

Model
Safety
Operating
Procedures
for Electric
Distribution
Utilities

2011



A
Collaboration
of the
Northeast
Public Power
Association
and the
Massachusetts
Department of
Labor
Standards

Model Safety Operating Procedures for Electric Distribution Utilities

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These model safety operating procedures for electric distribution utilities are primarily based upon regulations contained in the federal Occupational Safety and Health Administration (OSHA) performance standards for work on or near electric transmission and distribution lines and related work (1910.269). In addition, industry “best practices” have been included in some areas and are denoted in italics. (“Best practices” may not be required by regulation but may be recommended in other generally recognized industry standards and practices. These practices will provide additional employee protection).

Please note that the procedures contained in this document are not intended to be comprehensive in scope, but rather cover the most common tasks involved in the construction and maintenance of overhead electric distribution lines. They are intended to provide guidance to public power officials in the development of their own company operating procedures. It is suggested that each utility modify these procedures as appropriate.

It is also important to note that while OSHA standards have been used to compile these procedures, some New England states (Maine, New Hampshire and Rhode Island) have adopted their own standards for workplace safety. Accordingly, electric utilities in each New England state should assure that they are in compliance with the appropriate state standards. In Massachusetts, while OSHA does not cover public sector workplaces, it is the policy of the Department of Labor Standards that Massachusetts municipal employees shall comply with OSHA standards “as a minimum”.

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Qualified Employee

1. Qualified employees shall be trained and competent in:
 - a. The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment.
 - b. The skills and techniques necessary to determine the nominal voltage of exposed live parts.
 - c. The minimum approach distances corresponding to the voltages to which the qualified employee will be exposed.
 - d. The proper use of the special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools for working on or near energized parts of electric equipment.

Job Briefings

1. The employer shall ensure that the employee in charge conducts a job briefing with the employees involved before they start each job. The briefing shall cover at least the following subjects:
 - a. Hazards associated with the job
 - b. Work procedures involved
 - c. Special precautions
 - d. Energy source controls
 - e. Personal protective equipment

Working on or Near Exposed Energized Parts

1. Only qualified lineworkers may work on or with exposed energized lines or equipment.
2. At least two qualified lineworkers, one of which shall be a journeyman lineworker, shall be present while the following types of work are being performed:
 - a. Installation, removal, or repair of lines that are energized at more than 600 volts.
 - b. Installation, removal or repair of deenergized lines if an employee is exposed to contact with other parts energized at more than 600 volts.
 - c. Installation, removal or repair of equipment, such as transformers, capacitors, and regulators, if an employee is exposed to contact with parts energized at more than 600 volts.
 - d. Work involving the use of mechanical equipment, other than insulated aerial lifts, near parts energized at more than 600 volts.
3. This does not apply to the following operations:
 - a. Routine switching of circuits, if the employer can demonstrate that conditions at the site allow this work to be performed safely.
 - b. Work performed with live-line tools (hot sticks) if the employee is positioned so that he or she is neither within reach of, nor otherwise exposed to, contact with energized parts.

- c. Emergency repairs to the extent necessary to safeguard the general public. *(NOTE: Hands-on work on primary lines should not be performed alone under any circumstances).*

Insulate & Isolate Procedures

1. The worker shall be protected from any two simultaneous points of contact with energized and/or grounded conductors.
2. The worker shall be insulated by wearing approved rubber gloves with protectors and sleeves.
3. The worker shall be isolated from all energized and grounded conductors with the use of:
 - a. Minimum approach distances (see below)
 - b. Cover-up: approved insulating hoses, hoods, blankets, and cutout covers.
 - c. Bucket liners, upper fiberglass booms, and fiberglass inserts in lower boom.

