-shooting
4. Power switching
5. De-energizing and re-energizing procedures
6. Pushing/pulling fish tape or wire into an energized enclosure
7. Work performed on energized enclosures
8. Excavations near underground electrical lines

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Flame Resistant Clothing—Protective clothing that meets all the requirements of ASTM F 1506 and is labeled specifically with:

1. Identification as to meeting the requirements of ASTM F 1506
2. Manufacturer's name
3. Size and other associated standard labeling
4. Care instructions
5. Fiber content
6. The clothing must be designed for easy and rapid removal and the closure design should be appropriate for easy removal of the garment

Protective Clothing— Clothing including shirts, pants, coveralls and jackets, which is specifically designed and labeled as protective. Protective clothing is to be routinely worn by workers who, under normal working conditions, are exposed to momentary electric arc and related thermal hazards. Protective clothing must be made of all 100% natural fibers and be untreated.

Qualified Person—One who has skills and knowledge related to the construction and operation of electrical equipment and installations and has received safety training to recognize and avoid the hazards involved.

1. A qualified person must be familiar with and trained in:
   a. The proper use of special precautionary techniques
   b. Personal protective equipment
   c. Insulating and shielding materials
   d. Use of insulated tools and test equipment
2. A person can be considered qualified in respect to certain specific equipment and methods, but be unqualified for others.

Testing Equipment—Only testing equipment that bears the identifying mark of a recognized testing laboratory such as UL will be used in field operations.

Troubleshooting—Troubleshooting (testing of live electrical circuits) shall be confined to diagnostic readings of voltage and amperage only. Safe methods will be used during this procedure, and live parts shut down and locked out for subsequent repair or other work.

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Requirements

Under NFPA 70E, an electrically safe, locked-out condition is preferred over work on live electrical parts. Work on live parts may only be done when de-energizing the circuit prior to working on it would expose a worker to a greater hazard, is infeasible, or when the circuits to be energized during work are below 50 volts. Energized electrical conductors and circuit parts to which an employee might be exposed shall be put into an electrically safe work condition before an employee works within the Limited Approach Boundary of those conductors or parts.

(1) Greater Hazard. Energized work shall be permitted where the employer can demonstrate that deenergizing introduces additional or increased hazards.
(2) Infeasibility. Energized work shall be permitted where the employer can demonstrate that the task to be performed is infeasible in a de-energized state due to equipment design or operational limitations.
(3) Less Than 50 Volts. Energized electrical conductors and circuit parts that operate at less than 50 volts to ground shall not be required to be de-energized where the capacity of the source and any overcurrent protection between the energy source and the worker are considered and it is determined that there will be no increased exposure to electrical burns or to explosion due to electric arcs.

- All circuits, equipment, devices and other apparatus must be placed into an electrically safe work condition before any work can be performed. If the equipment cannot be placed into an electrically safe condition a Hazard/Risk Analysis should be performed and approved by the supervisor. No supervisor approval shall be granted unless all requirements of the Electrical Safety Program have been satisfied.
- An electrically safe (de-energized) work condition shall be achieved when performed in accordance with NFPA 70E standard and the following conditions have been met:

1. Determine all possible sources of electrical supply to the specific equipment. Check applicable up-to-date drawings, diagrams, and identification tags.
2. After safely interrupting the load current, open the disconnecting device(s) for each source.
3. Where possible, visually verify all blades of the disconnecting devices are fully open or that draw-out type circuit breakers are withdrawn to their fully disconnected positions.
4. Apply lockout/tagout devices in accordance with MS&T lockout/tagout procedure.
5. Use an adequately rated voltage detector to test each phase conductor or circuit part to verify they are de-energized. Before and after each test, determine that the voltage tester is operating satisfactorily. Proximity detectors are permitted for preliminary testing but shall not be considered an adequately rated voltage detector. An additional test with an adequately rated voltage detector is required when a proximity tester has been utilized.

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6. Where the possibility of induced voltages or stored electrical energy exists, ground the phase conductors or circuit parts before touching them. Where it could be reasonably anticipated that the conductors or circuit parts being de- energized could contact other exposed energized conductors or circuit parts, apply ground-connecting devices rated for the available fault.

- Only qualified persons are permitted to work on electrical conductors or circuits that cannot be de-energized.
- All equipment shall be installed and used in accordance with the manufacturer's instructions.
- Steps shall be taken to maintain electrical equipment's insulation and enclosure integrity.
- All work on equipment that is energized at 50 volts or more shall be planned and documented according to the procedures of this program. Every attempt shall be made to protect employees from shock, burn, arc-blast and other hazards that are present in this working environment. Employees shall be responsible for protecting themselves from such hazards with the assistance and supervision of management, and personal adherence to the policies and procedures set forth in this manual.
- Employees shall use only the appropriate equipment to accomplish an assigned task.
- The effectiveness of any safety program relies upon its execution and acceptance by the affected employees. This program shall be audited annually and revised as needed. The management shall encourage input from all employees concerning safety procedures and policies during the audit and at all other times.
- Training is essential to employee safety. The supervisor should strive to provide up-to-date training to employees. Employees shall keep current on personal protective techniques, safety policies and techniques and potential hazards. Please refer to Article 110.6: Training Requirements Within 70E Standard for Electrical Safety in the Workplace.

Hazard Control

Control of electrical hazards shall be established and observed by all employees to minimize hazards from electrical energy:

- Engineering Controls

1. Approved clearances will be established for all distribution panels and equipment.
2. Electrical rooms, vaults and areas containing equipment will be guarded against accidental damage by suitable barriers and structural means.
3. Electrical installations will conform to the requirements of the National Electrical Code (NEC), including support requirements for all conduit and equipment.

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4. Adequate lighting shall be maintained in all areas where energized work is to be carried out.
5. All enclosures, including junction boxes, switches, panels, etc., as required by the NEC, shall be properly maintained in order to safely contain energized parts. Since shock injuries may be caused by poorly grounded or ungrounded electrical equipment, close attention must be paid to the condition of all equipment and the integrity of the grounding system.

- Administrative Controls

1. Every electrical conductor or circuit part shall be considered energized until proven otherwise.
2. De-energized conductors and equipment that have not been locked out or tagged shall be treated as energized parts.
3. No bare-handed contact is to be made with exposed energized electrical conductors or circuit parts above 50 volts to ground.
4. All employees will follow established electrical safety requirements set forth in this safety program.
5. Work on energized electrical parts is limited to qualified persons, under the requirements set forth in this program.
6. The supervisor will identify qualified employees and establish records and procedures to ensure only qualified persons engage in work on live electrical parts.
7. Access to electrical rooms or other areas where employees are engaged in energized work is limited to those employees who have a legitimate need to enter.
8. Housekeeping duties will not be performed at close distances to live parts unless adequate barriers and insulating equipment are employed.
9. Portable ladders shall have non-conductive side rails if the ladder or employee might be in a position to approach live electrical parts.
10. Physical barriers and warning signs will be used to prevent unauthorized entry to areas where energized work is being carried out.

- Personal Protective Equipment

1. Qualified persons should wear electrically rated footwear when engaged in the performance of energized work.
2. Only tools that are designed and rated for the appropriate voltages will be used on energized circuits, equipment or systems.

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3. Metal belt buckles, jewelry, key chains, cell phones, pagers, etc., should be removed when working on anything energized. Hands should be clean and free of lotion or sunscreen to prevent damaging the voltage rated glove liners. Disposable cloth gloves may be worn inside the liners to limit the effects of perspiration.
4. Safety glasses and hard hats will be worn at all times. Additional personal protective equipment must be used as outlined table 130.7 (c) (10) Protective Clothing and PPE matrix of the NFPA70E standard.
5. Voltage rated gloves will be stored in the proper canvas bag, with the (rubber) liners separated from the outer leather (glove) protectors. The person doing the work will inspect all voltage rated PPE before use.
6. Blankets will be stored in protective tubes and bear an inspection date of not more than one year prior to the date of use.
7. Voltage rated tools should be clean and have a smooth finish with no breaks in the insulation. These tools should be stored separately or in protective devices to avoid damage from other tools or materials.

Procedures

The following procedures shall apply to all work on, or close to exposed and energized electrical conductors or circuit parts. Additional procedures may be needed for specific tasks.