Maintenance of Insulating Materials

- **Rubber insulating blankets should be tested before being issued and every 12 months thereafter.**
- **Rubber insulating line hose and covers should be tested upon indication that insulating value is suspect.**
- **Bucket liners and booms should be dielectrically tested on a yearly basis.**
- **Live-line hot stick tools should be removed from service every 2 years for examination and testing.**

Minimum Approach Distances

1. A minimum of 2 feet 1 inch clearance shall be maintained phase to ground, 2 feet 2 inches phase to phase @ 1.1kV to 15kV, between unprotected energized parts not being worked on and any unprotected part of your body.
2. A minimum of 2 feet 4 inches shall be maintained phase to ground, 2 feet 10 inches phase to phase @ 15.1kV to 36kV, between unprotected energized parts not being worked on and any unprotected part of your body.
3. These distances are measured from the finger tips with the arms outstretched and extended and not from the torso.
4. All conductors or equipment within these minimum approach distances shall be covered with approved protective equipment for the voltage being worked on, except for that portion which is actually being worked on.

Ground to Ground Rubber Glove/Sleeve Rules

1. Employees shall wear rubber gloves with leather protectors and rubber sleeves whenever ascending a pole or structure, or raising an aerial device off of the ground or the device cradle. Rubber gloves or sleeves shall not be removed until employees have descended the pole or structure or returned the aerial device to the ground or cradle.
2. Insulating sleeves shall be worn in addition to insulating gloves while performing any hands-on primary line work from a pole or an insulated aerial bucket truck.

3. Employees shall not touch or work on any exposed lines or apparatus except when wearing protective equipment approved for the working voltage being contacted. Note that the WORKING voltage is different from the TEST voltage as seen in the chart below:

Types of Rubber Gloves

Class	Test Voltage (ac)	Working Voltage (ac)
0	5,000	1,000
I	10,000	7,500
II	20,000	17,000
III	30,000	26,500
IV	40,000	36,000

(Note- Never confuse test voltages with actual voltages of rubber gloves! Utilities shall use only rubber gloves and sleeves rated for their system voltage: phase to phase not phase to ground).

4. Live-line work on overhead wires and equipment operating up to 5kV between phases may be performed from a pole or insulated aerial bucket truck with approved rubber gloves, protectors, and sleeves.
5. Live-line work on overhead wires and equipment operating from 15kV to 34.5kV between phases may be “hot sticked” if performed from a pole or structure with approved rubber gloves and protectors, and only with the use of approved and tested live-line “hot stick” tools.

Working Conditions and Rubber Glove/Sleeve Requirements

1. **Insulated Aerial Bucket Trucks** - 15kV live-line rubber gloving work shall only be performed from insulated bucket trucks or insulated platforms, with approved rubber gloves, protectors and sleeves. The bucket truck will have upper and lower controls, a fiberglass liner in the bucket and a fiberglass insert in the lower boom.
2. 15kV rubber gloving work shall consist of work associated with inspection and repairs to overhead plant and apparatus which includes the handling of wire energized up to 15kV between phases with the use of approved rubber gloves, protectors, and sleeves.
3. Energizing and de-energizing through the use of a switching device or a mechanical tap shall only be done while wearing approved rubber gloves and protectors, and with the use of an approved hot stick, so as to maintain safe working distances from a possible arc flash.
4. **Truck Derricks** - When working on truck derricks while swinging, raising, or lowering the derrick to within 10 feet of any energized conductor, approved rubber gloves and protectors shall be worn by the operator. This includes the use of insulating boom extensions. When a pole is set, moved, or removed near an exposed energized overhead conductor, the employer shall ensure that each employee wears electrical protective equipment or uses insulated devices when handling the pole, and that no employee contacts the pole with uninsulated parts of his/her body.
5. **Elevations** - Approved rubber gloves shall be used when working in trees, on ladders, platforms, or any elevation within possible reach of any wire or equipment that is energized or may become energized. This includes installation, connection, reconnection, removal, or replacement of overhead service wires and cables. Rubber gloves shall be worn on either end of the service cable once the pole end has been tied to the pulling line in preparation for being pulled up a pole carrying energized wires.

6. **Ground Level** – When working on conductors at ground level or in close proximity to conductors that are supported by poles or structures to which are attached any wires that are energized or could become energized, approved rubber gloves with protectors shall be worn. This includes above ground vaults, padmount and subsurface installations. Standing or kneeling on insulating material or platforms are not excepted. When working on padmount or subsurface installations, rubber gloves must be worn before opening the outer door and continue to be worn for all primary or secondary work performed on/in the padmount or subsurface unit.

Underground Rubber Glove Rules

1. Approved rubber gloves with protectors shall be worn:
 - a. When operating all UG switches. (*Note: In addition to rubber gloves, FR clothing, switching coats, protective switch hood, safety glasses and a hard hat should be worn*).
 - b. When working on any exposed conductor which is connected to any 5kV or 15kV distribution circuit, until such conductor has been insulated and shielded to ground for the normal voltage to which it may be subjected.
 - c. When working on 5kV or 15kV distribution cables, if working in an area of the cable where the sheath, shield or concentric wires are not continuous or bonded.
 - d. When removing lead from any lead covered cables for which the voltages are not known, or which are energized or may become energized at any voltage.
 - e. When connecting or disconnecting high voltage test leads and ground leads to or from equipment lines or circuits. (An example would be the leads from a thumper).

- f. When working on a pipe of an energized pipe type cable.
 - g. When working on any secondary cable which is energized or may become energized at 50 volts or more.
2. All energized primary splices or elbows shall be covered with arc blast blankets while working in an energized manhole or vault

Glove Maintenance and Inspection

1. All rubber insulating gloves shall be electrically tested before first use and every 6 months thereafter in accordance with OSHA 29CFR 1910.137. *(Note: Due to the importance of insulating rubber gloves, it is recommended that gloves be field tested daily before every job. It is also recommended that rubber gloves be tested at a laboratory on a monthly basis).*
2. All rubber insulating sleeves shall be electrically tested before first use and every 12 months thereafter in accordance with OSHA 29CFR 1910.137.
3. Leather protectors for rubber gloves shall be inspected daily for nicks, cuts, tears, and oil contamination.

Exceptions to the Rubber Glove Rule

1. Rubber Gloves are not required:
 - a. Where clearance or the delicate nature of the given task is such that the work cannot be performed wearing such gloves. In special circumstances, approved alternative insulating and/or isolating methods must be substituted **with the approval of the safety officer or his/her representative.**

- b. For splicer’s who are working from platforms or in aerial lifts on terminations within possible reach of energized wires, provided that all overhead within reach of the works are covered with protective equipment and grounded **with the approval of the safety officer or his/her representative.**

Flame Retardant Clothing (FR)

1. Employees who are exposed to the hazards of flames or electric arcs must not wear clothing that, when exposed to flames or electric arcs, could increase the extent of injury that would be sustained by the employee.
2. *Effective January 1, 2009, employers must perform an assessment to determine potential exposure to an electric arc for employees who work on or near energized parts or equipment. If the assessment determines a potential employee exposure greater than 2 cal/cm² exists, the employer shall require employees to wear clothing or a clothing system that has an effective arc rating not less than the anticipated level of arc energy (National Electric Safety Code Rule 410 A3). All electrical jobs require FR clothing to be worn, even if deenergized.*

In this Department, the following FR clothing is required:

Job	FR Clothing Rating	Comments

(Note: Employees should report to work in and wear FR clothing daily. This includes 100% cotton or FR underclothing. All employees involved in any

type of switching @ sub-stations or vaults should wear switching coats, switching hoods, and rubber gloves, along with their FR clothing).

Installing or Removing Meters

1. Rubber gloves with protectors shall be worn when installing or removing energized electric metering equipment.
2. When connecting or disconnecting energized service conductors in metering equipment, rubber gloves shall be worn.
3. A face shield with safety glasses is mandatory protective equipment for employees working on or near energized metering equipment under the following conditions:
 - a. When installing, changing, removing, repairing, or testing energized meter and related equipment.
 - b. When connecting or disconnecting, in an enclosed space.