1. Employees shall exhaust every reasonable effort to perform work de-energized.
2. If the decision is made to work on the circuit, equipment or system energized, then refer to Table 130.7 (C) (9) (a) Hazard/Risk Category Classifications of the NFPA 70E Standard. The definition of energized work is:
    - Any work on electrical equipment, circuits, devices, systems, or any other energized part(s) where an employee is required to deliberately, or could accidentally, place any part of his body or any type of tool into or around such electrical devices where the voltage has been determined to be in excess of 50 volts.
3. To work on energized devices as identified in this program you must be:
    - Trained on the Energized Electrical Work Safety Program
    - Be considered a qualified person as defined in this program
4. The work hazards and the extent of the risk shall be thoroughly examined
5. The Energized Electrical Work Permit will be completed, and approved. This form will be reviewed by each employee performing the work and will be maintained in the immediate work area

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6. Ensure the appropriate personal protective equipment has been obtained as outlined in the Matrix
7. Manufacturer's instructions and equipment details shall be consulted prior to any work being performed
8. All available electrical plans/drawings shall be consulted prior to any work being performed
9. Appropriate barricades, signs and warning tape must be employed in order to restrict the area to unauthorized personnel as well as create safe working space for authorized persons
10. If any person other than the qualified person cannot maintain a safe distance (a minimum of four feet) from the exposed part(s), he or she must wear the same level of PPE as the qualified person performing the work

Hazard Analysis Procedure

The employees involved in work on or near electrically energized conductors or circuit parts shall be responsible for completing an Energized Electrical Work Permit Form before any work may be performed. The form is included with this procedure.

- The Energized Electrical Work Permit should be submitted to the supervisor for approval before any work may be performed.
  1. The supervisor will review the Energized Electrical Work Permit and approve the work practices and personal protective equipment. Work may only begin after management approval.
- The Energized Electrical Work Permit must be filled out. Employees will follow the directions presented below for each section.
  1. Date work will be performed
  2. Project: Enter the Job Name
  3. Name of person requesting Energized Work: Enter the name of the person who will be directly responsible for supervising the work
  4. Enter the names of all qualified employees who will be directly involved in the work
  5. Explain the work to be performed: A detailed explanation of the work to be performed
  6. Required PPE: List all PPE according to the PPE matrix

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7. Explain safety practices that will be followed: List in detail all procedures that will be followed to minimize hazards and all tests that will be performed before, during and after the work to be performed. The procedures shall list specifically, but not be limited to the procedures found in the Electrical Safety Program
8. Explain why this work must be done energized and why the equipment cannot be placed in an electrically safe condition: A detailed explanation of the reasons for the energized work must be included in this section
9. Approval: Energized Electrical Work Permit form must be presented to each of the individuals listed and a signature obtained to indicate they have reviewed and approved the energized work
10. All involved employees will review all the documentation and receive task specific training necessary for the work to be performed

Reference Material

The Electrical Safety Program was developed with the guidelines set forth in National Fire Protection Association Publication NFPA 70E Standard for Electrical Safety Requirements for Employee Workplaces. Exact details for determining the approach boundaries, flash hazard boundary, personal protective equipment specifications and details for specific installations may be obtained from this publication.

Employees are encouraged to consult NFPA 70E before working on energized electrical equipment or circuit parts.

Energized Electrical Work Permit

Part I: To Be Completed by the Requester

Project Name: _____

Description of circuit/equipment/job location: _____

_____

Description of work to be done: _____

_____

Justification of why the circuit/equipment cannot be de-energized or the work deferred until the next scheduled outage: _____

_____

_____

_____ _____

Requester/Title Date

Part II: To Be Completed by the Electrically Qualified Persons Doing the Work

	Check When Complete
1. Detailed job descriptions procedure to be used in performing above detailed work: _____ _____	☐
2. Description of the Safe Work Practices to be employed: _____ _____	☐
3. Results of the Shock Hazard Analysis: _____ _____	☐
4. Determination of Shock Protection Boundaries: _____ _____	☐
5. Results of the Flash Hazard Analysis: _____ _____	☐
6. Determination of the Flash Protection Boundary _____ _____	☐
7. Necessary personal protective equipment to safely perform the assigned task: _____ _____	☐
8. Means employed to restrict the access of unqualified persons from the work area: _____ _____	☐
9. Evidence of completion of the Job Briefing including discussion of any job-related hazards: _____ _____	☐

10. Do you agree the above described work can be done safely? ☐ Yes ☐ No (If no, return to requester)

_____ _____

Electrically Qualified Person(s) Date

_____ _____

Electrically Qualified Person(s) Date

Part III: Approval(s) to Perform the Work While Electronically Energized

_____ _____

Department Supervisor Date

Note: Once the work is complete, forward this form to EHS for retention

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