Appendix A

Hazardous Energy Control (Lockout/Tagout)

1. A designated employee requests that system operator de-energize a line or equipment. This designated employee becomes the employee in charge and is responsible for the clearance.
2. All switches, disconnects, jumpers, taps, and other means through which known sources of electric energy may be supplied to the particular lines and equipment to be deenergized shall be opened. Such means shall be rendered inoperable, unless its design does not permit, and tagged to indicate that employees are at work.
3. Automatic and remotely controlled switches that could cause opened disconnecting means to close shall be tagged at the point of control.
4. Tags shall prohibit operation of the disconnecting means and indicate that employees are at work.
5. After the above steps have been taken, the line or equipment to be worked shall be tested to ensure it is de-energized.
6. Protective grounds shall be installed in accordance with OSHA 1910.269(n).
7. The line or equipment may now be worked as de-energized.
8. If two or more independent crews will be working on the same lines or equipment, each crew shall independently comply with the above steps.
9. Transfer of clearance shall be communicated to the system operator and the employees in the crew. The new employee in charge shall now be responsible for the clearance.
10. Clearance release requires the employee in charge to notify the employees under his/her direction that the clearance is to be released, determine that employees in the crew are clear of overhead lines and

equipment, determine that protective grounds have been removed, report this information to the system operator, and release the clearance.

11. The person releasing the clearance shall be the same person who requested it, unless the responsibility has been properly transferred.
12. Tags may not be removed unless the associated clearance has been released.
13. Only after all the above has been successfully accomplished, may the lines and equipment be re-energized.
 - a. If no system operator is in charge of the lines or equipment and their means of disconnection, one employee in the crew shall be designated as being in charge of the clearance. The employee in charge shall then take the place of the system operator and complete steps 2 through 13 above.
 - b. If only one crew will be working on the lines or equipment and if the means of disconnection is accessible and visual to and under the sole control of the employee in charge, then steps 1,3,4,8, and 12 need not be taken.
14. Tags:
 - a. A red tag or red and white striped "Do Not Operate" (DNO) tag shall be installed at the open point, switches, disconnects, jumpers, taps or other means through which known sources of energy may be supplied to the lines and equipment to be deenergized.
 - b. A workman tag (usually blue) shall be placed on top of the red or red striped DNO tag for each crew working on the deenergized line or equipment, to indicate workers present on that line or equipment.

- c. A yellow ground tag shall be installed on top of the blue workman tag if the crew or crews ground the line or equipment to be worked.
- d. This procedure will show that the line is deenergized with the placement of red tag or red striped DNO tag, workers are on the line or equipment working under the blue tag or tags, and that the line is also grounded by the placement of the yellow tag.
- e. To reenergize after repairs have been made, the tags should be removed in the order they were installed. Grounds will be removed by crew or crews and yellow tag removed. Crew or crews complete repair and clear off the line or equipment and remove their blue tag or tags. The person in charge is then notified by the crew or crews that all personal are clear of the line or equipment and the line can be reenergized.

Appendix B

Grounding for the Protection of Employees

1. This applies to the grounding of transmission and distribution lines and equipment for the purpose of protecting employees.
2. Grounding is required unless the employer/safety officer can demonstrate that installation of a ground is impracticable, or that conditions resulting from the installation of a ground would present greater hazards than working without grounds. In such cases, the line and equipment may be treated as deenergized, provided the following conditions are met:
 - a. The lines and equipment have been deenergized.
 - b. There is no possibility of contact with another energized source.
 - c. The hazard of induced voltage is not present.
3. Temporary protective grounds shall be placed at such location and arranged in such a manner as to prevent each employee from being exposed to hazardous differences in electrical potential.
4. Before any ground is installed, lines and equipment shall be tested and found absent of nominal voltage, unless a previously installed ground is present.
5. Order of connection: When a ground is to be attached to a line or to equipment, the ground-end connection shall be attached first, and then the other end shall be attached by means of a live-line tool (hot stick).
6. Order of Removal: When a ground is to be removed, the grounding device shall be removed from the line or equipment using a live-line tool (hot stick) before the ground-end connection is removed.
7. *Rubber gloves are to be worn on dead and grounded circuits.*

Appendix C

Overhead Lines

1. If conductors being installed or removed cross over energized conductors in excess of 600 volts, and if the design of the circuit-interrupting devices protecting the lines so permits, the automatic-reclosing feature of these devices shall be made inoperative.

Appendix D

Confined & Enclosed Spaces

1. The employer shall ensure the use of safe work practices for entry into and work in enclosed spaces and for the rescue of employees from such spaces.
2. Only employees who have been properly trained on the hazards associated with confined or enclosed space work shall be allowed to enter a confined or enclosed space.
3. Employees who enter enclosed spaces or who serve as attendants shall be trained in the hazards of enclosed space entry, enclosed space entry procedures, and enclosed space rescue procedures.
4. Employers shall provide equipment such as tripod, harness and winches to ensure the prompt and safe rescue of employees from the enclosed space.
5. All employees who enter a manhole or vault will wear a harness attached to the rescue retrieval system which will be set up on every manhole or vault entry job.
6. Before any entrance cover to a confined or enclosed space is removed, it shall be determined that there are no temperature or pressure differences,

or other hazardous conditions, that may injure the employees removing the cover.

7. When covers are removed, the openings shall be guarded by railing, temporary cover, or other temporary barrier.
8. Before entering a confined or enclosed space, all levels of the space shall be tested for lack of oxygen and then for the presence of flammable or toxic gases and vapors using a calibrated gas monitor.
9. The air shall be monitored during the entire entry.
10. If flammable or toxic gases or vapors are detected or if an oxygen deficiency is found, the space shall be continuously tested and forced ventilation shall be used to maintain oxygen at a safe level and to prevent a hazardous concentration of flammable or toxic gases and vapors.
11. While work is being performed in an enclosed space, a person with CPR and basic first aid training shall be immediately available to render emergency assistance.
12. All monitoring instrumentation must be calibrated. (Responsibility for maintaining and calibrating gas monitors should be assigned to a specific employee).
13. The attendant shall maintain continuous communication with employees authorized to be in the confined or enclosed space.

Appendix E

General Requirements for Personal Protective Equipment

1. Personal protective equipment must be worn whenever job conditions involve hazards or conditions which may result in possible injury or when directed by management, foreman, or other employee in charge.
2. Only approved personal protective equipment shall be worn.

3. Each employee is responsible for compliance with the protective equipment rules before starting work and while work is in progress. The employee supervising or directing the work will be held responsible for enforcement. The supervising or directing employee shall hold off part or all of the work until the required protection is in place.
4. Persons responsible for employees and/or contractors shall make certain that when the job assignment or conditions warrant, that personal protective equipment shall be worn.
5. All employees engaged in electrical work are required to wear FR clothing that has an effective arc rating not less than the anticipated level of arc energy.
6. All contractors will follow all the safety rules, work procedures, and policies of the utility they are employed by.
7. **Eye Protection:**
 - a. Eye protection equipment shall be worn while performing any outdoor or indoor work.
 - b. Examples for safety glasses:
 - i. Performing any work requiring rubber gloves.
 - ii. Working in manholes, vaults, or station cubicles.
 - iii. Working on energized parts, conductors or equipment.
 - iv. Replacing fuses in energized circuits.
 - v. Replacing street light bulbs or photo cells.
 - vi. Operating any power, pneumatic, hydraulic or hand tools.
 - vii. Using any solvents, silicone, epoxy mixtures, synthetic or hydrocarbon lubricants.
 - viii. Clearing brush or tree branches.

- ix. Working in and around substations, transformer vaults, and switchyards.
- c. Examples for goggles:
 - i. Handling acids, solvents or caustic chemicals. (*Note: May need faceshield over goggles for severe chemical splash potential*)
 - ii. Spraying epoxies or fast drying paints.
 - iii. Using air or liquid under pressure.
- d. Examples for face shield with safety glasses:
 - i. Operating or testing any overhead switching device or high voltage equipment such as reclosers, switches, cutouts and elbows.
 - ii. Working on energized and open breaker boxes.
 - iii. Working on equipment energized above 240 volts, such as terminal boxes, meters, or primary wiring cabinets.
 - iv. Performing any battery work in substations.
 - v. Operating padmount equipment.

8. Gloves:

If handling chemicals, refer to the Material Safety Data Sheet and glove manufacturer's information to determine if gloves are recommended and, if so, the type that are needed to prevent exposures.

For electrical exposures, refer to Rubber Glove Ground to Ground Rubber Glove/Sleeve information previously cited in this document.

9. Protective Headgear:

Approved protective Class E headgear which meets ANSI Standard Z89.1-2003 shall be worn by all employees, contractors and visitors. A hard hat is not to be used as a substitute for electrical switching headgear.

10. Safety Shoes:

Employee's who are exposed to toe injuries on a daily basis shall wear appropriate safety shoes at all times. *(If possible, shoes worn while engaged in electrical work should be approved for electrical hazards as well).*

11. Hearing Protection:

- a. Hearing protection equipment should be worn by employees when job operations and conditions may involve excessive noise and exposure, or when directed to do so by management, foremen, or other employee in charge.
- b. Hearing protection is required when:
 - i. Working at any location where the sound levels exceed 85 dB(A). *(Note: Noise levels are likely above 85 dbA if you are at arm's distance to someone and you have to raise your voice to be heard)*
 - ii. Closing any overhead fused cutout to energized wires, cables or connected load.
 - iii. Using a jack hammer, rotary hammer, or chain saw.

12. Fall Arrest Equipment:

- a. Fall arrest equipment, work positioning equipment, or travel restricting equipment shall be used by employees working at elevated locations more than 4 feet above the ground on poles, towers, or similar structures, if other fall protection has not been provided.

- b. Harnesses with lanyards must be attached and worn when working from aerial lifts.

Note: Fall protection shall be used by a qualified employee climbing or changing location on a pole, towers, or similar structures, unless conditions, such as, but not limited to, ice, high winds, the design of the structure (for example, no provision for holding on with hands), or the presence of contaminants on the structure, could cause the employee to lose his or her grip or footing.

14. High Visibility Roadway Clothing:

- a. A Class 2 high visibility vest shall be worn by employees when working on any roadway in daylight hours as a minimum.
- b. A Class 3 high visibility vest with pants shall be worn for nighttime road work or whenever traffic speeds exceed 50 mph.
- c. These vests and pants should be FR treated for all electrical workers.

Assignment of Responsibility for Safety Operating Procedures

Name of Utility _____

To be effective, safety operating procedures must be communicated to all managers, supervisors and employees, so that each individual in the organization knows what performance is expected of them. Accordingly, it is important that specific duties and responsibilities be clearly assigned, and that such assignments are made known to all. In this organization, responsibility for the following activities outlined in this document shall be assigned as follows:

Responsibility	Assigned to (Name & Title)
Assuring that all hands-on work on primary lines is performed by at least two qualified lineworkers	
Planning and conducting job briefings	
Assuring maintenance of insulating materials and hot stick tools	
Assuring that all rubber insulating gloves are electrically tested before first use and at least every 6 months thereafter	
Assuring that all rubber insulating sleeves are electrically tested before first use and every 12 months thereafter	
Assuring that leather protectors for rubber insulating gloves are inspected daily	
Approving the use of alternative methods that deviate from the standard glove/sleeve rule	
Maintaining and calibrating all gas monitors	

It is the responsibility of all employees to follow the organization’s safety procedures and to report unsafe conditions, unsafe work practices, or “near misses” to management.